SCA1
APROTININ USE AND RED BLOOD CELL TRANSFUSION IN OFF-PUMP BILATERAL LUNG TRANSPLANTATION
Morozowich S; Shu L; Phillips-Bute B; Hartwig M; Appel J; Welsby I
Duke University Medical Center, Durham, NC, USA

SCA2
CARDIAC FUNCTION AND ACUTE LUNG INJURY AFTER THORACIC SURGERY
Amor D; Zhang H; Roistacher N
Memorial Sloan-Kettering Cancer Center, New York, NY, USA

SCA3
COMBINED CLOPIDOGREL AND ASPIRIN THERAPY IN PATIENTS UNDERGOING CAROTID ENDARTERECTOMY IS ASSOCIATED WITH AN INCREASED RISK OF POSTOPERATIVE BLEEDING
Hindler K; Collard C; Lee V; Vaughn W; Pan W
The Texas Heart Institute at St Luke’s Episcopal Hospital, Houston, TX, USA

SCA4
INTENSE CARDIAC TROPONIN SURVEILLANCE FOR LONG-TERM BENEFITS IS COST-EFFECTIVE IN PATIENTS UNDERGOING ABDOMINAL AORTIC SURGERY
Mantha S1; Ellis P; Foss J; Roizen M2
1Nizam’s Institute of Medical Sciences, Hyderabad, AP, IN; 2University of Chicago, Chicago, IL

SCA5
PERIOPERATIVE CHANGES IN RED BLOOD CELL DEFORMABILITY IN PATIENTS UNDERGOING MAJOR NON-CARDIAC SURGERY: PRELIMINARY RESULTS
Christie A; Roche A; Bennett-Guerrero E
Duke University Medical Center, Durham, NC, USA

SCA6
APROTININ USE AND ALLOGRAFT FUNCTION AFTER OFF-PUMP BILATERAL LUNG TRANSPLANTATION
Morozowich S; Lin S; Phillips-Bute B; Hartwig M; Appel J; Ian W
Duke University Medical Center, Durham, NC, USA

SCA7
DIAGNOSIS AND ASSESSMENT OF PERIOPERATIVE DIASTOLIC DYSFUNCTION DURING ELECTIVE ABDOMINAL AORTIC ANEURYSM REPAIR AND ITS ASSOCIATION WITH MORTALITY AND MORTALITY
Mahmood F; Matyal R; Subramaniam B; Mitchell J
BIDMC, Boston, MA, USA

SCA8
ANESTHETIC PROBLEM-SOLVING FOR ENDOVASCULAR REPAIR OF A GIANT INNOMINATE ARTERY PSEUDOANEURYSM ERODING INTO A MEDIASTINAL TRACHEOSTOMY
Augoustides J; Berkowitz D2; Foyd T; Szeto W; Woo E; Velazquez O; McGarvey M; Acker M; Fairman R
1Hospital of the University of Pennsylvania; 2Children’s Hospital of Philadelphia, Philadelphia, PA, USA

SCA9
NITROSATIVE STRESS ASSOCIATED WITH SINGLE LUNG VENTILATION AND PULMONARY RESECTION IMPAIRS MYOCARDIAL CALCIUM CYCLING
Pan B; Hong R; Singer A; Lane P; Crabtree M; Heerdt P
Cornell University, New York, NY, USA

SCA10
DETECTION OF LOW PLASMA LEVELS OF LOW MOLECULAR WEIGHT HEPARIN
Inchiosa Jr M; Pothula S; Sanchala V; Kubal K
New York Medical College, Valhalla, NY, USA

SCA11
DEPRESSION AFTER CORONARY ARTERY BYPASS GRAFT SURGERY AND GENETIC VARIABILITY IN TWO SEROTONIN RELATED POLYMORPHISMS
Phillips-Bute B; Mathew J; Morris R; Podgoreana M; Stafford-Smith M; Grocott H; Schwinn D; Blumenthal J; Newman M
Duke University, Durham, NC, USA

SCA12
EFFECTS OF CARDIOPULMONARY BYPASS AND ANEMIA ON RENAL GENE EXPRESSION
Darby P1; Briet F2; Harrington A2; Hare G2; Mazer D2
1St. Michael’s Hospital, University of Toronto, Toronto, Ontario, Canada; 2St. Michael’s Hospital, Toronto, Ontario, Canada

SCA13
HIGH THORACIC EPIDURAL ANESTHESIA’S EFFECTS ON MYOCARDIAL BLOOD FLOW, OXYGEN CONSUMPTION, MYOCARDIAL WORK, AND MARKERS OF ISCHEMIA DURING CORONARY ARTERY BYPASS GRAFTING: A RANDOMIZED, CONTROLLED TRIAL
Hutcheson J1; Sonntag H2; Hill E2; Hanekop G; Kazmair S
1Medical University of South Carolina, Charleston, SC, USA; 2Georg-August University of Göttingen, Göttingen, LS, Germany

SCA14
THE INFLUENCE OF MINI-THORACOTOMY VS. MEDIAN STERNOTOMY ON THE INFLAMMATORY RESPONSE TO VALVE SURGERY
Szaibo T; Mathew J; White W; Morris R; Newman M; Grocott H
Duke University Medical Center, Durham, NC, USA

SCA15
REDUCTION IN MICROBUBBLE SIZE USING PERFLUOROCARBONS DURING CARDIOPULMONARY BYPASS IN THE RAT
Yoshitani K; Ma Q; de Lange F; Grocott H; Mackensen G
Duke University Medical Center, Durham, NC, USA

SCA16
DESFLURANE CAUSES MORE ARRHYTHMIAS IN OPCAB THAN SEVOFLURANE
Noël M; Choucri E; Noisieux N; Olivier J; Le N; Hemmerling T
University of Montreal, Montreal, PQ, Canada
Ska17
Plaque score of carotid arteries as a predictor of silent cerebral infarction in elderly coronary surgical patients
Baba T; Goto T; Maekawa K; Yoshitake A
Kumamoto Chuo Hospital, Kumamoto, Japan

Ska18
Atrial natriuretic peptide reduces myocardial stunning in rabbits
Tse J; Moalem J; Davidov T; Scholz P; Weiss H
UMDNJ-Robert Wood Johnson Medical School, New Brunswick, NJ, USA

Ska19
The effect of 6% hydroxyethyl starch 130/0.4 on coagulation and volume expansion in off-pump coronary bypass graft surgery: comparison with 6% hydroxyethyl starch 200/0.5
Kwak Y; Na S; Shim Y; Shim J; Hong Y
Yonsei University College of Medicine, Seoul, Korea

Ska20
Diffusion weighted magnetic resonance imaging and neurologic injury after cardiovascular surgery
Goto T; Maekawa K; Baba T; Yoshitake A
Kumamoto Chuo Hospital, Kumamoto, Japan

Ska21
Retrograde renal perfusion with perfluorocarbon emulsion providing systemic oxygenation in a rabbit model
Erith M, Humpherys M, Sebo T, Oliver Jr W, Nuttall G, Gettman M
Mayo Clinic College of Medicine, Rochester, MN, USA

Ska22
Comparison of the effects of tranexamic acid, aprotinin and placebo on blood conservation, fibrinolysis and platelet function with extensive heart surgery. A randomized clinical trial.
Demeyerere R; Bosteels A; Arnout J
University Hospital Gasthuisberg, Leuven, Flemisch B, Belgium

Ska23
Determinant of complications with recombinant factor VIIa (RFVIIa) therapy in patients with excessive blood loss after cardiac surgery
Meineri M; Van Rensburg A; Wasowicz M; Karkouti K; Beattie S; Wijeysundera D; McCluskey S; Karkouti K
Toronto General Hospital, Toronto, Ontario, Canada

Ska24
Protamine infusion to eliminate residual anti-Xa activity after cardiac surgery.
Welsby I; Ortel T; Mark F; Slaughter T
1Duke University Medical Center, Durham, NC, USA; 2Durham VAMC, Durham, NC, USA; 3Wake Forest University Baptist Medical Center, Winston-Salem, NC, USA

Ska25
Implementation of a treatment protocol for excessively bleeding cardiac surgical patients may improve clinical outcomes
Meineri M; Van Rensburg A; Wasowicz M; McCluskey S; Wijeysundera D; Beattie S; Karkouti K
Toronto General Hospital, Toronto, Ontario, Canada

Ska26
Combination anticoagulation minimizes thrombin generation during experimental cardiopulmonary bypass
Welsby I; Jones W; DeLange F; Arepally G; Phillips-Bute B; Grocott H; Mackensen G
Duke University Medical Center, Durham, NC, USA

Ska27
Collagen whole blood platelet aggregometry predicts myocardial injury after coronary artery bypass graft in aspirin taking patients
Jeon Y; Lee J; Lee J; Bahk J
Seoul National University Hospital, Seoul, South Korea

Ska28
Heparin antibodies are associated with severe adverse outcomes in the evolution trials
Spiess B; Aronson S; Dyke C; Koster A; Smedira N; Aldea G; Avery E; Agnihotri A; Veal J; Francis J
1Virginia Commonwealth University Medical Center, Richmond, VA, USA; 2Duke University, Durham, NC, USA; 3Gaston Medical Center, Gastonia, NC, USA; 4Deutsches Herzzentrum, Berlin, Germany; 5Cleveland Clinic Foundation, Cleveland, OH, USA; 6University of Washington, Seattle, WA, USA; 7Harvard University/Massachusetts General Hospital, Boston, MA, USA; 8Florida Hospital Center, Orlando, FL, USA

Ska29
Magnesium therapy does not prevent platelet or leukocyte activation during cardiac surgery
Bissessar R; Rinder C; Rinder H; Phillips-Bute B; Grocott H; Smith B; Newman M; Mathew J
1Duke University Medical Center, Durham, NC, USA; 2Yale University School of Medicine, New Haven, CT, USA

Ska30
A selective inhibitor of apoptotic protein p53 enhances isoflurane-induced cardioprotection during early reperfusion in rabbits
Venkatapuram S; Krolkowski J; Wang C; Warrtier D; Kersten J; Pratt P; Pagel P
Medical College of Wisconsin, Milwaukee, WI, USA

Ska31
Worsening of long-term myocardial function after successful pharmacological preconditioning with cyclosporine
Laudi S; Weimann J; Haschke M; Trump S; Schmitz V; Kaisers U; Christians U; Steudel W
1Charite - Universitaetsmedizin Berlin, Berlin, Germany; 2University of Colorado Health Sciences Center, Denver, CO, USA
SCA32
CLINICAL, PROCEDURAL AND GENETIC DETERMINANTS OF QT INTERVAL PROLONGATION FOLLOWING CARDIAC SURGERY
Zhang Q; Morris R; Mathew J; Schwinn D; Newman M; Podgorearu M
Duke University, Durham, NC, USA

SCA33
IMMEDIATE EXTUBATION: A ROUTINE AFTER OPEN-HEART SURGERY? A PROSPECTIVE STUDY OF 635 PATIENTS.
Hemmerling T; Basile F; Noiseux N; Olivier J; Choinière J; Prieto I
University of Montreal, Montreal, PQ, Canada

SCA34
ISOFLURANE ATTENUATES APOPTOSIS AFTER REGIONAL MYOCARDIAL ISCHEMIA AND REPERFUSION IN RABBITS VIA PHOSPHATIDYLINOSITOL-3-KINASE/AKT SIGNALING
Raphael J1; Rivo J2; Meir K2; Beeri R2; Pugatsch T2; Gozal Y2
1University of Virginia, Charlottesville, VA, USA; 2Hadassah Medical Center, Jerusalem, Israel

SCA35
OUTCOMES OF PREDICTING MITRAL SYSTOLIC ANTERIOR MOTION (SAM) IN MITRAL VALVE REPAIR
Ahenathy III J; Nowak M; Brinster D; Locke A; Scott J; Cohn L; D’Ambra M
Brigham and Women’s Hospital, Boston, MA, USA

SCA36
SEVERE DECREASES IN ANTITHROMBIN III ACTIVITY: SHOULD WE BE MONITORING THEM DURING DEEP HYPTHERMIC CIRCULATORY ARREST?
Sniecinski R; Chen E; Tanaka K
Emory University, Atlanta, GA, USA

SCA37
IMPROVED CLOT FORMATION BY COMBINED ADMINISTRATION OF FIBRINOGEN AND ACTIVATED FACTOR VIIA
Taketomi T; Piersonboon C; Szlam F; Calazis A; Tanaka K; Levy J
Emory University, Atlanta, GA, USA

SCA38
IS THE ROUTINE USE OF CERTIFIED REGISTERED NURSE ANESTHETISTS ASSOCIATED WITH A HOSPITAL’S RISK-ADJUSTED CABG SURGERY SURVIVAL RATES?
Brown P1; Anderson A2; Houser F3; Culler S4; Simon A5; Tarkington L6
1Cardiac Data Solutions, Inc., Atlanta, GA, USA; 2HCA CCMN, Nashville, TN, USA; 3Emory University, Atlanta, GA, USA

SCA39
HYPOTENSION DURING CARDIOPULMONARY BYPASS IS NOT ASSOCIATED WITH COGNITIVE DECLINE AFTER CABG
Green A; White W; Grocott H; Mathew J; Bar-Yosef S
Duke University Medical Center, Durham, NC, USA

SCA40
INCREASED PAL-MEDIATED PHOSPHORYLATION OF MYOCARDIAL BETA-2 ADRENERGIC RECEPTORS IN A LARGE ANIMAL MODEL OF CHRONIC HEART FAILURE
Monreal G; Gerhardt M
The Ohio State University, Columbus, OH, USA
SCA49  PATIENT SAFETY IN CARDIAC ANESTHESIA: DOES IT HAVE A SEPARATE IDENTITY?  
Barron M; Cooper L; Gallagher C  
University of Miami Miller School of Medicine, Miami, FL, USA

SCA50  THROMBIN SUPPRESSION REDUCES THE INFLAMMATORY RESPONSE TO EXPERIMENTAL CARDIOPULMONARY BYPASS.  
Welsby I; Jones W; De Lange F; Philips-Bute B; Arepally G; Grocott H; Mackensen G  
Duke University Medical Center, Durham, NC, USA

SCA51  ACUTE RESPIRATORY FAILURE REQUIRING PRONE POSITION IN THE CARDIAC OPERATING ROOM  
Felten M; Fedorko L; O’Leary G; Feindel C; Ralph-Edwards A; Karski J; Carroll J; Djaiani G  
Toronto General Hospital, Toronto, Ontario, Canada

SCA52  EFFECT OF INTRACORONARY SHUNT DURING RIGHT CORONARY ARTERY REVASCULARIZATION WITHOUT COLLATERAL SUPPLY ON RIGHT VENTRICULAR FUNCTION IN PATIENTS UNDERGOING OFF PUMP CORONARY ARTERY BYPASS GRAFT SURGERY  
Kwak Y; Shim J; Shim Y; Hong Y; Na S  
Yonsei University College of Medicine, Seoul, Korea

SCA53  CALCULATION OF LEFT VENTRICULAR MASS: TRANSESOPHAGEAL VERSUS TRANSTHORACIC ECHOCARDIOGRAPHY  
Murphy S; Wirkus J; Christie A; Forsberg E; Morris R; Swaminathan M  
Duke University Medical Center, Durham, NC, USA

SCA54  EFFECT OF TRICUSPID ANNULOPLASTY ON POSTOPERATIVE TRICUSPID REGURGITATION FOLLOWING LEFT VENTRICULAR ASSIST DEVICE IMPLANTATION  
Chumnanvej S; Wood M; MacGillivray T; Vidal Melo M  
Massachusetts General Hospital, Boston, MA, USA

SCA55  EVIDENCE-BASED PREDICTION OF TRANSFUSION REQUIREMENTS FOR AORTOCORONARY BYPASS GRAFT SURGERY  
Lappas G; Phillips-Bute B; Smith P; Hill S; Bredehoef t S; Mathew J; Stafford-Smith M  
Duke University Medical Center, Durham, NC, USA

SCA56  ISOFLURANE-INDUCED ANESTHETIC PRECONDITIONING IN PATIENTS UNDERGOING AORTIC VALVE REPLACEMENT  
Duncan A; Koch C; Pitas G; Starr N  
Cleveland Clinic Foundation, Cleveland, OH, USA

SCA57  COMPARISON OF MIXED VENOUS SATURATION- SVO2 (PULMONARY ARTERY) AND SCVO2 (CENTRAL VEIN) AND RELEVANCE TO HEAMODYNEICS IN OPCAB SURGERY. STUDY OF 50 CASES.  
Shastri N  
Heart Care Clinic, Ahmedabad, Gujarat, India

SCA58  ACUTE HIGH OUTPUT FAILURE FROM AN AORTOVENTRICULAR FISTULA DUE TO A RUPTURED SINUS OF VALSELVA ANEURYSM FOLLOWING BLUNT CHEST TRAUMA  
Muehlschlegel J; Alomar-Melero E; Staples E; Janelle G  
University of Florida, Gainesville, FL, USA

SCA59  THE ASSOCIATION BETWEEN MANNITOL DOSE AND POSTOPERATIVE ACUTE RENAL INJURY IN AORTOCORONARY BYPASS SURGICAL PATIENTS  
Szabo T; DeSimone N; Moaref K; Phillips-Bute B; Lawson S; Sinsir S; Stafford-Smith M  
Duke University Medical Center, Durham, NC, USA

SCA60  DETECTION OF INTERNAL CAROTID ARTERY FLOW WITH TEE DURING RETROGRADE CEREBRAL PERFUSION  
Kin N1; Komori C1; Ono N1; Orii R1; Konstadt S2  
1University of Tokyo, Bunkyo, Tokyo, Japan; 2Maimonides Medical Center, Brooklyn, NY, USA

SCA61  IMPROVING PATIENT SAFETY: IMPLEMENTATION OF A LOCALLY-DEVISED NOMOGRAM VS. EMPIRIC VANCOMYCIN DOSING IN THE POST CARDIAC SURGERY PATIENT  
Papadimos T1; Grabarcz ykJ; Marco A1  
1Medical University of Ohio, Toledo, OH; 2St. Luke’s Hospital, Maumee, OH, USA

SCA62  MYOCARDIAL PERFORMANCE INDEX AND TISSUE DOPPLER SYSTOLIC VELOCITY IN CARDIAC SURGERY PATIENTS  
Beathe J; Brown N; Ryjikov N; Girardi L; Lee L; Nikolaos S  
Weill Cornell Medical Center, New York, NY, USA

SCA63  GLUCOSE MANAGEMENT FOR THE CARDIAC RECOVERY ROOM  
Velardo B; Geller H; Burgess W  
Carolin as Medical Center, Charlotte, NC, USA

SCA64  DIFFERENCES BETWEEN ECHOCARDIOGRAPHIC CLASSIFICATIONS OF AORTIC ATHEROSCLEROSIS SEVERITY AND THEIR IMPACT ON CARDIAC SURGICAL TECHNIQUE  
Novalija P; Fox A2; Body S2; Collard C2; Fox J; Sherman S2  
1Clement J. Zablocki VA Medical Center, Milwaukee, WI; 2Brigham & Women’s Hospital, Harvard Medical School, Boston, MA; 3Texas Heart Institute, St. Luke’s Episcopal Hospital, Houston, TX, USA

SCA65  ECHOCARDIOGRAPHIC EQUIVALENTS OF PATHOANATOMY DIRECTING BICUSPID AORTIC VALVE REPAIR  
Savage R; Alfirevic A; Pettersson G; Blackstone E; Wallace L; Apostolakis J; Starr N  
Cleveland Clinic Foundation, Cleveland, OH, USA

SCA66  FIBEROPTIC BRONCHOSCOPY ASSISTED NASAL INTUBATION FOR INTRAOPERATIVE TEE IN LOW BODY WEIGHT PATIENTS  
Kin N1; Ono N1; Komori C1; Orii R1; Konstadt S2  
1University of Tokyo, Bunkyo, Tokyo, Japan; 2Maimonides Medical Center, Brooklyn, NY, USA
INOTROPIC EFFECT OF VOLATILE PRECONDITIONING
Cork R; Liu Y; Wang H; Elsharydah A
LSU Health Sciences Center, Shreveport, LA, USA

THE ADVANTAGES OF COMBINED EPIDURAL AND GENERAL ANESTHESIA VS. CONVENTIONAL GENERAL ANESTHESIA IN OFF PUMP CORONARY ARTERY BYPASS SURGERY
Petrovski V; Slavevski D; Stoicovski E; Belostotskii V; Hristov N; Mitrev Z
Special Hospital for Cardiosurgery Filip II, Skopje, Macedonia

THE EFFECT OF MILRINONE ON BLOOD FLOW OF THE Y-GRAFT COMPOSED WITH THE RADIAL AND INTERNAL THORACIC ARTERY IN PATIENTS WITH CORONARY ARTERY DISEASE
Kwak Y; Na S; Shim Y; Shim J; Hong Y
Yonsei University College of Medicine, Seoul, South Korea

Tuesday Posters, May 2, 2006 • 12 noon – 1:30 pm
Moderators: Katherine P. Grichnik, MD/Jeffery S. Vender, MD

ECHOCARDIOGRAPHIC ASSESSMENT OF AORTICATHEROMA BURDEN AND IMPACT ON ADVERSE OUTCOMES AFTER CARDIAC SURGERY: A SYSTEMATIC REVIEW AND ANALYSIS OF GRADING SYSTEMS
Murphy S; Morris R; Glas K; Sheran S; Reeves S; Shanewise J; Swaminathan M; Intraoperative Council of the American Society of Echocardiography
1Duke University Medical Center, Durham, NC, USA; 2Emory University School of Medicine, Atlanta, GA, USA; 3Columbia University, College of Physicians and Surgeons, New York, NY, USA; 4Medical University of South Carolina, Charleston, SC, USA; 5Brigham and Women’s Hospital, Boston, MA, USA

CHANGING TRENDS IN NEUROLOGICAL OUTCOMES FOLLOWING CORONARY ARTERY BYPASS SURGERY – A SINGLE INSTITUTION EXPERIENCE OF 33,009 CASES OVER 15 YEARS
Mishra M; Karlekar A; Trehan N
Escorts Heart Institute & Research Centre, New Delhi, India

EMERGENCY AVR IN PREGNANCY - THE USE OF NOREPINEPHRINE AFTER CARDIOPULMONARY BYPASS
Cooper L; Barron M; Gallagher C
University of Miami Miller School of Medicine, Miami, FL, USA

INTRAOPERATIVE DIAGNOSIS OF A PULMONARY ARTERY THROMBUS USING CONTRAST-ENHANCED TRANSESOPHAGEAL ECHOCARDIOGRAPHY
Izrailtyan I; Clark J; Swaminathan M; Podgoreanu M; Mackensen B; Davis R; Mathew J
Duke University, Durham, NC, USA

SHOULD TEE BE ROUTINELY USED PRIOR TO CENTRAL LINE INSERTION?
Muzic D; Patel K; Minhaj M; Gramling-Babb P; Tung A; Chaney M
University of Chicago, Chicago, IL, USA

ANESTHETIC CONSIDERATIONS IN PATIENTS WITH THE 3RD GENERATION VENTRASSIST LVAS DEVICE PRESENTING FOR NON-CARDIAC SURGERY.
McIlroy D; Buckland M; Esmore D; Anesthesia Group T
Alfred Hospital, Melbourne, Victoria, Australia

THE EFFECTS OF SEVOFLURANE ON APOPTOSIS FOLLOWING MYOCARDIAL ISCHEMIA
Yu W; Lorencic I; R Reedy; Patel T; Nader N
University at Buffalo, Buffalo, NY, USA

COMPARISON OF SVO2 AND ETCO2 AS RELIABLE FUNCTIONAL HAEMODYNEMIC PARAMETER FOR ADEQUACY OF CARDIAC OUTPUT IN OPCAB SURGERY
Shastri N
Heart Care Clinic, Ahmedabad, Gujarat, India

THE EFFECT OF HIGH THORACIC EPIDURAL ON GLYCAEMIC CONTROL AND INSULIN REQUIREMENT AFTER ON-PUMP CORONARY ARTERY BYPASS SURGERY
Mahmoud A; Berridge J
Leeds General Infirmary, Leeds, UK

DOES RESPIRATION WITH A HIGH FRACTION OF INSPIRATORY OXYGEN INCREASE THE PULMONARY BLOOD FLOW IN CASES WITH LEFT-TO-RIGHT SHUNT?
Kurokawa S; Honma T; Baba H; Nomura M
1Niigata University, Niigata City, Niigata Pr, Japan; 2Tokyo Women’s Medical University, Shinjuku-ku, Tokyo, Japan

BYPASSING THE ICU AFTER OPCAB: A PROSPECTIVE AUDIT
Hemmerling T; Basile F; Noiseux N; Prieto I
University of Montreal, Montreal, PQ, Canada

EFFECT OF ROUTINE INTRAOPERATIVE TEE ON SURGICAL MANAGEMENT IN PATIENTS UNDERGOING CARDIAC SURGERY
Patel K; Muzic D; Minhaj M; Gramling-Babb P; Tung A; Chaney M
University of Chicago, Chicago, IL, USA

IMPLANTATION OF THE VENTRASSIST LVAS - ANESTHETIC MANAGEMENT
Buckland M; McIlroy D; Daly D; Cairo S; Silvers A; Esmore D; Begg J
1Alfred Hospital, Melbourne, Victoria, Australia; 2Ventracor Ltd, Chatswood, New South, Australia

OFF PUMP CORONARY ARTERY BYPASS ON AWAKE PATIENTS USING A NOVEL TECHNIQUE
Prieto I; Noiseux N; Basile F; Hemmerling T
University of Montreal, Montreal, PQ, Canada

DOES SODIUM BICARBONATE REDUCE POST-OPERATIVE RENAL FAILURE AFTER CARDIOPULMONARY BYPASS?
Zvara D; Amitie D; Beck C; Fisher, Jr. E; Reichert M; Kon N; Houle T
Wake Forest University, Winston-Salem, NC, USA
SCA85
PULSE PRESSURE IS A BETTER PREDICTOR OF STROKE VOLUME THAN PULMONARY ARTERY DERIVED PARAMETERS
Falcucci O; Weis R; Zhu J; Ewbanks B; Berger B; Spiess B
Virginia Commonwealth University, Richmond, VA, USA

SCA86
AWAKE OFF PUMP CORONARY ARTERY BYPASS SURGERY: INITIAL EXPERIENCE
Petrovski V; Anguseva T; Belostotskii V; Hristov N; Mitrev Z
Special Hospital for Cardiosurgery Filip II, Skopje, Macedonia

SCA87
THE PREVALENCE OF PLATELET FACTOR FOUR HEPARIN COMPLEX ANTIBODIES IN A HETEROGENEOUS CARDIAC SURGERY POPULATION
Cain R; DeAnda A; Volman R; Baker K; Kasirajan V; Spiess B; Nelson M; Falcucci O
Virginia Commonwealth University Medical Center, Richmond, VA, USA

SCA88
BLOODLESS THORACIC AORTIC SURGERY REQUIRING DEEP HYPOTHERMIC CIRCULATORY ARREST: CASE SERIES FROM A HIGH-VOLUME UNIVERSITY CENTER
Augoustides J; Harris H; Watson T; Pochettino A; Bavaria J; Savino J
Hospital of the University of Pennsylvania, Philadelphia, PA, USA

SCA89
IMPACT OF AGE AND GROWTH HORMONE ON ANESTHETIC-INDUCED ALTERATIONS IN CARDIAC PERFORMANCE
Beck C; Bennett C; Sonntag W; Groban L
Wake Forest University School of Medicine, Winston-Salem, NC, USA

SCA90
Withdrawn

SCA91
THE USE OF CT GENERATED 3D MODELS FUSED WITH TEE IN THE COMPLEX CARDIAC PROCEDURE: HELPING CLINICIANS EXPERIENCE ANATOMIC ANOMALY IN A VIRTUAL REALITY ENVIRONMENT.
Bernstein W; George I; Abrishamchian A; Brown J
University of Maryland, Baltimore, MD, USA

SCA92
HEMOSTASIS FOR ROBOT ASSISTED LAPAROSCOPIC PROSTATECTOMY: OUR EXPERIENCE WITH MICROPOROUS POLYSACCHARIDE HEMOSPHERES
Ereth M, Magera Jr J, Nuttall G, Oliver Jr W, Gettmann M
Mayo Clinic College of Medicine, Rochester, MN, USA

SCA93
ANESTHETIC DRUG ADMINISTRATION ERRORS REPORTED TO A UNIVERSITY HOSPITAL CQI SYSTEM
Bowdle A; Freund P; Posner K
University of Washington, Seattle, WA, USA

SCA94
IMPACT OF CARDIAC INDEX ON CEREBRAL REGIONAL OXYGEN SATURATION
Connelly G; Bennett C; Sonntag W; Groban L
Wake Forest University School of Medicine, Winston-Salem, NC, USA

SCA95
INCIDENCE OF MASSIVE BLEEDING IN A BLINDED RANDOMIZED CONTROLLED TRIAL OF ANTFIBRINOLYTIC DRUGS IN HIGH RISK CARDIAC SURGERY
Mazer D¹, Fergusson D², Hebert P², Rodger M², Pretorius R², Teoh K¹, MacAdams C¹, Robbilee J⁰, Bussieres J¹, Karsi J¹, Karkouti K¹, Arellano R⁰, Duke P⁰, Blajchman M¹⁰, Murkin J¹¹, Femes S¹²
St. Michael’s Hospital, University of Toronto, Toronto, ON, Canada¹; Ottawa Health Research Institute, University of Ottawa, Ottawa, ON, Canada; Hamilton Health Sciences Centre, McMaster University, Hamilton, ON, Canada¹; Foothills Medical Center, Calgary, AB, Canada; University of Ottawa Heart Institute, Ottawa, ON, Canada²; Hamilton Health Sciences Centre, McMaster University, Hamilton, ON, Canada¹; QE II Health Sciences Centre, Halifax, NS, Canada; University of Manitoba, Winnipeg, MB, Canada; University of Ottawa, Ottawa, ON, Canada²; Montreal Heart Institute, Montreal, Quebec, PQ, Canada; Toronto Hospital-General Division, University of Toronto, Toronto, ON, Canada³; QE II Health Sciences Centre, Halifax, NS, Canada; University of Ottawa Heart Institute, Ottawa, ON, Canada²; Institute Universitaire de cardiologie et de pneumologie, Quebec, PQ, Canada; Toronto Hospital-General Division, University of Toronto, Toronto, ON, Canada³; QE II Health Sciences Centre, Halifax, NS, Canada; University of Ottawa Heart Institute, Ottawa, ON, Canada²; London Health Sciences Centre, London, ON, Canada³; Schulich Heart Centre, University of Toronto, Toronto, ON, Canada³

SCA96
Withdrawn

SCA97
PATIENT SAFETY IN CARDIAC ANESTHESIOLOGY - DO AUTOMATED ANESTHESIA MEDICATION DISPENSING SYSTEMS DELAY ACCESS TO EMERGENCY MEDICATIONS?
Cooper L¹; Barron M¹; Gallagher C¹; Powell T²; Hitchen K²
¹University of Miami Miller School of Medicine, Miami, FL, USA; ²Jackson Health System, Miami, FL, USA
SCA1

APROTININ USE AND RED BLOOD CELL TRANSFUSION IN OFF-PUMP BILATERAL LUNG TRANSPLANTATION

Morozowich S; Shu L; Phillips-Bute B; Hartwig M; Appel J; Welsby I
Duke University Medical Center; Durham, NC, USA

Introduction: Red blood cell (RBC) transfusion may contribute to overall morbidity and mortality (1). In lung transplantation, aprotinin has been shown to reduce RBC transfusion when performed with cardiopulmonary bypass (CPB) (2). However, off-pump lung transplantation is becoming the standard of care and the efficacy of aprotinin in this setting has not been studied. Therefore, our objective was to determine whether aprotinin use will decrease intraoperative RBC transfusion in off-pump bilateral orthotopic lung transplantation (OP-BOLT).

Methods: After IRB approval, we completed a retrospective chart review of all adult OP-BOLT’s done between January 2000 and January 2005 at a single university center (n=158). The 4 most common preoperative diagnoses were included: chronic obstructive pulmonary disease (COPD, n=71), cystic fibrosis (CF, n=41), idiopathic pulmonary fibrosis (n=37), and sarcoidosis (n=9). Exclusions were re-do lung transplantation and the use of CPB. The decision to use aprotinin was determined by the attending anesthesiologist and it was started at the time of induction at the recommended dose used during cardiothoracic surgery. The decision to transfuse was determined by the attending anesthesiologist. The primary outcome variable was RBC transfusion in the OR. Clinical covariates included the primary diagnosis, sex, height, weight, previous thoracotomy status, and the following preoperative labs: hemoglobin, activated partial thromboplastin time, international normalized ratio, and platelet count. An ordinal logistic regression model, adjusting for covariate predictors of transfusion, was utilized to analyze the data.

Results: Eighty patients received aprotinin (aprotinin group) and 77 did not (non-aprotinin group). Clinical covariates were similar for both groups. Only weight (p=0.004) was found to be a significant predictor of RBC transfusion. Overall, there was no difference in RBC transfusion between the aprotinin and non-aprotinin groups. However, investigation of interaction terms between diagnosis subgroups and aprotinin use revealed that the COPD group that received aprotinin showed a reduction in RBC transfusion (p=0.03) and the CF group that received aprotinin showed an increase in RBC transfusion (p=0.01) (figure 1).

Conclusion: Our results in OP-BOLT show a significant reduction in RBC transfusion in the OR when aprotinin was used in our largest transplanted group, COPD. This is consistent with previously observed effects of aprotinin use on bleeding in thoracic surgery (3). It is unclear whether a residual confounding factor led to the use of aprotinin in CF patients who were at a higher bleeding risk or if a true paradoxical effect of aprotinin was observed in this group. Further prospective study should investigate this observation.

References
CARDIAC FUNCTION AND ACUTE LUNG INJURY AFTER THORACIC SURGERY
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Memorial Sloan-Kettering Cancer Center, New York, NY, USA

Background: The effects of major lung resection on heart function and occurrence of acute lung injury (ALI) have not been well established. Our goal was to study right and left heart function early after thoracic surgery using Doppler echocardiography at a time usually preceding ALI.

Methods: Using a prospective database, we examined the records of 279 patients who had thoracic surgery and had transthoracic echocardiography performed on postoperative day 1-4 as part of a larger research effort. ALI was defined as acute respiratory failure requiring intubation within 30-days of surgery. Data were analyzed with Fisher’s exact or Wilcoxon rank sum tests.

Results: ALI occurred in 13/279 (4.7%) of patients. Pneumonia occurrence was strongly associated with ALI 6/13 (46%) vs. 9/266 (3.4%) with no ALI, P <0.0001. Except for a trend of a lower DLCO-ppo. among ALI patients (P=0.08), those with or without ALI did not differ in any clinical or echocardiographic variable measured, Tables 1 and 2. Indices of left or right heart function were within the normal range in both groups, Table 2.

Conclusion: Early postoperative indices of left or right heart function did not differ in patients with or without ALI. The occurrence of pneumonia after lung resection appears to be a strong predictor of ALI.

Table 1: Patient Characteristics.

<table>
<thead>
<tr>
<th></th>
<th>ALI (n=13)</th>
<th>No ALI (n=266)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, yr.</td>
<td>65 ± 11</td>
<td>61 ± 11</td>
<td>0.26</td>
</tr>
<tr>
<td>Male (%)</td>
<td>9 (69)</td>
<td>155 (58)</td>
<td>0.56</td>
</tr>
<tr>
<td>Hypertension (%)</td>
<td>3 (23)</td>
<td>56 (21)</td>
<td>0.74</td>
</tr>
<tr>
<td>Coronary Artery Disease (%)</td>
<td>0 (0)</td>
<td>14 (5)</td>
<td>0.99</td>
</tr>
<tr>
<td>Diabetes Mellitus (%)</td>
<td>2 (15)</td>
<td>16 (6)</td>
<td>0.20</td>
</tr>
<tr>
<td>FEV1 % ppo.</td>
<td>41±19</td>
<td>47±23</td>
<td>0.33</td>
</tr>
<tr>
<td>DLCO % ppo.</td>
<td>36±21</td>
<td>47±25</td>
<td>0.08</td>
</tr>
<tr>
<td>Operation type</td>
<td></td>
<td></td>
<td>0.63</td>
</tr>
<tr>
<td>Wedge resection (%)</td>
<td>1 (8)</td>
<td>22 (8)</td>
<td></td>
</tr>
<tr>
<td>Lobectomy (%)</td>
<td>4 (31)</td>
<td>116 (44)</td>
<td></td>
</tr>
<tr>
<td>Pneumonectomy (%)</td>
<td>8 (62)</td>
<td>128 (48)</td>
<td></td>
</tr>
</tbody>
</table>

Data are mean ± SD or n (%). ppo- predicted postoperative.

Table 2: Echocardiographic Data.

<table>
<thead>
<tr>
<th></th>
<th>ALI (n=13)</th>
<th>No ALI (n=266)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate, bpm</td>
<td>101 ± 20</td>
<td>92 ± 16</td>
<td>0.16</td>
</tr>
<tr>
<td>IVC-p, mmHg</td>
<td>4.1 ± 3.9</td>
<td>4.5 ± 3.6</td>
<td>0.19</td>
</tr>
<tr>
<td>Left atrial size, cm</td>
<td>4.2 ± 0.8</td>
<td>4.4 ± 0.9</td>
<td>0.49</td>
</tr>
<tr>
<td>Right atrial size, cm</td>
<td>4.6 ± 0.6</td>
<td>4.6 ± 0.7</td>
<td>0.96</td>
</tr>
<tr>
<td>TR-Jet, m/s</td>
<td>2.2 ± 0.6</td>
<td>2.2± 0.6</td>
<td>0.88</td>
</tr>
<tr>
<td>LVEF, %</td>
<td>62 ± 8</td>
<td>63 ± 10</td>
<td>0.84</td>
</tr>
</tbody>
</table>

IVC-p: inferior vena cava estimated right atrial pressure; TR-Jet: tricuspid regurgitation jet velocity; LVEF: left ventricular ejection fraction.
COMBINED CLOPIDOGREL AND ASPIRIN THERAPY IN PATIENTS UNDERGOING CAROTID ENDARTERECTOMY IS ASSOCIATED WITH AN INCREASED RISK OF POSTOPERATIVE BLEEDING

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Introduction: Clopidogrel (Plavix), a potent inhibitor of ADP-induced platelet aggregation, may reduce the risk of stroke in carotid endarterectomy (CEA) patients [1]. However, clopidogrel administration may also significantly increase postoperative blood loss after cardiovascular surgery [2,3]. We investigated whether combined preoperative clopidogrel and ASA therapy in patients undergoing CEA improves in-hospital outcomes without increasing postoperative bleeding.

Methods: All patients who underwent CEA (n=1518) between 01/01/98 and 01/06/05 at our institution were classified by preoperative treatment type: clopidogrel and ASA (n=323), ASA only (n=651), or no oral antiplatelet therapy (n=527). Patients with concomitant cardiac surgery or preoperative clopidogrel therapy only were excluded. Patient demographics and risk factors were abstracted from our database and entered into a multivariate regression analysis to determine whether combined preoperative clopidogrel and ASA administration is independently associated with improved outcomes after CEA. The discriminatory power of the multivariate model was quantified by the c-index.

Results: Combined preoperative clopidogrel and ASA therapy did not reduce the risk of 30-day mortality, cardiac arrhythmia, MI, cardiac arrest, low-output syndrome, stroke, respiratory failure, renal dysfunction, need for reoperation, or length of hospital stay (Table 1). In contrast to single ASA therapy, combined preoperative clopidogrel and ASA therapy was independently associated with a nearly 5-fold higher risk of postoperative bleeding (OR=5.1; 95% CI=1.8-14.1; Figure 1). The majority of these bleeding episodes required surgical intervention (OR=3.2; 95% CI=1.2-10.1).

Conclusion: Combined preoperative clopidogrel and ASA administration did not significantly reduce any measured adverse clinical outcome. Moreover, the combined risks of perioperative transfusion and need for reoperation may outweigh the risks of discontinuing preoperative ADP-induced antiplatelet therapy.

Table 1: Incidence of adverse postoperative outcomes following CEA in patients receiving combined preoperative clopidogrel/ASA therapy, ASA only, or not receiving anti-platelet therapy.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Combined ASA Therapy (n=323)</th>
<th>ASA Therapy only (n=651)</th>
<th>No Antiplatelet Therapy (n=527)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-Day Mortality (%)</td>
<td>0.31</td>
<td>0.97</td>
<td>0.76</td>
<td>0.47</td>
</tr>
<tr>
<td>Major Adverse Events (%)</td>
<td>2.0</td>
<td>1.8</td>
<td>1.2</td>
<td>0.70</td>
</tr>
<tr>
<td>Cardiovascular Events (%)</td>
<td>0.95</td>
<td>0.61</td>
<td>0.47</td>
<td>0.88</td>
</tr>
<tr>
<td>Ankle Perfusion (%)</td>
<td>0.63</td>
<td>0.60</td>
<td>0.57</td>
<td>0.64</td>
</tr>
<tr>
<td>Venous Thrombosis (%)</td>
<td>1.2</td>
<td>1.8</td>
<td>1.2</td>
<td>0.79</td>
</tr>
<tr>
<td>Venous Thrombosis (%)</td>
<td>0.81</td>
<td>0.92</td>
<td>0.52</td>
<td>0.92</td>
</tr>
<tr>
<td>Ischemic Perfusion (%)</td>
<td>1.90</td>
<td>2.80</td>
<td>1.53</td>
<td>0.56</td>
</tr>
<tr>
<td>Renal Failure (%)</td>
<td>0.63</td>
<td>0.77</td>
<td>0.74</td>
<td>0.60</td>
</tr>
<tr>
<td>Infections (%)</td>
<td>1.90</td>
<td>2.90</td>
<td>2.00</td>
<td>0.96</td>
</tr>
<tr>
<td>Perioperative transfusion (%)</td>
<td>6.65</td>
<td>8.92</td>
<td>0.52</td>
<td>0.08</td>
</tr>
<tr>
<td>Length of Hospital Stay (d)</td>
<td>2.406</td>
<td>3.766</td>
<td>4.104</td>
<td>0.80</td>
</tr>
</tbody>
</table>

Figure 1: Significantly increased risk of Clopidogrel-associated postoperative bleeding when compared to Aspirin and non antiplatelet therapy. Incidence of postoperative bleeding (%) and p-values according to each subgroup are shown.
INTENSE CARDIAC TROPOIN SURVEILLANCE FOR LONG-TERM BENEFITS IS COST-EFFECTIVE IN PATIENTS UNDERGOING ABDOMINAL AORTIC SURGERY

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Introduction: Recent studies suggest that preoperative coronary revascularization before elective vascular surgery does not alter the long-term outcome. Early recognition and treatment may be a key strategy to reduce cardiac risk. Cardiac troponin I (cTnI) screening is an effective means of surveillance for perioperative myocardial infarction (MI).[1] The cTnI surveillance has allowed recognition of two distinct patterns (i.e., early and delayed) of MI in patients undergoing abdominal aortic surgery.[2] The cTn measurement has long-term prognostic value with regard to cardiac outcomes and mortality after vascular surgery.[3]

Methods: We designed a Markov based decision analysis model to determine the cost-effectiveness of routine postoperative surveillance with cTnI on days 0,1,2,3 with an aim to institute risk-reducing strategies in patients screened positive. The cut-off value for cTnI intervention was 1.5 ng/ml. Key baseline input variables included the following: sensitivity and specificity of cTnI 0.80 and 0.93 respectively, probability of MI: 0.049, probability of death in patients who suffered MI: 0.22, probability of death in others: 0.033.[2] Other variable assumptions include the following: cost of troponin: $357, cost and efficacy of risk reducing strategies: $11,390 (five days of ICU management) and 0.47 respectively. Annual rates for future MI and coronary revascularization in those who suffered MI: 0.076 and 0.037 and in those who did not suffer MI: 0.012 and 0.012 respectively. Base-case was “standard-care” management without cTnI surveillance. The time horizon was life-time and the target population being individuals aged 65 years (median) undergoing elective open abdominal aortic surgery. Long-term survival was modeled using US life tables while incorporating excess mortality rates associated with different states in the decision tree. Medicare reimbursement cost data were used to reflect societal perspective for analysis. Future costs (in 2003 US dollars) and QALYs were discounted at a 3% annual rate. Sensitivity analysis also included multivariate second-order Monte Carlo simulation for incremental cost-effectiveness ratio (ICER) values.

Results: Baseline analysis is listed in the table. Monte Carlo analysis with 10,000 simulations revealed median (2.5% and 97.5%) ICER values $22,434 ($11,796 and $52,122).

Discussion: In patients presenting for elective open abdominal aortic surgery, routine intensive surveillance with cTnI and early institution of treatment is cost-effective for long-term benefits when interpreted by comparing with published ICERs for commonly funded interventions.

References:

<table>
<thead>
<tr>
<th>Table</th>
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<tbody>
<tr>
<td>Strategy</td>
</tr>
<tr>
<td>Standard care</td>
</tr>
<tr>
<td>cTnI surveillance</td>
</tr>
</tbody>
</table>
PERIOPERATIVE CHANGES IN RED BLOOD CELL DEFORMABILITY IN PATIENTS UNDERGOING MAJOR NON-CARDIAC SURGERY: PRELIMINARY RESULTS
Christie A; Roche A; Bennett-Guerrero E
Duke University Medical Center, Durham, NC, USA

Background: Morbidity in high-risk surgical patients is responsible for increased length of stay (LOS) and hospital costs. There is growing evidence that altered microcirculatory flow is a causative factor in the development of organ dysfunction, and that changes in erythrocyte deformability may play a critical role. (1-3) In contrast to micropipette or cell-transit time, laser-assisted optical rotational red cell analyzer (LORCA) is one of the few established assays that can be used to quickly measure RBC deformability in a large number of clinical samples. In only 4 minutes, a blood sample is subjected to 9 different shear stresses (0.3 to 30 Pa) and an elongation index (EI) is calculated for each sample with $EI = (A-B)/(A+B)$.(4) It is not known if RBC deformability changes in the perioperative period. Therefore, we sought to assess these potential changes in a diverse group of non-cardiac surgical patients.

Methods: As part of an ongoing IRB-approved study, 25 subjects undergoing a diverse group of non-cardiac surgical procedures were enrolled in the study. Blood was collected preoperatively, at the end of surgery (EOS), and on post-operative day #1 (POD1). All samples were collected in 4 cc Vacutainer tubes (K2 EDTA). Using a single LORCA device blood was assayed according to manufacturer’s instructions.

Results: The figure shows EI at the study time points (mean ± SD). Statistically significant (p=0.0059) decreases in deformability were observed between preoperative and post-operative day #1 values. There was little difference observed between preoperative and end of surgery samples.

Conclusion: In patients undergoing major non-cardiac surgery, there is a statistically significant decrease in erythrocyte deformability observed on post-operative day #1. Values at the end of surgery, however, were similar to baseline. The association of these changes to postoperative morbidity and organ dysfunction will be assessed once enrollment is complete in this study.

References:
APROTININ USE AND ALLOGRAFT FUNCTION AFTER OFF-PUMP BILATERAL LUNG TRANSPLANTATION

Morozowich S; Lin S; Phillips-Bute B; Hartwig M; Appel J; Welsby I
Duke University Medical Center, Durham, NC, USA

Introduction: In lung transplantation, ischemia-reperfusion injury (IRI) contributes to primary graft dysfunction, a marker for mortality (1). In an animal model of lung transplantation, aprotinin appears to attenuate IRI when added to the lung preservation solution (2). Furthermore, aprotinin may be beneficial in lung transplantation by reducing bleeding, transfusion requirement, and related lung injury, which may also impact mortality (3). However, aprotinin use without the relative coagulopathy associated with cardiopulmonary bypass (CPB) may predispose the off-pump patient to thrombotic complications (4); and since off-pump lung transplantation is becoming the standard of care, the impact of aprotinin use in this setting is unknown. Therefore, we tested the hypothesis that aprotinin use will have no immediate effect on allograft function after off-pump bilateral orthotopic lung transplantation (OP-BOLT).

Methods: After IRB approval, we completed a retrospective chart review of all adult OP-BOLT’s performed between 2000 and 2005 at a single university center (n=158). The 4 most common preoperative diagnoses were included: chronic obstructive pulmonary disease (n = 71), cystic fibrosis (n=41), idiopathic pulmonary fibrosis (n=37), and sarcoidosis (n=9). Exclusions were re-do lung transplantation and the use of CPB. The decision to use aprotinin was determined by the attending anesthesiologist. Aprotinin was started at the time of induction and was administered at the recommended dose used during cardiothoracic surgery. The primary outcome variable was PaO2/FiO2 ratio at the end of surgery. Clinical covariates included inhaled nitric oxide use and allograft ischemic time. A multivariable linear regression model was utilized to analyze the data.

Results: Eighty patients received aprotinin (aprotinin group) and 77 did not (non-aprotinin group). The unadjusted effect of aprotinin use on the P/F ratio is illustrated in figure 1. There was no difference in P/F ratios by diagnosis or inhaled nitric oxide use. However, allograft ischemic times differed between the aprotinin and non-aprotinin groups (p=0.02). Therefore, the model was adjusted for ischemic time, which showed no main effect of aprotinin (p=0.47) or ischemic time (p=0.22). There was no interaction between aprotinin use and ischemic time (p=0.65).

Conclusion: In our study, there were no differences in the end of surgery PaO2/FiO2 ratios between the aprotinin and the non-aprotinin groups undergoing off-pump bilateral lung transplantation. These results suggest no immediate benefit or risk from aprotinin use with regards to immediate allograft function. This merits confirmation with prospective study including postoperative allograft function.

References
SCA7
DIAGNOSIS AND ASSESSMENT OF PERIOPERATIVE DIASTOLIC DYSFUNCTION DURING ELECTIVE ABDOMINAL AORTIC ANEURYSM REPAIR AND ITS ASSOCIATION WITH MORBIDITY AND MORTALITY
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Introduction: Transmitial Color M-Mode flow propagation velocity (Vp) obtained through transesophageal echocardiography (TEE) has been shown to be a valuable tool in the assessment of perioperative diastolic dysfunction. We compared Canadian Consensus Guidelines2 (CCG) for classification of diastolic function and Vp in predicting outcome.

Materials and Methods: All patients undergoing elective open repair of abdominal aortic aneurysm were considered eligible. After induction of general anesthesia, TEE exam was performed and mitral valve and left atrial (LA) inflow patterns were recorded with pulse wave Doppler (PWD) before (baseline), during and after application of the aortic cross clamp and Vp was recorded simultaneously. Diastolic dysfunction according to the CCG was graded as 1 for normal, 2 for mild, 3 for mild-to-moderate, 4 for moderate and 5 for severe diastolic dysfunction and 0 value was assigned for inconclusive results. A Vp value of less than .4m/sec was considered consistent with diastolic dysfunction.

Results: Thirty patients (M:F=22:8), aged 64 +/- 11.9 years, were enrolled. Their co-morbidities were hypertension in 50%, diabetes mellitus in 20%, 50% had been on a beta-blocker preoperatively, but all received beta-blockade perioperatively. The aorta was cross-clamped for an overall average duration of 78 &± 28".

In 10 patients Vp could not be recorded and 3/30 had inconclusive data by CCG. 14/30 patients had normal diastolic function by CCG and 2/20 by Vp throughout the procedure. Vp diagnosed all the patients with diastolic dysfunction that were diagnosed by CCG and additional six patients in which the CCG was either normal or inconclusive.

Six patients had postoperative cardiac complications (20%). There was one death postoperatively (3.3%), 3 had postoperative CHF (20%) and 1 myocardial infarction (MI) (3.3%), and 1 patient had postoperative atrial fibrillation with hemodynamic instability. We assessed for a relationship of CCG and Vp for a combined outcome of death, congestive heart failure or post-operative arrhythmia. CCG were normal throughout the procedure for 4 patients who had postoperative complications and diagnosed diastolic dysfunction only in 2 patients. We did not find a significant relationship between either a Vp of <0.4 or a CCG of greater than 1 (p=0.05). It is possible to assign a severity grade to diastolic dysfunction by CCG, whereas Vp is a categorical measure only. Ongoing study will be necessary to identify such a relationship and assess severity grade in Vp.
SCA8

ANESTHETIC PROBLEM-SOLVING FOR ENDOVASCULAR REPAIR OF A GIANT INNOMINATE ARTERY PSEUDOANEURYSM ERODING INTO A MEDIASTINAL TRACHEOSTOMY

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Introduction: We describe emergency endovascular repair of a leaking giant innominate pseudoaneurysm (IPA). The anesthetic plan required no airway manipulation, cardiopulmonary bypass (CPB), and precise control of anesthetic depth. To our knowledge, this is the first report of endovascular non-traumatic IPA repair with CPB.

Clinical Presentation: A 16-year old boy presented with hemoptysis secondary to a giant IPA. He had received radiation for mediastinal lymphoma. He later developed tracheal stenosis and tracheal-innominate fistula. Definitive surgical management required ligation of the innominate artery and mediastinal tracheostomy. A giant IPA subsequently resulted; it was initially managed with endovascular coil embolization. During this presentation, aortography confirmed flow into the IPA with dispersed coils. Repeat embolization or open surgical management was deemed too high-risk. After extensive discussion, endovascular exclusion of the IPA was selected. Anesthetic monitoring consisted of routine ASA monitors, a dorsalis pedis arterial line and EEG. Flow-by oxygen at 6 liters per minute was administered. A 20G peripheral intravenous line was established. The patient was sedated with titrated ketamine (5-10mg per bolus) after preoperative midazolam and glycopyrrolate.

Under local anesthesia, the left femoral vein was cannulated for large-bore central venous access. After heparin administration, the right femoral artery and vein were cannulated and CPB was initiated. General anesthesia was then induced with titrated propofol (2mg/kg total). The patient subsequently received scopolamine 0.4 mg and a remifentanil infusion at 0.5-1.0 mcg/kg/min. Neuromuscular blockade was achieved with vecuronium (0.1mg/kg) and subsequently titrated for a train-of-four ratio of 25%.

The endovascular stent (ES) design was for abdominal deployment and so was too small for a left iliac artery approach. After considerable dissection, the left axillary artery was deemed too small for stent deployment. The remaining arterial approach was the left common carotid artery (LCCA).

To provide cerebral flow during ES deployment, the left internal carotid artery was cannulated and connected to the arterial cardiopulmonary bypass circuit. With antegrade cerebral perfusion accomplished, the ES was deployed through the LCCA to exclude the IPA and spare the origin of the LCCA. These findings were confirmed during completion angiography. There were no EEG changes.

Prompt emergence from general anesthesia was then achieved after termination of the remifentanil infusion, and administration of physostigmine and neuromuscular reversal. After adequate spontaneous ventilation had resumed, the patient was rapidly weaned from CPB. The remaining hospital course was uneventful.

Discussion: This unusual airway at high risk for exsanguinating hemoptysis prompted airway management with CPB and a no-touch technique. The anesthetic plan must remain flexible and accommodating especially in unusual and emergency circumstances.

References:
Ann Thorac Surg 2004; 77:591-6
Eur J Vasc Endovasc Surg 1999; 18:80-2
J Endovasc Ther 2000; 7:245-50
SCA9

NITROSATIVE STRESS ASSOCIATED WITH SINGLE LUNG VENTILATION AND PULMONARY RESECTION IMPAIRS MYOCARDIAL CALCIUM CYCLING
Pan B; Hong R; Singer A; Lane P; Crabtree M; Heerdt P
Cornell University, New York, NY, USA

Recent data suggest that pulmonary resection during single lung ventilation elicits a systemic oxidative challenge that persists postoperatively (1). Additional studies have indicated that, within the heart, oxidative/nitrosative stress resulting from chronic disease can have direct effects on myocyte calcium cycling (2). In particular are data demonstrating that peroxynitrite (ONOO-) mediated nitration of the key calcium cycling protein sarcoplasmic endoreticular calcium ATPase subtype 2a (SERCA2a) impairs protein function and may contribute to diminished inotropy and lusitropy in dilated myopathy (2). The present study was designed to test the hypothesis that oxidative/nitrosative stress associated with pulmonary resection during single lung ventilation in otherwise healthy subjects can mimic the reported effects of chronic disease on SERCA2a activity.

Methods: Myocardial tissue harvested from 12 swine were used for the study; 7 animals had undergone left upper lobectomy 3 days prior to tissue harvest (LOBE) while the other 5 were non-operated controls. Within each group, myocardial ONOO-generation (reflecting the reaction of superoxide with nitric oxide) was quantified by HPLC measurement of protein 3-nitrotyrosine (3-NT) content. Attendant changes in SERCA2a expression and function were determined from Western blotting and analysis of indo-1 uptake by isolated sarcoplasmic reticular membranes, respectively. In addition, since SERCA2a activity is regulated by the phosphorylation state of phospholamban (PLB), phosphorylation at serine 16 (P-Ser16) and threonine 17 (P-Thr17) of PLB was determined by Western blotting. Control vs LOBE differences were compared by t-test. Data are presented as mean [SPCHAR(plusmn)] SE, and for all statistical tests, a p<0.05 was considered significant (* in figures).

Results: There was a distinct difference in myocardial 3-NT between control and LOBE animals that was associated with a marked reduction in calcium uptake by SERCA2a (figure 1). This decline in SERCA2a activity was not coincident with altered expression of SERCA2a (1.2[SPCHAR(plusmn)] 0.1 vs 1.1[SPCHAR(plusmn)]0.1) or decreased PLB phosphorylation (figure 2).

Conclusion: These data strongly support the probability that perioperative oxidative/nitrosative stress associated with lung resection can influence SERCA2a activity independent of any influence on protein expression or phosphorylation of the SERCA2a regulator PLB. Importantly, these are the first data to link an acute event with a subcellular process previously described only in chronic illness.

References
2.  Circulation 2005;111:988-995
DETECTION OF LOW PLASMA LEVELS OF LOW MOLECULAR WEIGHT HEPARIN

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Introduction: The detection of low-molecular-weight (LMWH) heparin in blood is complicated by the fact that it is refractory to neutralization by protamine. Thromboelastographic analysis has demonstrated that the anticoagulant effect of LMWH can be reversed by heparinase I(1). Although LMWH can be formed by controlled digestion of unfractionated heparin with heparinase, more prolonged digestion appears to result in complete loss of anticoagulant activity. In an effort to develop a relatively simple and rapid test for detection of effective levels of LMWH, we utilized a test-tube coagulation assay, Hemochron Saline (HS), which contains no activators of coagulation. In previous studies, the HS assay proved sensitive to detection of low levels of unfractionated heparin and protamine excess (2,3). The HS assay is carried out in a small, battery-operated apparatus and is fully automated. After a comparison of the sensitivities of HS, activated partial thromboplastin time (aPTT) and thrombin time (TT) to enoxaparin anticoagulation, we tested the extent of reversal of the enoxaparin effect in the HS assay, after digestion with heparinase.

Methods: In the initial studies comparing the effect of enoxaparin on clotting times in the HS, aPTT and TT assays, blood was drawn pre-incision with IRB approval from 2 patients scheduled for cardiac surgery. HS was assayed in the Hemochron 801 apparatus; aPTT and TT were assayed by the clinical laboratory. In the second study of the effects of heparinase digestion on enoxaparin, 6 assays were conducted on 4 different pooled plasma samples obtained commercially. Blood or plasma samples were spiked with enoxaparin to simulate “4 hr” or “12 hr” levels post- subcutaneous injection of 50 mg, which would be approximately 0.5 and 0.125 IU/ml, respectively (4). Only the low-level LMWH conditions (“12 hr”) were tested for reversal by heparinase, using the manufacturer’s (Dade-Behring, New Castle, DE) conditions (except we used 15 min digestion at 37°C rather than room temperature).

Results: All three assays detected the presence of enoxaparin at both simulated plasma levels (Figure). Average baseline clotting times were 232, 28.4, and 19.6 sec for HS, aPTT and TT, respectively. Of note, the average prolongation with enoxaparin for the “12 hr” level was 26.9 sec. In the reversal studies, the average decrease in clotting time with heparinase was 21.6 (11) sec, mean (SD)(p<0.05), which returned clotting time to 100.5 (4.7)% of the baseline values.

Conclusions: Heparinase appeared to completely reverse the anticoagulant effects of enoxaparin. In comparison with laboratory assays, the HS assay may provide a detection advantage because of the magnitude (in sec) of the decrease in clotting time with heparinase.

References:
SCA11
DEPRESSION AFTER CORONARY ARTERY BYPASS GRAFT SURGERY AND GENETIC VARIABILITY IN TWO SEROTONIN RELATED POLYMORPHISMS
Phillips-Bute B; Mathew J; Morris R; Podgoreanu M; Stafford-Smith M; Grocott H; Schwinn D; Blumenthal J; Newman M Duke University, Durham, NC, USA

Introduction: Despite advances and improved outcomes following coronary artery bypass graft (CABG) surgery, postoperative depression remains a particularly devastating concern. Post CABG depression has been associated with both increased morbidity and mortality and decreased quality of life. Although depression has multiple complex causes, much evidence exists to implicate serotonin (a monoamine neurotransmitter) in the pathophysiology of the disease. The aim of this study is to assess the association between genetic variability in two serotonin-related gene polymorphisms (MAOA-uVNTR and 5HTTLPR) and postoperative depression in CABG patients.

Methods: 427 CABG patients (158 females) were genotyped for the two single nucleotide polymorphisms (SNPs) and assessed for depression using the Center for Epidemiological Studies – Depression Scale (CES-D) at baseline and at six-months and one year postoperatively. Logistic regression was used to assess the association between depressed patients (defined as CES-D score >= 16) and genotype. The sexes were combined for 5HTTLPR analysis but since MAOA-uVNTR is sex-linked, males and females were analyzed separately. Age and race were investigated as possible confounders of genotype and depression; p<0.05 was considered significant.

Results: Although neither SNP is associated with baseline depression, the 3/4 genotype of MAOA-uVNTR is associated with new-onset depression (OR: 6.56, 95% CI: 2.22-22.45; p=0.001) in females at one year follow-up (Figure 1). There is no MAOA-uVNTR effect in males. 5HTTLPR is not associated with new-onset depression (p=0.15), but is associated with all depression (chronic + new onset) at one year (OR: 1.95, 95% CI: 1.20-3.15; p=0.007). Genetic findings were not affected by adjusting for age and race.

Conclusion: This study identifies two serotonin-related genetic polymorphisms potentially useful in identifying patients who are at risk for depression after CABG surgery. An improved ability to anticipate postoperative depression could prove valuable as a tool for reducing adverse outcomes associated with CABG surgery.

References:
SCA 12 ABSTRACTS

SCA 12

EFFECTS OF CARDIOPULMONARY BYPASS AND ANEMIA ON RENAL GENE EXPRESSION

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1St. Michael’s Hospital, University of Toronto, Toronto, Ontario, Canada; 2St. Michael’s Hospital, Toronto, Ontario, Canada

Introduction: Renal failure (RF) is a serious complication of cardiopulmonary bypass (CPB). Post-CPB dialysis, required in 1-15% of patients, increases mortality more than 20-fold. Anemia, hypoxia, ischemia, and acute inflammation are potential mechanisms of RF. We investigated in rats the effect of CPB±anemia on renal cortex and medulla gene expression using microarray analysis.

Methods: With ACC approval, Sprague-Dawley rats were anesthetized with ketamine/xylazine, isoflurane, fentanyl, midazolam, and cisatracarium. Study animals underwent normothermic CPB for one hour with a neonatal membrane oxygenator. Sham animals had identical instrumentation but did not undergo CPB. 3 groups of animals were studied: sham, CPB, and Anemia-CPB. Target hemoglobin was 100g/L in sham and CPB, and 65g/L in the Anemia-CPB group. Animals were sacrificed the next day and total RNA from renal medulla and cortex was extracted. Gene expression was measured using Affymetrix GeneChip Rat 230.2. Data for each microarray was normalized to sham, log transformed, and filtered using GeneSpring. A 2-fold change in gene expression compared to sham was considered significant. GeneSifter was used for clustering and pathway analysis.

Results and Discussion: There were no significant differences between groups in physiologic variables, other than Hb. 18,000 genes were present, with 2-fold changes in 787 genes in cortex and 883 in medulla. Over 50% were involved in physiological processes: metabolism (95 vs 6 genes, cortex vs medulla), stress response (43,36), inflammation (11,10), and nitric oxide pathway (5,1). We focused on genes associated with hypoxia/ischemia, inflammation, and carbohydrate metabolism. Data in the table below are expressed as fold-change compared to sham (mean±SD). Endothelial nitric oxide synthase (eNOS) and extracellular superoxide dismutase (SOD3) were upregulated, suggesting increased hypoxia/ischemia-induced effects in medulla compared with cortex. However neutrophil gelatinase-associated lipocalin (NGAL), an early marker of ischemia-induced renal dysfunction was significantly down-regulated in all tissues. Upregulation of inflammation-related genes (tumor necrosis factor receptor-12 (TNFR-12) and ICAM-1) also occurred after CPB. Hexokinase 1, the first enzyme in glycolysis, was increased in renal medulla, while glucose 6-phosphatase, involved in glycogenolysis, was decreased, suggesting a metabolic response to reduced tissue oxygen delivery.

Conclusion: In this CPB model, there is altered expression of genes associated with hypoxia, ischemia, glucose metabolism and inflammation. 24 hours post-CPB, NGAL was downregulated. However, NGAL is upregulated at 2-6 hours, suggesting the importance of also investigating gene expression at earlier times. Further research to better define the time course of renal gene expression and protein products will enhance our understanding of the mechanism of renal dysfunction associated with CPB and anemia.

<table>
<thead>
<tr>
<th>Gene</th>
<th>CPB</th>
<th>Anemia CPB</th>
<th>CPB</th>
<th>Anemia CPB</th>
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<td>0.5±0.04</td>
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<td>Inflammation</td>
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<tr>
<td>TNF Receptor-12</td>
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<tr>
<td>Glucose 6-phosphatase</td>
<td>0.7±0.05</td>
<td>1.0±0.60</td>
<td>0.3±0.09</td>
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<td>Hexokinase 1</td>
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<td>0.6±0.05</td>
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SCA13
HIGH THORACIC EPIDURAL ANESTHESIA’S EFFECTS ON MYOCARDIAL BLOOD FLOW, OXYGEN CONSUMPTION, MYOCARDIAL WORK, AND MARKERS OF ISCHEMIA DURING CORONARY ARTERY BYPASS GRAFTING: A RANDOMIZED, CONTROLLED TRIAL

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Introduction: While human studies with high thoracic epidural anesthesia (HTEA) in cardiac surgery have shown improved hemodynamics and catecholamine levels, there is no clear evidence for myocardial protection from ischemia.(1-2) We designed a randomized, controlled trial to test the hypothesis that high thoracic epidural anesthesia (HTEA) protects patients from myocardial ischemia by decreasing myocardial work, which correlates with reductions in myocardial blood flow (MBF), myocardial oxygen consumption (MVO2), and improved levels of ischemic markers.

Methods: Twenty Caucasian males with coronary artery disease scheduled for coronary artery bypass grafting (CABG) were randomized with IRB approval to receive either HTEA (T2-4) plus a standard general anesthetic for surgery (n = 10) or general anesthesia only (n = 10). All subjects received a pulmonary artery flotation catheter, a gas-tight coronary sinus catheter, and a left ventricular catheter with tip manometer. MBF was measured using an argon gas technique.(3) Hemodynamic and blood data were collected at five time points: 1) baseline; 2) after general anesthesia; 3) after HTEA dosed; 4) after sternotomy; and 5) after bypass. Epidurals were dosed with 8-10 cc of 0.5\% bupivicaine.

We use generalized estimating equations (GEEs) to assess associations between trial arm and the outcomes MVO2, MBF, myocardial work (calculated as the product of HR, MAP and systemic vascular resistance), and markers of ischemia while controlling for other clinically significant variables. All models included time, treatment group, and their interaction, and subject’s baseline outcome measure.

Results: Based on the GEE analyses, HTEA was associated with significant reductions in MBF, MVO2, and myocardial work. Specifically, significant percent reductions in MBF at corresponding time points for average subjects treated with an epidural were: time 3 = 24\%, p=0.0006; time 4 = 41\%, p<0.0001; and time 5 = 29\%, p<0.001. Significant reductions in MVO2 were: time 3 = 34\%, p<0.001; time 4 = 46\%, p<0.001; and time 5 = 34\%, p<0.001. Significant reductions in myocardial work were: time 3 = 25\%, p<0.001; and time 4 = 31\%, p=0.0002. We fit additional GEE models to investigate the association between markers for ischemia and treatment group over time. Treated subjects had significantly higher levels of hypoxanthine relative to controls immediately following HTEA dosing (p=0.0003).

Discussion: This is first study to quantify the effects of HTEA and directly measure MBF, MVO2, and markers of ischemia while controlling for physiologic determinants. Significant reductions in MBF, MVO2 and myocardial work during CABG suggest that epidurals play a role in reducing the myocardial workload, thereby decreasing the demand for blood and oxygen in patients with severe CAD. The highly significant difference in hypoxanthine levels when controlling for treatment further substantiate the myocardial protective effect of HTEA in cardiac surgery.

References:
THE INFLUENCE OF MINI-TORACOTOMY VS. MEDIAN STERNOTOMY ON THE INFLAMMATORY RESPONSE TO VALVE SURGERY

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Introduction: Cardiac surgery induces a pronounced systemic inflammatory response involving the release of cytokines. Both surgical trauma and cardiopulmonary bypass (CPB) can stimulate the release of these cytokines (1,2). In addition to having significant cardiovascular activity (by regulating nitric oxide homeostasis and mediating interactions between leukocytes and the endothelium), excessive release of cytokines has been associated with poor clinical outcomes including increased bleeding, prolonged respiratory support, greater capillary leak and decline in independent functioning (3). The purpose of this study was to compare the inflammatory response in patients undergoing valve surgery via either median sternotomy or a minimally invasive mini-thoracotomy approach.

Methods: After IRB approval, 49 patients undergoing valve surgery (9 aortic valve-, and 40 mitral valve repairs/ replacements) who had been enrolled in an unrelated prospective trial where serum cytokine levels were drawn were studied. The patients were divided according to surgical approach: median sternotomy (n=30) group and mini-thoracotomy (n=19) group. Blood samples for interleukin-6 (IL-6), IL-8 and CRP were drawn at baseline (prior to induction of anesthesia), at the end of CPB, then 4 and 24 hours after the end of CPB. Continuous variables were compared between the two treatment groups using Wilcoxon Rank Sum tests. Categorical characteristics were compared using an exact Pearson Chi-Square test. All analyses were performed using SAS statistical software version 9.1. A p-value of less than 0.05 was considered to be statistically significant.

Results: There were no significant differences in demographics or intraoperative characteristics between the two groups. In addition, there were no differences in IL-6, IL-8 and CRP levels between the two groups either (Table 1, Figure 1).

Conclusions: Our results indicate that the inflammatory response induced by minimally invasive mini-thoracotomy approach is of similar magnitude to the one that is elucidated by median sternotomy. This suggests that CPB itself has a larger influence on the inflammatory response than the trauma of the surgical approach.

References:
SCA15
REDUCTION IN MICROBUBBLE SIZE USING PERFLUOROCARBONS DURING CARDIOPULMONARY BYPASS IN THE RAT
Yoshitani K; Ma Q; de Lange F; Grocott H; Mackensen G
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Introduction: Perfluorocarbon (PFC) emulsions are gas-dissolving agents that have been investigated as artificial oxygen carriers (1). Based on the high solubility of gases in PFC, they have also been tested in regard to their ability to treat the sequelae of cerebral gas embolism (2). Cerebral gas emboli are well documented during cardiopulmonary bypass (CPB) and are thought to contribute to adverse cerebral outcomes after cardiac surgery (3). This study was designed to test, whether PFC emulsions would reduce the volume of microbubbles within the CPB circuit.

Methods: Sprague-Dawley rats (400-450g) undergoing 60 min of normothermic non-pulsatile CPB were randomized to one of three groups. The PFC group (n=10) received a gas mixture of 60% O₂, 36% N₂ and 4% CO via the membrane oxygenator and 2.7g/kg (4.5 ml/kg) of PFC (Oxycyte, Synthetic Blood International, San Diego, CA) into the venous reservoir. The control group (n=10) received the same gas mixture but 4.5 ml/kg of 0.9% saline. Animals in the nitrous oxide group (serving as a positive control; n=6) were exposed to 60% O₂, 36% N₂O and 4% CO and 4.5 ml/kg of 0.9% saline during 60 minutes of normothermic CPB. At 10 min and 35 min of CPB, a gaseous microbubble (400µL of room air) was injected into a bubble chamber positioned on the venous side of the bypass circuit as previously described (4). After 20 minutes of equilibration time the microbubble was removed for volumetric analysis. Changes in microbubble size were compared using one way ANOVA and Bonferroni t-test as a post hoc comparison. Statistical significance was considered when P < 0.05.

Results: Changes in microbubble size during bypass were – 2 ± 2% in the control group, - 13 ± 5 % in the PFC group (P < 0.0001, PFC vs control), + 46 ± 9 % in the nitrous oxide group (P < 0.0001, nitrous oxide vs control; Figure 1).

Discussion: Consistent with its physicochemical properties, PFC caused a small but significant decrease in the volume of microbubbles present within the CPB circuit. Whether this effect is of sufficient magnitude to alter the clinical consequences of microbubble embolization remains to be determined.

References
(1) Spahn DR, et al, Anesthesiology 97, 1338-49, 2002
DESFLURANE CAUSES MORE ARRHYTHMIAS IN OPCAB THAN SEVOFLURANE
Noël M; Choucri E; Noiseux N; Olivier J; Le N; Hemmerling T
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Purpose: This prospective, randomized and double-blind study compares the arrhythmogenic effects of sevoflurane and desflurane in off-pump coronary artery bypass graft (OPCAB).

Methods: Forty patients undergoing coronary artery bypass graft (CABG) are included. Anesthesia was induced by fentanyl 2-3 µg/kg, propofol 1-2 mg/kg, and maintained using either 1 MAC sevoflurane (N=20) or 1 MAC desflurane (N=20). Analgesia regimen consisted of high thoracic epidural analgesia (TEA) installed preoperatively and removed after 72 h. Patients were meant to be immediately extubated in the OR, followed by continuous ECG monitoring for 48 h. Arrhythmic events were noted, as well as ischemic markers, cardiac function and hemodynamic stability during surgery. Patient data and arrhythmogenic data were recorded and compared using Wilcoxon test or Fisher exact test, P<0.05.

Results: All patients were immediately extubated; there was no difference in patient data between the two groups. (Table 1). There were significantly more patients with supraventricular tachycardias, atrial fibrillation and patients with immediate agitation after desflurane than sevoflurane (Table 2).

Conclusion: Sevoflurane and desflurane can both be used to ultra-fast track patients after OPCAB (immediate OR extubation). However, desflurane causes significantly more arrhythmias than sevoflurane.

<table>
<thead>
<tr>
<th>Table 1: Demographic data for patients</th>
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<tr>
<td>Group 1 (n=20)</td>
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</tr>
<tr>
<td>Age (years)</td>
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<tr>
<td>Sex (M:F)</td>
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<tr>
<td>MAP (mmHg)</td>
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<tr>
<td>Duration of TEA (h)</td>
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<tr>
<td>Numbers of intra-coronary bypass</td>
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<tr>
<td>Intubation time (h)</td>
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<tr>
<td>Postoperative agitation (N)</td>
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<td>Duration of hospitalization (day)</td>
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<td>Ejection fraction (%)</td>
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<th>Table 2: Arrhythmogenic data for patients</th>
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<tbody>
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<td>----------------</td>
</tr>
<tr>
<td>Supraventricular tachycardias</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
</tr>
<tr>
<td>Ventricular tachycardias</td>
</tr>
<tr>
<td>Ventricular fibrillation</td>
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<tr>
<td>Bradycardia</td>
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PLAQUE SCORE OF CAROTID ARTERIES AS A PREDICTOR OF SILENT CEREBRAL INFARCTION IN ELDERLY CORONARY SURGICAL PATIENTS

Baba T; Goto T; Maekawa K; Yoshitake A
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Introduction: Silent cerebral infarctions (SCI) are common in elderly patients and are a risk factor for neurologic dysfunction as long with cerebrovascular disease (CVD), peripheral vascular disease (PVD) or abdominal aortic aneurysm (AAA). Carotid lesions are an indicator of systemic atherosclerosis. We examined the plaque score (PS) of carotid arteries as a predictor of SCI in patients undergoing coronary artery bypass grafting (CABG).

Methods: Data were collected prospectively on 633 CABG patients (≥60 y) who underwent preoperative carotid ultrasonography, cerebral MRI and craniocervical MRA. PS was computed by summing the plaque thickness (≥1. mm) at four locations in both carotid arteries and then classified into four groups: none, 0; mild, 0.5-5.0; moderate, 5.1-10.0; and severe, ≥10.1. SCI was defined that patients with infarctions on MRI had no previous CVD. Neuropsychological (NP) dysfunction was defined as a decrease in performance from baseline of at least 4 as measured on the Hasegawa dementia scale (HDS; score 0-30), a modification of MMSE, administered before surgery and postoperative day 7. The patients were divided into three groups: control (n=306); SCI (n=129); and high risk (CVD, PVD, AAA: n=198). We compared PS, risk factors, and the incidence of neurologic dysfunction among these 3 groups. In addition, the probability of SCI was calculated for each combination of risk factors.

Results: PS of the 3 groups were as follows: high risk, 9.0 ± 5.3; SCI, 7.1 ± 4.8; control, 5.4 ± 4.5 (p<0.01). Among the 3 groups, the SCI group had intermediate craniocervical and aortic atherosclerosis. The incidences of perioperative stroke were: high risk, 6.1%; SCI, 3.1%; control, 1.3%, and NP dysfunction was 12%, 9% and 4% (p<0.05). The percentage of patients with SCI increased as PS increased (7%, 27%, 35%, 39%). Univariate analysis revealed that 4 factors were correlated with SCI: PS ≥5.0, age ≥70 y, creatinine ≥1.9mg/dl and preoperative cognitive decline (HDS < 24). The probability of SCI in patients with no risk factors other than PS ≥5.1 was 0.28 and increased progressively to 0.83 with in presence of all 4 risk factors.

Conclusion: Patients with SCI were associated with systemic atherosclerosis and an increased risk of postoperative neurologic dysfunction. PS of the SCI group was high and would be useful to predict SCI when PS is combined with age, creatinine and cognitive decline.
SCA18

ATRIAL NATRIURETIC PEPTIDE REDUCES MYOCARDIAL STUNNING IN RABBITS

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Introduction: Natriuretic peptides have proven useful for the treatment of heart failure and may have some utility after myocardial ischemia(1,2). We tested the hypothesis that atrial natriuretic peptide (ANP) would decrease both the effects of myocardial stunning and oxygen consumption in rabbit hearts.

Methods: The study was approved by IACUC. An open-chest preparation was performed on 3 groups of anesthetized New Zealand white rabbits (2-3 kg) (9 Stunned-control, 8 Stunned-ANP-treated and 8 Non-stunned-ANP-treated). Myocardial stunning was induced by two consecutive 15 minute periods of the left anterior descending coronary artery (LAD) occlusion followed by 15 minutes of reperfusion. After the second reperfusion period, either ANP (0.2 mg) or lactated Ringers (0.2 ml) was injected into the left ventricular free wall, in the LAD distribution field, in three equal divided doses. Hemodynamic parameters measured included heart rate, aortic and left ventricular pressures, functional wall thickening (WT), delay of onset of WT, and rate of WT. Coronary blood flow (microspheres) and O2 extraction (microspectrophotometry) were used to determine myocardial O2 consumption. ANOVA was used for statistical analysis. A value of p<0.05 was accepted as significant. Data were presented as Mean±S.E.M.

Results: There were no significant differences in hemodynamic parameters between groups prior to treatment. Stunning lowered heart rate slightly in the stunned-control group (227± 7 beats/min to 201±6). Stunning and ANP lowered systolic (95±3 mm Hg to 82±3) and mean arterial pressures (73±2 to 66±2) slightly in the stunned-ANP treated rabbits. Arterial blood gases and pH were controlled and not different between groups before or after stunning. Figure 1 shows the effect of stunning and ANP on the time delay to the onset of contraction in the stunned segment. This parameter is derived from the time difference between the beginning of the rise of intraventricular pressure and the beginning of the increase in wall thickening of the studied left ventricular wall segment. In the stunned-control group, baseline delay to contraction was 25±7 msec, and this increased to 84±16 following stunning and vehicle administration. In the stunned-ANP group, baseline delay was 20±6 and increased slightly to 30±7 after stunning and ANP administration. Wall thickening decreased by approximately 30% with stunning and vehicle but only 8% in the stunned-ANP treated hearts. Stunning did not affect regional O2 consumption (6.0±1.1 stunned vs. 7.4±1.2 mlO2/min/100g non-stunned). ANP administration did not affect O2 consumption (7.3±1.7 stunned vs. 6.4±1.0 non-stunned).

Conclusion: The data showed that ANP greatly reduced the detrimental functional effects of myocardial stunning. However, ANP had no significant effects on regional oxygen consumption in stunned myocardium.

References:
(1) Bas. Res. Cardiol. 99:90-93, 2004
(2) Bas. Res. Cardiol. 99:94-100, 2004

Figure 1: Effects of vehicle or ANP on the time delay (msec) to the onset of regional wall thickening after myocardial stunning (Stun). * Significantly different from Base, p<0.05. † Significantly different from vehicle, p<0.05.
THE EFFECT OF 6% HYDROXYETHYL STARCH 130/0.4 ON COAGULATION AND VOLUME EXPANSION IN OFF-PUMP CORONARY BYPASS GRAFT SURGERY: COMPARISON WITH 6% HYDROXYETHYL STARCH 200/0.5

Kwak Y; Na S; Shim Y; Shim J; Hong Y
Yonsei University College of Medicine, Seoul, Korea

Introduction: Hydroxyethyl starches (HES) are widely used as plasma substitutes in surgical patients, but they may cause coagulopathy when administered in large doses. Newly developed low molecular, low substituted HES such as 6% HES 130/0.4 and 6% HES 200/0.5 solutions were reported to have less effect on coagulation. This study was performed to compare immediate plasma substitution effect of 6% HES 130/0.4 with that of HES 200/0.5 solution and to investigate the impacts of both solutions on coagulation and their overall safety in off-pump coronary bypass graft (OPCAB) surgery.

Methods: With IRB approval, forty-eight patients undergoing OPCAB surgery were randomly divided into two groups, receiving 6% HES 130/0.4 (n = 24) or 6% HES 200/0.5 (n = 24) during perioperative period. To evaluate immediate plasma substitution effect of the both solutions, a 10 mg/kg of either 6% HES 130/0.4 or HES 200/0.5 was loaded after anesthesia. Up to 33 mg/kg of both the HES solutions were infused for volume replacement guided with cardiac index and pulmonary wedge pressure during the surgery and until 6 hrs thereafter. Volume requirements in excess of the maximum dose of HES solution were treated with crystalloid. Coagulation profiles, hemodynamic, hematological and biochemical variables were recorded serially after anesthesia, volume loading, and sternal closure, and 16 hrs after the operation. Total amount of blood loss, infused colloid and blood products were measured.

Results: After volume loading, heart rate and cardiac index decreased in HES 200/0.5 group but not in HES 130/0.4 group, and greater oxygen delivery were noted in the HES 130/0.4 group compared to the HES 200/0.5 group (Table 1). The total amount of infused HES preparations, blood loss, and allogenic blood products were similar in both groups. Coagulation profiles and hemodynamic variables were not different between two groups throughout the study period. Biochemical variables were within normal limits in both groups.

Conclusion: As an immediate plasma substitute, HES 130/0.4 demonstrated better maintenance of cardiac index and oxygen delivery compared to HES 200/0.5. However, both HES 130/0.4 and 200/0.5 were equally efficient in point of maintaining plasma volume during and after surgery and have no significant effect on coagulation in patients undergoing OPCAB surgery.

<table>
<thead>
<tr>
<th>Table 1. Changes in Hemodynamic Variables after HES Loading</th>
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<tr>
<td>Group</td>
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<tr>
<td>HES 200/0.5</td>
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<td>HES 130/0.4</td>
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<td>MIP (mmHg)</td>
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<td>HES 130/0.4</td>
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<td>PCWP (mmHg)</td>
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<td>HES 200/0.5</td>
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<td>HES 130/0.4</td>
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<tr>
<td>CI (L/min/m²)</td>
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<td>LVEDD (mm)</td>
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<td>CO delivery (L/min/m²)</td>
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<td>PetCO₂ (mmHg)</td>
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<td>HES 200/0.5</td>
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<td>HES 130/0.4</td>
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<td>Thermodilution (%)</td>
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<td>HES 200/0.5</td>
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<td>HES 130/0.4</td>
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Values are expressed as mean ± standard deviations.

* P < 0.05 versus before loading. Ty < 0.05 HES 130/0.4 versus HES 200/0.5. MIP = mean blood pressure, PCWP = pulmonary capillary wedge pressure, LVEDD = left ventricular end diastolic diameter. Before loading: baseline values before loading 10 mg/kg of HES solution after induction of anesthesia.

After loading: 5 min after loading 10 mg/kg of HES.
DIFFUSION WEIGHTED MAGNETIC RESONANCE IMAGING AND NEUROLOGIC INJURY AFTER CARDIOVASCULAR SURGERY
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Introduction: Diffusion-weighted MRI (DW-MRI) detects ischemic lesions quantitatively within early several hours of onset and may provide clues on the association of ischemic lesions in the brain with emboli after cardiovascular surgery. We investigated whether preoperative DW-MRI abnormalities exist in systemic atherosclerosis and the risk factors for neurological dysfunction after cardiovascular surgery.

Methods: After institutional approval, we studied 74 patients undergoing elective cardiovascular surgery. All patients received preoperative DW-MRI, magnetic imaging and angiography (MRI, MRA) to detect cerebral ischemic changes, cerebral artery stenosis, carotid artery stenosis and intraoperative epiaortic ultrasonography to assess atherosclerosis in the ascending aorta. Four neuropsychological examinations were conducted preoperatively and 7 days after surgery. Postoperative neuropsychological (NP) dysfunction was defined as a 20% or greater decline from baseline on two or more tests. Patients with new postoperative neurological symptoms and positive findings on postoperative MRI or CT of the brain were examined by a staff neurologist to confirm perioperative stroke. The patients were divided into two groups according to the preoperative DW-MRI abnormalities: control (no DW-MRI abnormalities) and DW-MRI group (DW-MRI abnormal). We compared the incidence of stroke and systemic atherosclerosis between two groups using Chi squared and unpaired t-tests, with differences at p<0.05 considered statistically significant.

Results: Preoperative DW-MRI abnormalities were present in 6 patients of 74 patients (8.1%). Two of these patients (33%) had multiple lesions (>2). Most of these lesions were small and located in subcortical regions without overt clinical signs. We delayed elective surgery about 2 or 4 weeks and ruled out new infarctions in 2 patients: the latter had transient deficits after coronary angiography. Compared to controls, patients in the DW-MRI group were significantly more likely to have a history of cerebrovascular disease (50% vs. 13%), preoperative cerebral infarction (50% vs.22%) and cognitive decline (50% vs. 10%). The DW-MRI group tended to have severe carotid stenosis (33% vs. 7%) and severe aortic atherosclerosis (17% vs. 6%). There were no differences in NP dysfunction between the two groups (17% vs. 16%). Perioperative stroke occurred in both of DW-MRI and control groups (16.7% vs. 1.5%, p=0.147). The patient with a preoperative DWI abnormality developed intraoperative infarction due to expansion of preoperative new lesion in the left posterior limb of the internal capsule after off-pump CABG. The remaining patient with thrombocytosis in control group suffered a lacunar infarction 15 days after on-pump CABG and mitral valve replacement.

Conclusions: Patients with preoperative DW-MRI abnormalities are more likely to exhibit the comorbid conditions that best predict perioperative stroke after cardiovascular surgery, including history of cerebrovascular disease, preoperative cerebral infarctions and cognitive decline. Preoperative DW-MRI may useful to detect underlying embolic load of the brain in high-risk patients undergoing cardiovascular surgery.
SCA21

RETROGRADE RENAL PERFUSION WITH PERFLUOROCARBON EMULSION PROVIDING SYSTEMIC OXYGENATION IN A RABBIT MODEL

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Objective: Renal ischemia has been a focus of research for many years. The accepted practice of nephron sparing surgery has increased the importance of limiting ischemic insult to the kidney during vascular occlusion. The purpose of this project was to investigate a novel method of perfusing the kidney with an oxygenated perfluorocarbon emulsion (PFC) via retrograde access to the urinary collecting system.

Methods: This pilot study involved 38 New Zealand White rabbits and the oxygenation of a PFC, Oxygent™, as an alternative oxygen carrier. Each animal underwent abdominal exploration, left nephrectomy and right retrograde renal perfusion. Each animal’s retrograde renal perfusion was randomized to be PFC, chilled PFC, normal saline, chilled saline or no perfusion. The kidney was exposed to an ischemic time of 40 minutes and the pelvic pressures were monitored throughout the perfusion. Each animal was survived for two weeks then sacrificed.

Results: The experiment demonstrated that the retrograde perfusion cohorts resulted in statistical improvements in histologic tubular damage, preservation of renal function and creatinine clearance, as well as increased systemic venous oxygenation compared to the sham cohort. No adverse effects were associated with the use of the PFC during the 2 week follow up period.

Conclusions: These preliminary results show the safety, feasibility, and potential benefit of retrograde renal perfusion with an alternative oxygenation carrier during times of renal ischemia. However, more study is required before widespread application of this novel technology.
SCA22
COMPARISON OF THE EFFECTS OF TRANEXAMIC ACID, APROTININ AND PLACEBO ON BLOOD CONSERVATION, FIBRINOLYSIS AND PLATELET FUNCTION WITH EXTENSIVE HEART SURGERY. A RANDOMIZED CLINICAL TRIAL.
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Introduction: CPB results in fibrinolysis as reflected by increased plasmin concentrations and fibrin degradation products, both of which have deleterious effects on platelet function.
We designed a study to compare the effects of a high dose of aprotinin (A), tranexamic acid (TA) and no treatment (P) on blood loss, transfusion of blood products, fibrinolysis and platelet function during and after heart surgery.

Methods: After IRB approval, 60 consecutive consenting patients undergoing combined aortic valve replacement surgery with CABG were studied. They were randomized to either: high-dose A (280 mg loading dose, 70 mg/h infusion rate and 280 mg in the prime)(n=20); TA (100 mg/kg loading dose, 1 mg/kg/h infusion rate)(n=20); or saline (n=20).
The effect of A and TA on some markers for the activation of thrombin formation and fibrinolysis was studied (D-dimer, plasminogen, α2-antiplasmin, antithrombin and glycocalcin, a fragment of the platelet-membrane GPIb). Sampling was at induction (t1), at the start and end of CPB (t2, t3), and at 1, 4 and 24 h after CPB (t4, t5, t6).
Analysis of variance for repeated measurements was applied for statistical comparisons between groups. p values < 0.05 were considered as significant. Data are expressed as mean values ± SEM.

Results: Study groups did not differ with regard to demographic data and type of operation. Blood loss and chest tube drainage was significantly less in the A and TA group as compared with the P group at all time points and was accompanied with the use of less blood products, volume replacement and higher hemoglobin levels. The duration of the surgical post-CPB period was significantly shorter in the A and TA groups (55 ± 18, 71 ± 19 and 84 ± 26 min respectively). There was no difference in platelet count between groups. There were no re-explorations for postoperative bleeding. Inhibition of fibrinolysis was significant with both antifibrinolytic drugs (D-dimers 578±81, 550±105 and 3603±440 mcg/mL at t4). During and after the operation the D-dimers were much higher in the placebo group. α2-antiplasmin levels were higher in the A group compared with the TA and P groups. This effect was present until 24 h after CPB. TA had no effect on this parameter. Plasminogen levels were lower in the TA group at t4, t5 and t6. TA patients more often received additional boluses of heparin to maintain ACT > 480 s during bypass (15/20 patients versus 9/20 and 8/20 patients in the A and P groups respectively). aPTT values were significantly prolonged at the end of CPB in the A group. Antithrombin values were significantly higher in the A group at t3, t4 and t5. Glycocalcin values were slightly higher in the TA group during bypass.

Discussion: TA can inhibit fibrinolytic activity by blocking plasmin(ogen) activity measured as D-dimer, but seems to have no influence on neutralization of plasmin by α2-antiplasmin. Both A and TA effectively suppress the appearance of markers of fibrinolysis as compared with placebo. The results also suggest that the antifibrinolytic effects of TA and A can reduce blood loss in patients undergoing extensive CPB surgery.

References
DETERMINANT OF COMPLICATIONS WITH RECOMBINANT FACTOR VIIA (RFVIIA) THERAPY IN PATIENTS WITH EXCESSIVE BLOOD LOSS AFTER CARDIAC SURGERY

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Introduction: Blood loss that becomes refractory to standard hemostatic interventions is a serious complication of cardiac surgery that is associated with increased morbidity and mortality [1]. Recombinant factor VIIa (rFVIIa), a hemostatic agent currently approved for hemophiliac patients, is increasingly being used in the treatment of refractory excessive blood loss (EBL) after cardiac surgery. Its “off label” use in this setting is currently based on several case series and case-control studies that support its effectiveness for this indication. The high rate of serious adverse events in the majority of these reports, however, has raised concerns about its safety in this setting [2]. The purpose of this observational study was to identify the determinants of complications associated with rFVIIa therapy in a cohort of cardiac surgical patients with EBL.

Methods: In this single-institution observational study, we compared the unadjusted and adjusted perioperative complication rates, expressed as observed to expected (O/E) ratios, in 114 consecutive cardiac surgical patients who received rFVIIa for refractory EBL with 552 concurrent patients who developed EBL but did not require rFVIIa. The primary outcome was a composite perioperative complication outcome that included death, stroke, renal failure, myocardial infarction, and major vein thrombosis. For risk adjustment, a logistic regression model for this outcome was constructed that adjusted for known confounders.

Results: Whereas the unadjusted complication rate was 88% higher in patients who received rFVIIa (O/E =1.88; 95% CI =1.58-2.19), the adjusted rate was comparable to those who did not receive rFVIIa (O/E =1.06; CI =0.85-1.28). In addition, late versus early rFVIIa therapy (relative to the amount of blood loss with patients dichotomized to greater than or less than the 50th percentile median RBC units transfused before rFVIIa therapy) was associated with an increased risk-adjusted complication rate (late O/E =1.32; CI =1.00-1.63; early O/E =0.83; CI 0.54 – 1.12; P =0.03).

Discussion: The results of this study suggest that the observed association between rFVIIa therapy and postoperative adverse events is due to the effect of confounders. The results also suggest that rFVIIa therapy late in the course of blood loss may be associated with increased morbidity and mortality. Late rFVIIa therapy may be harmful because as patients bleed more, they are more likely to become hemodynamically unstable and develop disseminated intravascular coagulation (DIC), and rFVIIa therapy in the presence of DIC may increase the risk of thrombotic complications.

References:
PROTAMINE INFUSION TO ELIMINATE RESIDUAL ANTI-XA ACTIVITY AFTER CARDIAC SURGERY.

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**Introduction:** Postoperative infusion of protamine sulphate (25mg/hr) has been shown to reduce bleeding after cardiac surgery (1) but detectable anti-Xa levels persist despite this strategy. While not causing bleeding in most patients, residual anti-Xa activity may explain the increased bleeding seen after supplemental antithrombin III (ATIII) administration during cardiac surgery (2) and may be important to avoid antigenic circulating heparin in cardiac surgery patients with HIT receiving heparin and an antiplatelet agent.(3) Therefore we tested the hypothesis that a higher dose of protamine sulphate could eliminate measurable anti-Xa activity after cardiac surgery.

**Methods:** With IRB approval 42 adult primary CABG patients at the Durham Veterans Affairs Medical Center received, in addition to standard intraoperative heparin anticoagulation with protamine reversal, an infusion of protamine sulphate at 50mg/hr for 6 hours after separation from CPB or an equal volume of saline in this randomized, placebo controlled, double blind study. Redo surgeries and patients with coagulopathies or renal insufficiency were excluded from enrollment. Blood samples were taken at baseline and hourly for the 6 hours following the start of study drug infusion. Platelet poor plasma was frozen at -70C and batch analyzed by ELISA for anti-Xa activity. Fisher’s Exact Test was used to compare the number of samples per group with detectable anti-Xa activity.

**Results:** Two patients from the protamine group were excluded, as surgery was cancelled, and 13 patients (7 from the protamine group) were receiving heparin at baseline. The incidence of detectable anti-Xa effect in the post-op period was significantly less in the protamine group (p=0.0066); 66.67% of the placebo group had a detectable anti-Xa activity at some postop period whereas only 10% of the protamine group did. The incidence of detectable anti-Xa activity at each timepoint is illustrated in the figure.

**Discussion:** Our results indicate that it is possible to effectively eliminate circulating heparin in the postoperative period by infusing protamine sulphate at 50mg/hr. Further study with larger patient groups is needed to determine the effect of this on bleeding and transfusion. These results may be important in HIT patients, patients receiving supplemental ATIII or patients receiving postoperative FFP transfusion.

**References**

SCA25
IMPLEMENTATION OF A TREATMENT PROTOCOL FOR EXCESSIVELY BLEEDING CARDIAC SURGICAL PATIENTS MAY IMPROVE CLINICAL OUTCOMES
Meineri M; Van Rensburg A; Wasowicz M; McCluskey S; Wijeysundera D; Beattie S; Karkouti K
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Introduction: Excessive blood loss (EBL) is a common complication of cardiac surgery that is associated with increased morbidity and mortality [1-3]. Treatment protocols aimed at cardiac surgical patients with EBL may improve outcomes by allowing for prompt and optimal care. To date, however, such protocols have been primarily directed towards improving blood product utilization rather than improving clinical outcomes [4,5]. The objective of this observational study was to assess the independent effect of a blood management treatment protocol on the outcome of cardiac surgical patients with EBL.

Methods: In November 2002, an institutional treatment protocol for rapid identification and aggressive treatment of excessively bleeding cardiac surgical patients was implemented in order to determine the patients’ eligibility for treatment with recombinant factor VIIa. The independent relationship between protocol implementation and adverse outcomes was measured by comparing the outcomes of patients with EBL who underwent surgery at the study institution during the three years before protocol implementation with those who underwent surgery during the two and a half years after protocol implementation. Multivariate logistic regression analysis was used to control for the effects of confounders. EBL was defined as 4 or more units of packed red blood cells transfused within 24 hour of surgery. A composite adverse event that included death, renal failure, stroke, and sepsis was the primary outcome. Bootstrapping and sensitivity analyses were used to confirm the validity of the results.

Results: 11,324 patients underwent surgery at our Institution during the study period, 1863 (16%) of whom were classified as having had EBL. Of those with EBL, 954 were in the pre protocol period and 909 were in the post protocol period.

After controlling for all measured confounders, protocol implementation was associated with a 36% reduction (95% Confidence interval 24%-52%) in the odds of the primary composite outcome. This estimate was stable across different modeling conditions as well as in bootstrap sampling.

Discussion: In conclusion, in this large before/after study, we found that the implementation of a practical blood management protocol for cardiac surgical patients with EBL was independently associated with a marked reduction in adverse postoperative events. Randomized controlled trials are required to determine whether or not this is a cause-effect relationship.

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Combination Anticoagulation Minimizes Thrombin Generation During Experimental Cardiopulmonary Bypass

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Introduction: Thrombin generation during cardiopulmonary bypass (CPB) activates a procoagulant and inflammatory response resulting in adverse outcome after cardiac surgery. This occurs despite high dose heparin anticoagulation, which does not effectively suppress tissue factor mediated thrombin generation [1]. Our overall hypothesis is that adjunctive anticoagulant therapy (using the direct thrombin inhibitor bivalirudin in addition to heparin) can optimize anticoagulation during CPB by inhibiting the tissue factor mediated thrombin generation, while simultaneously avoiding problems associated with high dose alternative anticoagulants.

Methods: With IRB approval, 45 male Sprague-Dawley rats were anesthetized, surgically cannulated for CPB and assigned to one of 4 groups: Sham (n=6 analyzed prior to others to validate model); Heparin (H; n=13) 0.3-0.4 units/g IV heparin prior to CPB with 50 units heparin in the pump prime [2]; full dose bivalirudin (B; n=13) 1mg/g bolus followed by 1mg/g/hr infusion and heparin plus half dose bivalirudin (H&B; n=13)[3]. We compared thrombin-antithrombin complex (TAT) levels, using ELISA, after 60 minutes of CPB. Values were expressed as % change from baseline measured just prior to initiation of CPB. A 3-group Wilcoxon Rank Sum test was used to test for a difference between groups with a post-hoc test comparing between groups. With correction for multiple comparisons, the alpha level was 0.07.

Results: Sham operated animals (identical surgery and anesthesia but no CPB) had minimal detectable TAT complexes. As illustrated in Figure 1, thrombin generation after 60 minutes CPB was significantly different among groups (chi-square 12.3, p=0.0017). Post-hoc analysis showed that thrombin generation in group H&B was significantly lower than in group H (chi-square 13.3, p=0.0003). No difference was found between groups H&B and B (chi-square 0.71, p=.34).

Discussion: Consistent with human CPB, heparin anticoagulation failed to suppress thrombin generation in this animal model of CPB. In contrast, combination anticoagulation using the direct thrombin inhibitor bivalirudin, effectively suppressed thrombin generation. This was achieved with half the dose effectively used as a sole anticoagulant for CPB. Elucidating the dose response relationship in this model may guide human studies where minimal bivalirudin doses can be used to augment heparin anticoagulation while minimizing risk of increased bleeding.

References
SCA27

COLLAGEN WHOLE BLOOD PLATELET AGGREGOMETRY PREDICTS MYOCARDIAL INJURY AFTER CORONARY ARTERY BYPASS GRAFT IN ASPIRIN TAKING PATIENTS
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During CABG (Coronary Artery Bypass Graft), the endothelium of coronary vessels is injured by surgical manipulations and then the integrity of the endothelium may be lost. When the platelets are exposed to subendothelial collagen matrix and activated, they may initiate coagulation cascade and release potent vasoconstrictors. Subsequently, it may increase the organ injury by thrombosis or spasm. Although aspirin is usually used to prevent the platelet activation during CABG, some of the patients are resistant to it and aspirin blocks only a part of the platelet activating pathways.

We hypothesized that during CABG, even if the patients take the aspirin, the variance of the platelet response to the platelet agonists may correlate with the myocardial and renal injury. Thus, for 44 patients taking aspirin who were scheduled for elective CABG, we studied preoperative WBAs (whole blood aggregometry) and investigated the relationship of those with the postoperative myocardial and renal injury.

Before the induction of anesthesia, WBA in the presence of collagen 2 µg/ml, 5 µg/ml and ADP 5 µg/ml as stimulant agents was performed by the impedance method. After CABG, myocardial injury was evaluated with enzyme analysis (creatine kinase [CK], creatine kinase-MB [CK-MB], lactate dehydrogenase [LD] at the end of operation, 6, 24, 48, 72 and 120 hr after operation) and electrocardiograms (at the end of operation, 6, 24, 72 and 120 hr). For the evaluation of renal injury, Ccr was measured at postoperative 0, 6, 24, 72 and 120 hr.

Preoperative WBA with collagen (5 mcg/ml) had significant correlation with the increase of cardiac enzymes. The myocardial enzyme levels were increased in CK at postoperative 6, 48 and 72 hr (P=0.049, 0.049 and 0.045 respectively), CK-MB at postoperative 48, 72 hr (P= 0.024 and 0.031 respectively) and LD at postoperative 24 hr (P=0.020). There were no significant relationship between preoperative WBA and postoperative Ccr.

In conclusion, this study showed that in patients taking aspirin who undergo CABG, preoperative platelet response to collagen (5 mcg/ml) is correlated with the postoperative myocardial injury in contrary to low dose collagen and ADP. And that emphasize the importance of collagen mediated platelet activation during CABG.
HEPARIN ANTIBODIES ARE ASSOCIATED WITH SEVERE ADVERSE OUTCOMES IN THE EVOLUTION TRIALS

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Introduction: Heparin induced thrombocytopenia (HiT) is caused by antibodies to heparin/platelet factor-4 (HPF4-AB). In cardiology HPF4-AB are associated with adverse outcomes even without thrombocytopenia. Bivalirudin (Biv), a short acting direct thrombin inhibitor is used as a replacement for unfractionated heparin (UFH) in cardiology. The EVOLUTION trials were designed to assess the use of bivalirudin in cardiac surgery. We investigated the incidence of HPF4-AB and their impact on clinical outcome in the EVOLUTION trials.

Methods: The trials were 2:1 prospective, randomized, open label utilizing Biv versus UFH. Antibodies were analyzed with ELISA by a reference laboratory: collected at baseline, seven and 30 days after surgery. Patients were not treated due to their HPF4-AB status, as it was not known until after the study. Patients randomized to Biv may have received UFH in the cath lab or post-operatively as there was no restriction of UFH except as the primary anticoagulant for operation. HPF4-AB levels were considered negative at all times if < 0.4 optical density (OD), moderate >0.4-.0 OD and strong >1.0 OD. Serious adverse events included: death, Q-wave myocardial infarction (Q-MI), stroke or severe adverse bleeding. Adverse events were examined either as composites or individually. Data were examined at each of the three time points as well as in cohorts that sero-converted. In patients that sero-converted the level of antibody was tested for association with the incidence of adverse events.

Results: See Tables and Figures.

Discussion: Five percent of patients presented with HPF4-AB. Sero-conversion was common and numerically more (P=.1) in the UFH group. Presence of antibodies at day seven was associated with an ascending and impressive difference in composite adverse event incidence. Sero-conversion, especially with development of high levels of HPF4-AB was associated with the highest incidence of adverse events. Pre-operative presence of antibodies was associated with severe bleeding whereas sero-conversion was associated with Q-wave MI and composite endpoints. Although the use of Biv vs UFH as the primary anticoagulant for heart surgery did not show statistical differences in either HPF4-AB formation or sero-conversion the trends were always towards Biv having less antibody and in some sub-groups fewer adverse events (Stroke and Q-wave MI).
MAGNESIUM THERAPY DOES NOT PREVENT PLATELET OR LEUKOCYTE ACTIVATION DURING CARDIAC SURGERY

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Introduction: Magnesium is important in the regulation of vascular tone, heart rhythm, and thrombosis. Recently, low serum magnesium levels have been associated with a 2-fold increase in the risk of death or myocardial infarction (MI) after CABG surgery(1). To investigate potential mechanisms underlying magnesium-induced reductions in adverse cardiac events, we hypothesized that intraoperative high-dose magnesium supplementation reduces the platelet and leukocyte activation commonly seen during cardiac surgery with cardiopulmonary bypass (CPB).

Methods: Following IRB approval, 100 patients >= 55 years in age and undergoing primary CABG and/or valve surgery were enrolled into this prospective, randomized, double-blind, placebo controlled trial. Patients were excluded if they had a history of symptomatic cerebrovascular disease, alcoholism, psychiatric illness, or renal failure (creatinine >2.0 mg/dl), had < 7th grade education, were pregnant, or had a Mini-Mental State Examination score < 24 on baseline cognitive testing. Patients were randomized to receive either placebo or magnesium administered immediately after induction of anesthesia as a 50 mg/kg bolus infusion over 20 minutes followed by another 50 mg/kg infusion over 3 hours (total dose=100 mg/kg). Blood samples were drawn at baseline, end-bolus, 10 minutes after cross-clamp release, end-surgery, and 24 and 48 hours postoperatively. Mean CD11b fluorescence and percentage of platelets expressing CD62P were determined on a flow cytometer as respective markers of leukocyte and platelet activation. The association of platelet and leukocyte activation with magnesium treatment group was tested using repeated measures analysis of variance. Log transformation was conducted on the positively skewed cellular activation data in order to meet assumptions of normality; p<0.05 was considered significant.

Results: Fifty patients were randomized to receive magnesium and fifty to a placebo bolus and infusion. 72.5% of the study population underwent CABG only, 15.7% CABG + Valve, and 11.8% Valve only. There were no differences between the magnesium and placebo groups with respect to age, gender, race, ejection fraction, bypass and cross-clamp time, number of grafts, and a history of hypertension, MI, or diabetes. There were also no differences between treatment groups in platelet (Figure 1) and leukocyte activation or in platelet-leukocyte binding (p>0.05). Sensitivity analysis revealed that with a sample size of 100, we had 80% power to detect a difference in log-transformed values of > 0.5.

Conclusions: High-dose magnesium supplementation does not decrease platelet and leukocyte activation during cardiac surgery with CPB. The previously reported association between low magnesium levels and increased MI and mortality rates after cardiac surgery is unlikely to be related to perioperative platelet or leukocyte activation.

Reference:
A SELECTIVE INHIBITOR OF APOPTOTIC PROTEIN P53 ENHANCES ISOFLURANE-INDUCED CARDIOPROTECTION DURING EARLY REPERFUSION IN RABBITS
Venkatapuram S; Krolikowski J; Wang C; Warltier D; Kersten J; Pratt P; Pagel P
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Introduction: Brief exposure to isoflurane before and during early reperfusion after coronary artery occlusion protects against myocardial infarction by activating phosphatidylinositol-3-kinase (PI3K)-mediated signal transduction. The apoptotic protein p53 is regulated by PI3K, and inhibition of p53 has been previously shown to protect against ischemic injury in isolated rat hearts. Whether p53 mediates isoflurane-induced postconditioning is unknown. We tested the hypothesis that inhibition of p53 enhances protection against infarction produced by isoflurane during early reperfusion.

Methods: Barbiturate-anesthetized rabbits (n=36) were instrumented for the measurement of systemic hemodynamics and subjected to a 30 min left anterior descending coronary artery occlusion followed by 3 h reperfusion. In six experimental groups, rabbits were randomly assigned to receive 0.9% saline (control), isoflurane [0.5 or 1.0 minimum alveolar concentration (MAC)] administered for 3 min before and 2 min after reperfusion, the selective p53 inhibitor pifithrin alpha (PIF; 1.5 or 3.0 mg/kg) dissolved in dimethylsulfoxide and administered intraperitoneal 30 min before coronary occlusion, or 0.5 MAC isoflurane plus 1.5 mg/kg PIF. Myocardial infarct size was determined using triphenyltetrazolium chloride staining. Statistical analysis was performed with ANOVA followed by the Student-Newman-Keuls test (*P<0.05). Data are mean±SD.

Results: Systemic hemodynamics and left ventricular area at risk were similar between groups. Isoflurane (1.0 but not 0.5 MAC) and PIF (3.0 but not 1.5 mg/kg) reduced (P<0.05) infarct size [21±4*, 43±7, 22±6*, and 43±7%, respectively, of left ventricular area at risk] as compared to control (44±4%). Isoflurane (0.5 MAC) plus 1.5 mg/kg PIF also produced protection (28±3*%).

Conclusions: The results of the current investigation indicate that inhibition of the apoptotic protein p53 enhances isoflurane-induced cardioprotection during early reperfusion in vivo.

References:
SCA31
WORSENING OF LONG-TERM MYOCARDIAL FUNCTION AFTER SUCCESSFUL PHARMACOLOGICAL PRECONDITIONING WITH CYCLOSPORINE
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Preconditioning with cyclosporine (CsA) has been shown to decrease infarct size 24 hours after myocardial ischemia/reperfusion (I/R) injury. The goal of this study was to determine the effects of CsA preconditioning on long-term outcome and cardiac function after I/R-injury. Male Sprague-Dawley rats were randomly assigned to three treatment groups: 1) vehicle only, 2) CsA, 5mg/kg/day, and 3) CsA, 12.5mg/kg/day. Treatment was given via oral gavage for three days prior to I/R-injury (30 minutes of left anterior descending [LAD] coronary artery occlusion). We evaluated post-I/R survival and cardiac function by transthoracic echocardiography and invasive left ventricular hemodynamic measurements 14 days after I/R-injury. Rats with I/R-injury showed an overall increased left ventricular end diastolic pressure compared to rats without I/R-injury (p<0.005). Although CsA initially decreased infarct size, no differences of left ventricular end diastolic pressure (LVEDP) were seen 4 days after I/R-injury (vehicle: 21.2±8.9 mmHg, CsA 5 mg/kg/day: 21.5±0.7 mmHg, CsA 12.5 mg/kg/day: 20.5±9.4 mmHg). Ejection fraction and fractional shortening were decreased in all groups compared to baseline, but no differences between groups were observed. On day 14, a dose-dependent increase in left ventricular end diastolic diameter was seen (p<0.001). CsA pretreatment was also associated with a dose-dependent decrease in post-I/R survival (vehicle: 56%, CsA 5mg/kg/day: 32%, CsA 12.5mg/kg/day: 16%; p=0.017). CsA preconditioning did not improve long-term cardiac function despite decreased infarct size 24 hours after I/R-injury, and increased post-I/R mortality significantly. Poor cardiac function after CsA preconditioning seems to be related to dose-dependent left ventricular dilation.
CLINICAL, PROCEDURAL AND GENETIC DETERMINANTS OF QTC PROLONGATION FOLLOWING CARDIAC SURGERY
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Introduction: Prolongation of corrected QT (QTc) interval has been associated with risk of cardiovascular adverse events in a broad range of clinical populations, including patients undergoing non-cardiac surgery. Although long-term changes in ventricular repolarization following coronary revascularization have been reported, the impact of cardiac surgical injury on early postoperative repolarization abnormalities is not known. We tested the hypothesis that clinical, procedural and genetic factors are associated with perioperative changes in QTc interval in cardiac surgical patients.

Methods: After excluding patients with ventricular conduction abnormalities (bundle branch blocks), pacemaker, perioperative atrial fibrillation, or receiving perioperative antiarrhythmic drugs in the study period, 460 patients who underwent cardiac surgery (CABG, valve, or combined CABG/valve) using cardiopulmonary bypass were selected. QTc intervals were measured from 24-hour pre and postoperative 12-lead ECG by two investigators blinded to genetic data; prolonged QTc was defined as >440 msec. Number of intraoperative cardioversions upon aortic cross-clamp release was recorded as an index of reperfusion arrhythmias. MALDI-TOF mass spectrometry was used to genotype 45 single-nucleotide polymorphisms (SNPs) in 24 candidate genes modulating pathways implicated in arrhythmia susceptibility. A multivariate regression model including demographic and procedural covariates was developed. A two-step strategy was used for genetic analyses – marker selection, followed by clinico-genomic model building. Bonferroni correction was used to adjust for multiple comparisons.

Results: QTc interval was significantly prolonged following cardiac surgery with cardiopulmonary bypass (p<0.01), and was associated with higher incidence of intraoperative reperfusion arrhythmias (p=0.006). Gender, age, procedure and cross-clamp time were independent predictors of QTc prolongation. Moreover, two functionally important SNPs in adrenergic receptor (ADRB2) and interleukin-1β (IL1B) genes were independently associated with postoperative QTc prolongation.

Conclusions: Perioperative QTc is modestly but significantly prolonged following cardiac surgery. This may reflect disrupted electrophysiological stability of the myocardium and thus substrate for triggering malignant arrhythmias. Two functional variants in genes related to inflammation and adrenergic responsiveness are independent risk factors for postoperative QTc prolongation. This may aid in perioperative identification and monitoring of high-risk cardiac patients and the development of novel cardioprotective strategies.

References:
1. Okin PM, J Am Coll Cardiol 2004;43(4):572-4

Table: Combined clinical-genetic multivariable models for postoperative QTc prolongation in cardiac surgical patients

<table>
<thead>
<tr>
<th></th>
<th>Preop</th>
<th>Postop</th>
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<tbody>
<tr>
<td>QTc* (msec)</td>
<td>402±29</td>
<td>421±32</td>
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<tr>
<td>Incidence of Prolonged QTc (%)</td>
<td>9.30</td>
<td>22.3</td>
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F-value p-value

<p>| | | |</p>
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<td>Clinical model (r²=0.39)</td>
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<tr>
<td>QTc-preop</td>
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<td>Age (y)</td>
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<tr>
<td>Procedure</td>
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<tr>
<td>Cross-clamp time (min)</td>
<td>5.27</td>
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<tr>
<td>Race (self-reported)</td>
<td>0.40</td>
<td>0.669</td>
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<td>Clinico-genomic model (r²=0.45)</td>
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<td>IL1B(rs16944)/ADRB2(rs1800888)</td>
<td>5.68</td>
<td>0.044*</td>
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* Bazett's formula
# Bonferroni-adjusted p-value
IMMEDIATE EXTUBATION: A ROUTINE AFTER OPEN-HEART SURGERY? A PROSPECTIVE STUDY OF 635 PATIENTS.

Hemmerling T; Basile F; Noiseux N; Olivier J; Choinière J; Prieto I
University of Montreal, Montreal, PQ, Canada

Objective: The purpose of this study is to examine the feasibility of routine immediate operating room extubation (ultra-fast-track-anaesthesia-UFT) during open-heart surgery and to focus on pain scores comparing various anesthetic and analgesic techniques.

Methods: 635 consecutives patients undergoing cardiac surgery with an ejection fraction (EF) of at least 25% were included in this prospective audit. Patients received different regimens of analgesia: group A) high T2/T3 thoracic epidural analgesia (TEA) installed preoperatively and removed after 72 h; B) fentanyl during surgery and postoperative patient-controlled analgesia (PCA)-morphine; or C) bilateral paravertebral blocks + fentanyl followed by PCA-morphine. Anesthesia was induced using standard protocols with fentanyl and propofol, and maintained using sevoflurane titrated to a Bispectral index (BIS) monitoring of 40-50. All patient data were recorded; pain scores were compared between groups using Kruskal Wallis test, P < 0.05.

Results: Mean age was 63 ± 11 years (range: 27-91), weight 77 ± 16 kg (43-140), 12% have EF <40%, 59% high blood pressure, 14% COPD, and 25% diabetes. 461 patients underwent off-pump CABG, 29 on-pump CABG, 110 aortic valve replacements simple or combined, 35 mitral valve replacements or reconstructions. Duration of surgery was 123 ± 31 min (35-295), ischemic time during aortic cross clamp 44 ± 16 min (13-103). All patients were successfully immediately extubated after cardiac surgery in the operating room within 15 ± 5 minutes, no differences between groups, and sent to postoperative anesthesia care unit for 2-4 hrs for stabilisation. Post-operative pain scores were significantly lower in the TEA group, see figure. There was no complication related to epidural catheter placement and no neurologic complications. Only three patients needed re-intubation, two due to respiratory failure within 60 minutes after extubation and one secondary to myocardial infarction (MI). Perioperative mortality was 1%, MI and low output syndrome occurred in 2.4% and 2.7% respectively, 17% needed blood transfusion, and atrial fibrillation was noticed in 17%.

Conclusion: Our study proved the feasibility and security of immediate extubation after coronary surgery, but also with heart valve surgery using cardiopulmonary bypass. Significantly better postoperative pain scores were achieved with TEA. UFT allows fast rehabilitation, and may help lowering the costs of health care.
ISOFLURANE ATTENUATES APOPTOSIS AFTER REGIONAL MYOCARDIAL ISCHEMIA AND REPERFUSION IN RABBITS VIA PHOSPHATIDYLINOSITOL-3-KINASE/AKT SIGNALING

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1University of Virginia, Charlottesville, VA, USA; 2Hadassah Medical Center, Jerusalem, Israel

Objectives: The present study was designed to test whether anesthetic preconditioning attenuates myocardial apoptosis and whether the phosphatidylinositol-3-phosphate (PI3K)/Akt pathway is involved in regulation of anesthetic induced cardioprotection.

Methods: Using a model of regional myocardial ischemia and reperfusion, rabbits were subjected to 40 minutes of ischemia followed by 180 minutes of reperfusion and were assigned to the following groups: a control group of ischemia and reperfusion (I/R), anesthetic (1 minimal alveolar concentration of the anesthetic isoflurane) preconditioning group and a group that was exposed to combination of isoflurane and the PI3K inhibitor, wortmannin (0.6 mg/kg intravenously). A sham-operated, wortmannin + I/R and wortmannin + sham groups were also included. Myocardial infarct size was assessed by 2,3,5-triphenyltetrazolium chloride staining. Myocardial apoptosis was evaluated by terminal deoxynucleotidyl transferase-mediated dUTP nick-end labeling (TUNEL) and activated caspase 3 assays. Phosphorylation of Akt, a downstream target of PI3K was assessed by Western blotting.

Results: Isoflurane reduced infarct size compared to the control group: 22±4% vs. 41±5% (p<0.05). The percentage of apoptotic cells decreased in the isoflurane group (3.8 ± 1.2%) compared to control group (12.4 ± 1.6%; P < 0.05). These results were also confirmed by the activated caspase-3 assay. Wortmannin inhibited the effect of isoflurane: myocardial infarction increased to 44 ± 3% and the percentage of apoptotic cells was 11.9 ± 2.1%. Akt phosphorylation increased after isoflurane preconditioning. Wortmannin blocked this effect as well.

Conclusion: Isoflurane protects the heart against ischemia and reperfusion by decreasing apoptosis and subsequently infarct size via activation of PI3K.
OUTCOMES OF PREDICTING MITRAL SYSTOLIC ANTERIOR MOTION (SAM) IN MITRAL VALVE REPAIR

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The occurrence of SAM after CPB in patients undergoing mitral valve repair (MVP) can add significant morbidity to a hospital course. Predicting SAM based on preCPB TEE findings allows the surgeon to take preventive measures during initial repair such as upsizing the annuloplasty ring and placing an edge to edge suture (E2E) between mitral leaflets (usually A2 to P2) (Fig 2). Making predictions of SAM has not been common practice, however, because TEE predictive criteria have not been validated. The Maslow and Levine study, which is most cited on this topic, analyzed only 11 patients with SAM (1).

With IRB approval, we studied intraop (BWH Anes TEE Database) and post-discharge outcomes in 1,612 patients undergoing MVP from 1999 to 2003. Of these, 347 had documented TEE assessment of SAM postop (Group 1). When preCPB prediction of SAM was performed, predictive criteria were multifactorial and varied by anesthesiologist. Criteria were the Maslow Criteria [coaptation to ventricular septum (C-sept.) and mitral annulus distances], symmetry of anterior leaflet lengths, subvalvular attachment location of chordae, degree of mitral override of ventricular septum (aortic-mitral angle), and presence of SAM on LV unloading during initiation of CPB.

In 20 patients (Group 2), E2E was performed based on predicted SAM. In Group 2, incidence of post-CPB SAM was 0%. Overall incidence of SAM in Group 1 was (54/347) 15.2%. Serious SAM (re-operation [n=7] or prolonged hemodynamic management [n=15]) was 6.3%. Comparison of Group 1 vs Group 2 SAM incidence by one-tailed Fisher’s Exact test was significantly different (p=0.037). Comparing E2E [0/20] with serious SAM [22/347] trended toward significance, but p=0.302. Figure 2 shows the mitral valve from the LV apex with an E2E suture in place, and demonstrates that mitral orifice size is very adequate with E2E. Figure 1 shows postop mitral inflow after E2E; inflow is not sig. impaired.

No patient of the 20 with E2E in this series had mitral stenosis or mitral regurgitation on follow-up transthoracic ultrasound from 1-3 years post operatively.

Predicting SAM is presently a clinical judgment based on multiple TEE findings. The predictive impact of individual findings will require further quantitation and analysis of our datasets. However, the present data shows that clinical prediction of SAM and resulting preventive action by surgeons can significantly reduce the incidence of post CPB SAM without long-term adverse impact on valvular function. Examination of our entire cohort, now over 1,800 MVP patients, should allow validation of TEE predictors of SAM.

References:
1 Maslow, J Am Coll Cardiol. 1999;34:2096-104
SEVERE DECREASES IN ANTITHROMBIN III ACTIVITY: SHOULD WE BE MONITORING THEM DURING DEEP HYPOTHERMIC CIRCULATORY ARREST?

Sniecinski R; Chen E; Tanaka K
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Introduction: Antithrombin III (AT) is the body’s most effective regulator of coagulation. Levels of AT activity decrease to approximately 50% during routine cardiopulmonary bypass (CPB).1 Cases of catastrophic thrombosis associated with this acquired AT deficiency have been reported.2 Deep hypothermic circulatory arrest (DHCA), with its prolonged CPB times, hypothermia, and blood stasis, would be expected to place an even further stress on regulation of coagulation. In this pilot study, we wanted to investigate the effects of DHCA on AT activity levels.

Methods: We collected AT levels on adult patients undergoing elective cardiac procedures with DHCA. Heparin (400 units/kg) was given prior to onset of CPB, with additional doses given to keep the kaolin activated clotting times greater than 480 seconds. Circulatory arrest was carried out at a nasopharyngeal temperature of 18°C. Full dose aprotinin was used (2 million KIU load, 500,000 KIU per hour infusion, 2 million KIU placed in CPB prime volume). At the end of the procedure, heparin was reversed with 3-4 mg/kg of protamine. AT activity levels were obtained prior to systemic heparinization and after termination of CPB, before any protamine or blood products were given.

Results: The mean CPB time was 200±15 minutes. The mean DHCA time was 24±4 minutes. Baseline and post-CBP AT activity levels for each patient are shown in figure 1. The mean baseline value was 85±4% and mean post-CBP value was 37±4%. No thromboembolic complications occurred in any patient.

Discussion: Although limited by a small sample size, our study shows that AT levels fall after DHCA by a magnitude somewhat greater than that previously reported. During DHCA, this low level of AT activity may be finely balanced by decreased catastrophic factors and platelet counts. Case reports have described catastrophic thrombosis after DHCA following protamine or platelet administration.3,4 Although AT levels were not reported with these cases, one could hypothesize that they became too low to regulate the normal coagulation process. Further research into this area is needed to determine if AT activity should be monitored and increased in patients undergoing DHCA.

References
3. Fanashawe M, Shore-Lesserson L, Reich D. Two cases of fatal thrombosis after aminocaproic acid therapy and deep hypothermic circulatory arrest. Anesthesiology 2001; 95:1525-7

![Figure 1: Changes in AT activity level](image)
SCA37

IMPROVED CLOT FORMATION BY COMBINED ADMINISTRATION OF FIBRINOGEN AND ACTIVATED FACTOR VIIA
Taketomi T; Piamsonboon C; Szlam F; Calazis A; Tanaka K; Levy J
Emory University, Atlanta, GA, USA

Introduction: Case reports have suggested that recombinant activated factor VII (rFVIIa) is effective for refractory bleeding after cardiopulmonary bypass (CPB). However, its indication in non-hemophilic patients has not clearly been established, and there is no standardized protocol for administering rFVIIa with other hemostatic components. Because of the pivotal role of fibrinogen in clot formation, we investigated the in vitro hemostatic effects of rFVIIa and fibrinogen concentrate using RoTEM® Haemostasis Analyser.

Method: After IRB approval and informed consent, blood samples were obtained from 7 healthy volunteers and 7 cardiac surgical patients following CPB. rFVIIa (NovoNordisk, Princeton, NJ), fibrinogen concentrate (Aventis-Behring, Marburg, Germany), and Ro-TEM® (Pentapharm, Munich, Germany) were used in the study. In the preliminary experiment, coagulopathy was simulated by in vitro addition of heparin (0.1 U/ml) to platelet poor plasma. Using heparinized plasma and post-CPB whole blood samples, RoTEM® was performed according to manufacturer’s instructions in recalcified samples with kaolin activation. We obtained three variables; clotting time (CT sec), angle (°) and maximal clot firmness (MCF mm) in control (no treatment) and in vitro treatment samples. The treatment included fibrinogen (final concentration 100 mg/dl), rFVIIa (1.5 [SPCHAR(micro)]g/ml), and fibrinogen(100 mg/dl) plus rFVIIa (1.5 [SPCHAR(micro)]g/ml). Data are shown in mean[SPCHAR(plusmn)]SE. Paired t-test was used for comparison, and P<0.05 was considered significant.

Results: Table 1 summarizes the preliminary RoTEM® experiments in samples treated with heparin, and samples with heparin plus hemostatic agent. Heparin addition prolonged the onset of clotting. Addition of fibrinogen increased the amplitude (Fig, double arrow) whereas rFVIIa shortened the clotting time (Fig, arrow). In clinical samples, hematocrit and platelet count were 26[SPCHAR(plusmn)].2 and 45[SPCHAR(plusmn)].7.0 after protamine administration. Table 2 includes RoTEM variables for native and hemostatic agent-treated samples. Similar to findings in volunteer samples, we observed the most prominent improvement of clotting in co-administration of rFVIIa and fibrinogen.

Conclusion: The hemostatic effect of rFVIIa is reflected in shorter onset of clotting, whereas fibrinogen improves the clot strength. Treatment of clinical post-CPB bleeding should include initial step of normalizing fibrinogen levels with cryoprecipitate (or fibrinogen concentrate in Europe) in order to optimize the response to rFVIIa.

Reference:
J Thrombosis Haemostasis 2004;2:102-110

| Table 1 |
|----------------------|-----------------|-----------------|-----------------|
|                  | CT (sec) | Angle (°) | MCF (mm) |
| Control | 615 +/- 38.3 | 55.9 +/- 1.8 | 25.0 +/- 0.5 |
| Fibrinogen | 535 +/- 31.3 | 62.1 +/- 1.9 | 29.1 +/- 0.5 |
| rFVIIa | 452 +/- 24.9* | 82.3 +/- 1.3 | 25.3 +/- 0.5 |
| Fibrinogen+rFVIIa | 340 +/- 22.0* | 68.2 +/- 1.3* | 26.9 +/- 0.4* |

| Table 2 |
|----------------------|-----------------|-----------------|-----------------|
|                  | CT (sec) | Angle (°) | MCF (mm) |
| Control | 719 +/- 48.2 | 43.2 +/- 2.9 | 32.3 +/- 2.2 |
| Fibrinogen | 633 +/- 40.1 | 53.7 +/- 2.2* | 43.1 +/- 1.5* |
| rFVIIa | 598 +/- 78.8* | 42.1 +/- 6.0 | 31.2 +/- 4.5 |
| Fibrinogen+rFVIIa | 505 +/- 28.6* | 62.1 +/- 2.4* | 42.4 +/- 1.3* |

PPP=platelet poor plasma, WB=whole blood, CT=clotting time, MCF= maximal clot firmness
*P<0.05 vs. control
IS THE ROUTINE USE OF CERTIFIED REGISTERED NURSE ANESTHETISTS ASSOCIATED WITH A HOSPITAL'S RISK-ADJUSTED CABG SURGERY SURVIVAL RATES?

Brown P\(^2\); Anderson A\(^2\); Houser S\(^3\); Culler S\(^4\); Simon A\(^4\); Tarkington L\(^2\)

\(^1\)Cardiac Data Solutions, Inc., Atlanta, GA, USA; \(^2\)HCA CCMN, Nashville, TN, USA; \(^3\)Emory University, Atlanta, GA, USA

Purpose: There is substantial debate among clinicians concerning the appropriate role of certified registered nurse anesthetists (CRNAs) in complex cardiac surgery cases. Because off-pump coronary artery bypass graft (OPCAB) surgery often requires an intensive anesthetic experience, this abstract attempts to compare hospital average risk-adjusted survival rates between hospitals that routinely use CRNAs for OPCAB versus those hospitals that do not.

Method: The primary data source, HCA Heart Services Standards Database (HSSD), is a web-based survey containing detailed information regarding structures and processes in place at each of 58 HCA hospitals. The study population includes 54 HCA hospitals that performed OPCAB surgery on at least 10 patients during 2004. Hospitals were divided into two groups: hospitals that routinely use CRNAs for OPCAB surgery and hospitals that do not routinely use CRNAs during these cases. A risk-adjusted CABG surgery mortality model, controlling for 21 demographic and co-morbid factors, was used to predict the number of expected mortalities at each hospital. The number of risk-adjusted lives saved (LS) was calculated for each hospital as the difference between the number of observed deaths and the risk-adjusted expected number of deaths. Statistical differences in the average number of LS and LS per 1,000 patients between hospitals in the two study groups were compared using the Student T-test and Pearson Correlation Coefficients.

Results: The Table indicates that 17 (31%) of the 54 HCA hospitals do not routinely use CRNAs during OPCAB surgery. The table also indicates that hospitals not routinely using CRNAs performed significantly more CABG surgeries and had significantly (p<0.05) better average outcomes (more LS and LS per 1000 patients) than those hospitals routinely using CRNAs. There was no statistically significant difference in percent of CABG surgeries performed off-pump between hospitals in the two groups. Finally, the estimated Pearson Correlation Coefficient between the indicator variable that a hospital routinely used CRNAs and the hospital’s risk-adjusted number of LS and risk-adjusted number of LS/1000 was -0.31 (p=0.023) and -0.28 (p=0.037), respectively.

Conclusions: This study provides preliminary evidence that hospitals routinely using anesthesiologists during OPCAB surgery have better risk-adjusted CABG surgery survival rates. However, future research needs to adjust for other structural and process factors that may be related to outcomes.
SCA39
HYPOTENSION DURING CARDIOPULMONARY BYPASS IS NOT ASSOCIATED WITH COGNITIVE DECLINE AFTER CABG
Green A; White W; Grocott H; Mathew J; Bar-Yosef S
Duke University Medical Center, Durham, NC, USA

Introduction: Neurocognitive dysfunction (NCD) continues to occur in a significant number of patients after cardiopulmonary bypass (CPB) [1]. The factors influencing its incidence and severity are not completely known. Systemic hypotension during CPB has been suspected as a contributing factor in post-cardiac surgery NCD, although its role has been incompletely studied. We investigated the relationship between hypotension during CPB and postoperative NCD.

Methods: Following IRB approval, we identified patients who participated in non-interventional studies of NCD. All patients underwent CABG surgery utilizing CPB during 1993-2004. Invasive mean arterial blood pressure (MAP) was recorded every 30-60 seconds using automatic anesthesia record keeping. Baseline MAP was defined as the median MAP over the first three minutes of the case. The hypotensive burden during CPB was quantified by the area less than 50 mm Hg on a MAP vs. time curve (MAP area<50). Neurocognitive testing was performed both preoperatively (baseline) and 6 weeks after surgery, and an overall cognitive score was calculated by factor analysis [1]. Effects on six-week change in cognitive score were analyzed by multivariable linear regression. A dichotomous neurocognitive deficit was defined as a drop of greater than one standard deviation from baseline on any of the 4 cognitive factors; this was analyzed using multivariable logistic regression.

Results: 590 patients had both 6-week cognitive testing and adequate MAP data available and are included in this analysis. Table 1 describes their demographic characteristics. A scatter plot of cognitive change versus MAP area<50 displays the lack of association between these two variables (Figure 1). This was corroborated by a multivariable regression analysis, even when controlling for baseline MAP (p=0.62; see Table 2). Similarly, no effect of MAP area<50 was seen on the dichotomous neurocognitive deficit outcome (p=0.39).

Discussion: The effect of hypotension during CPB on post-CABG NCD has not been adequately defined. This well-powered study indicates that the hypotensive burden during CPB is not associated with the incidence or severity of cognitive change after CABG.

References:

Table 1: Study Sample Demographics (N=590)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
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<tr>
<td>Age of Surgery</td>
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<td>10.4</td>
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<tr>
<td>Years of Education</td>
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<tr>
<td>Sex  (Female)</td>
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<td>48</td>
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<tr>
<td>LV Systolic Fraction (%)</td>
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<tr>
<td>CPB Time (min)</td>
<td>118.5</td>
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<tr>
<td>Aortic Cross-Clamp Time (min)</td>
<td>66.2</td>
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<tr>
<td>Baseline Mean Arterial Pressure (mm Hg)</td>
<td>94</td>
<td>16.2</td>
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<tr>
<td>MAP minutes &lt;50 mm Hg</td>
<td>24</td>
<td>23.3</td>
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</table>

Table 2: Multivariable Regression Model of 6 Week Cognitive Change

<table>
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<th>Coef.</th>
<th>SE</th>
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<th>p-value</th>
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<td>Baseline Cognitive Score</td>
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<td>0.2</td>
<td>-1.26</td>
<td>&lt;0.0001</td>
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<tr>
<td>Age at surgery</td>
<td>-0.006</td>
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<td>Years of Education</td>
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<td>0.002</td>
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<td>Diabetes</td>
<td>-0.043</td>
<td>0.071</td>
<td>-0.63</td>
<td>0.5282</td>
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<td>Caucasian vs Any Other</td>
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<td>0.097</td>
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<td>MAP area&lt;50</td>
<td>0.003</td>
<td>0.003</td>
<td>1.00</td>
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<td>Baseline MAP</td>
<td>-0.0007</td>
<td>0.003</td>
<td>-0.31</td>
<td>0.5519</td>
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</table>

Figure 1: Scatter Plot of 6 Week Cognitive Change versus MAP area <50 mm Hg with 95% confidence interval for the regression line.
SCA40
INCREASED PKA-MEDIATED PHOSPHORYLATION OF MYOCARDIAL BETA-2 ADRENERGIC RECEPTORS IN A LARGE ANIMAL MODEL OF CHRONIC HEART FAILURE
Monreal G; Gerhardt M
The Ohio State University, Columbus, OH, USA

Introduction: Chronic heart failure (CHF) is characterized by deranged beta-adrenergic receptor (βAR)/Gsα signal transduction. The G proteins Gsα and Gαi-2 regulate cardiac inotropy via stimulation and inhibition of adenylyl cyclase, respectively. The role of increased Gαi-2 in CHF remains unknown. Gαi-2 may activate cardiac antiapoptotic pathways via MAP kinase signal transduction. βARs undergo negative feedback inhibition by phosphorylation by PKA or BARk. Protein kinase A (PKA)-mediated phosphorylation of β2AR (PKA-p-β2AR) alters coupling of β2AR to favor Gαi-2 over Gsα in cell culture. It is unknown if PKA-p-β2AR couples to Gαi-2 to activate these survival pathways. While this association has been demonstrated in vitro (1), PKA-p-β2AR has not been demonstrated in vivo. Gαi-2 is increased in CHF myocardium (2) and may preferentially couple PKA-p-β2AR to Gαi-2, resulting in contractile inhibition. We therefore test the hypotheses that myocardial PKA-p-β2AR increases in CHF and correlates with increased Gαi-2 protein in a large animal model of CHF (3).

Methods: CHF was induced in sheep via microembolization of the circumflex coronary artery (LCx) (3). Left ventricular (LV) myocardium was obtained from 4 CHF sheep (LV ejection fraction <35% for ~20 months) and 4 control sheep. Immunohistochemistry and western blots were performed with antisera specific for Gαi-2 and PKA-p-β2AR at the PKA phosphorylation site. Protein bands were quantified using densitometry.

Results: Microembolization of the LCx resulted in ischemia/fibrosis (LV posterior wall). EF decreased from 51±3% to 23±5%. PKA-p-β2AR increased 24% in CHF compared to controls. Gαi-2 significantly increased 6.4-fold in the CHF compared to controls. PKA-p-β2AR positively correlated to Gαi-2 protein levels (p=0.0146) in CHF but not in controls. Immunohistochemistry revealed increased PKA-p-β2AR and disorganized distribution in CHF compared to controls.

Conclusions: PKA-p-β2AR is increased in an ovine model of CHF. PKA-p-β2AR positively correlated to Gαi-2 protein levels in CHF. Increased PKA-p-β2AR may promote increased coupling to Gαi-2. This is the first study to demonstrate increased PKA-p-β2AR and correlate upregulation of PKA-p-β2AR with Gαi-2 in vivo, a prerequisite if putative antiapoptotic pathways are functional. Failing myocardium may be forced to choose between acute transient inotropic augmentation via βAR/Gsα pathways at the expense of continued receptor desensitization. Alternatively, PKA-p-β2AR may provide sanctuary to the β2AR by allowing it to couple to Gαi-2 with the potential activation of survival pathways for long-term benefit of cardiac function.

References:
RENAAL DYSFUNCTION AFTER DEEP HYPOTHERMIC CIRCULATORY ARREST IN THE RAT

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Introduction: Renal failure after deep hypothermic circulatory arrest (DHCA) is common with an incidence of 25% to 50% (1-2). In addition to its association with serious morbidity, acute renal impairment is also associated with significant mortality (3). The development of renal protective strategies has been hampered by the lack of experimental models of DHCA-related renal injury. In order to further understand the etiology and develop renal protective strategies, we sought to characterize renal dysfunction following DHCA in the rat.

Methods: After Animal Care Committee approval, 14 male Sprague Dawley rats (400-465g) were anesthetized and cannulated for cardiopulmonary bypass (CPB) using the right jugular vein for venous return and the tail artery for aortic inflow (4-5). Mean arterial pressure was monitored via the superficial caudal epigastric artery. Two groups of rats were studied. The DHCA rats (n=6) were subjected to 65min of CPB and 45min of DHCA once their pericranial temperature reached 7.0°C. After rewarming to 35.5°C the animals were separated from CPB and allowed to passively rewarm to 37°C. The CPB Control rats (n=8) underwent 60min of normothermic (37.5°C) CPB. All the rats were extubated 120min after the end of CPB and recovered in an oxygen-enriched environment for 24h. Creatinine levels at baseline and at 48h after surgery were determined using a solution of alkaline picrate followed by spectrophotometric quantitation of the chromogen.

Renal dysfunction was characterized by determining the percent change in creatinine from baseline to 48h. Between groups comparisons were made using a multivariate linear regression analysis and were adjusted for bypass time due to variable rewarming requirements in the DHCA group.

Results: All animals survived for their 48h renal assessment. Compared to the control animals, the DHCA group experienced a significant increase (mean ± SD) in creatinine at 48 hrs compared to baseline (-15 ± 53 %, control vs. 77 ± 103 %, DHCA; p = 0.05; Figure). CPB time (65 ± 5 DHCA vs. 60 ± 0 controls) was not a significant predictor of change in creatinine between the groups (p=0.38).

Discussion: DHCA resulted in significant renal dysfunction with a 77% increase of creatinine at 48h after surgery. This model of significant postoperative renal dysfunction may allow future studies to elaborate on the etiology and potential renal protective strategies.

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INFLUENCE OF VARIOUS THROMBIN INHIBITORS ON HEPARIN-INDUCED ANTICOAGULATION FOR CARDIOPULMONARY BYPASS IN PEDIATRIC PATIENTS

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Introduction: Antithrombin III (ATIII) is the main inhibitor of thrombin in adult plasma while other thrombin inhibitors, alpha-2-macroglobulin (α2M) and heparin cofactor II (HCII), play a lesser role (1). However, in ATIII-deficient neonatal plasma, the relative contributions of α2M and HCII to thrombin inhibition may be quite different than that seen in adult plasma. Indeed, while studies support a correlation between heparin responses and ATIII concentrations in adult patients undergoing cardiopulmonary bypass (CPB) (2), in pediatric patients such correlations have not been found. In this investigation, we examine the relationship between heparin responses in pediatric patients undergoing CPB to the different thrombin inhibitors: ATIII, α2M and HCII.

Methods: After informed parental consent, 98 children scheduled for elective cardiac surgery were stratified into 5 age groups: <1 month, 1-3 months, 3-6 months, 6-12 months and 12-24 months. Baseline ATIII, HCII and α2M levels were measured as well as baseline celite and kaolin activated clotting times (ACT). Three minutes after our standard heparin dose of 400 units/kg, celite and kaolin ACTs were repeated. Changes in ACT values before and after heparin administration and a heparin dose-response relationship (HDRR) were calculated for each patient. The HDRR was calculated by dividing the change in ACT values before and after heparin by an estimate of the circulating whole blood heparin concentration as described by Lemmer and Despotis (3).

Results: In patients <1 month, correlation existed between α2M values and changes in celite and kaolin ACT with heparin (r = -0.474, p < 0.05 and r = -0.479, p < 0.05 respectively). In patients <1 month, correlation existed between α2M values and the HDRR-celite and HDRR-kaolin (r = -0.45, p < 0.05 and r = −0.47, p < 0.05 respectively). Correlation was also seen in patients 3-6 months between α2M and the change in kaolin ACT and the HDRR-kaolin (r = -0.448, p < 0.05 and r = −0.45, p < 0.05 respectively). No other significant correlations were found.

Conclusion: Our data showed consistent correlation between α2M and all the examined heparin responses in patients <1 month of age, thus supporting the concept that α2M may be the major correlate to heparin’s effect in ATIII-deficient neonatal plasma.

References:
FUNCTIONAL DEFICITS IN RATS EXPOSED TO CARDIOPULMONARY BYPASS VS. DEEP HYPOTHERMIA CIRCULATORY ARREST

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Objective: Cardiopulmonary bypass (CPB) and deep hypothermia circulatory arrest (DHCA) have enabled surgical treatments for congenital and acquired cardiovascular defects. Unfortunately, neurological complications can result following both CPB and DHCA over 60 min. Because of technical demands, studies in this area have used large animal models. Development of rodent models would facilitate study of the mechanisms underlying these sequelae and testing new therapies. We sought to investigate if 75 min of CPB or DHCA caused motor or cognitive deficits in rats.

Methods: Adult Sprague-Dawley rats (350-400 g) were randomized into 3 groups: CPB, DHCA, or sham. All underwent the same anesthesia, catheterization and infusions. Rats in the CPB group were subjected to 75 min of normothermic full-flow CPB. Rats in the DHCA group were cooled to 15°C over 5 min using CPB and surface cooling, subjected to 75 min DHCA at 15°C, and rewarmed to 34.5°C over 60 min on CPB and maintained at 34.5°C for 8 h. All rats in CPB and sham groups were kept at normothermia. Motor function was assessed using beam testing on post-operative days 3-13. Cognitive performance was evaluated using a Morris water maze tasks on days 7-13. Rats were sacrificed on day 14 for histological evaluation.

Results: Six rats died during surgery or prior to post-operative day 13 in the CPB group, 2 in the DHCA group, and 1 in the sham group, leaving n=9 for the CPB group, n=7 for the DHCA group, and n=8 for the sham group. Sustained deficits on beam testing were seen only in the CPB group (p<0.05) (Fig 1). Rats in the CPB and DHCA groups exhibited similar cognitive performance vs sham (Fig 2). No microscopic alterations were present in brain sections from rats in the sham group. Significant neuronal degeneration was uncommon, being present within the brain sections from rats in the CPB (n=3) and DHCA groups (n=2). These were often associated with vascular occlusion.

Discussion: We conclude that CPB and DHCA are feasible in adult rats. Fatality rates were 40%, 22%, 11% in the CPB, DHCA, and sham groups, respectively; many were due to technical errors associated with multiple surgical interventions in this highly demanding model. Motor dysfunction in the CPB group could result from peripheral or central neurologic injury. Vaso-occlusive disease could be ascribed to prothrombotic state triggered by both surgery and CPB. Surprisingly, unlike CPB, DHCA was not associated with motor or cognitive deficits vs sham in our model. A longer duration of DHCA, higher temperature or use of more difficult performance tasks may be necessary to establish a rodent model of DHCA with neurological complications.
AN ASSOCIATION OF TYPE OF CARDIAC SURGICAL PROCEDURES WITH ACUTE CONFUSIONAL STATES AFTER SURGERY IN PATIENTS WITH AND WITHOUT Atheromatous Disease of the Proximal Thoracic Aorta

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Introduction: Atheroma of the proximal thoracic aorta is a recognized risk factor of neurological morbidity after cardiac surgery. Postoperative confusion represents a common manifestation of this morbidity. This study was designed to determine an association of open and closed chamber cardiac procedures with acute confusional states after cardiac surgery in patients with and without atheromatous disease of proximal thoracic aorta.

Methods: After REB approval, we reviewed the perioperative data acquired prospectively from April 2005 to September 2005 on 173 patients undergoing either coronary artery bypass graft (CABG) or mitral valve repair surgery. Data collected included demographic variables, transesophageal and epiaortic ultrasound reports, perioperative scores of the NEECHAM confusion scale (2), requirements for Haloperidol administration, and major outcomes data. Patients were divided into three groups; Group 1, Atheroma (evidence of the ascending aorta/aortic arch atheroma > 4mm); Group 2, Controls (patients who had normal proximal thoracic aorta, i.e. intimal thickness < 2mm), and Group 3, Mitral Valve (MV) Repair (patients who underwent mitral valve repair surgery and had normal proximal thoracic aorta). Statistical analysis was performed using MANOVA and Chi square test with SAS software program. P value < 0.05 was considered statistically significant.

Results: Patients in ‘Atheroma’ group were significantly older than patients in the ‘Control’ and ‘MV repair’ groups respectively. Patients were similar with respect to gender, BMI, and preoperative morbidity. The NEECHAM scores were considerably lower in the ‘Atheroma’ group during the 1st postoperative day. Haloperidol requirements were the highest in the ‘Atheroma’ group then ‘MV repair’ and finally ‘Control’ groups. Prevalence of atrial fibrillation after surgery and hospital length of stay was the highest in the ‘MV repair’ group. Other postoperative morbidity was comparable between the three groups.

Discussion: Early postoperative confusion is associated with both open and closed chamber surgical procedures. Atheromatous disease of proximal thoracic aorta appears to increase the risk of postoperative confusion in this patient population.

References
VOLUMETRIC AND FUNCTIONAL CHANGES OF RIGHT VENTRICLE AS A PREDICTOR FOR OUTCOME AFTER RESTORING SIZE AND SHAPE OF LEFT VENTRICLE-(SVR-SURGICAL VENTRICLE RESTORATION) WITH CABG IN DILATED CARDIOMYOPATHY (DCM).

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Introduction: Restoring the size and shape of left ventricle (SVR) has recently given new direction to the field of DCM along with the CABG, if associated with CAD. But still morbidity and mortality is very high. In SVR, geometry of the LV is modified and restored near normal. We rarely focus on the RV function and volume status at that time. In this study we have correlated the RV volume and functional changes post SVR with echocardiography finding and RV volumetric and functional relation & relevance to outcome. Measurement of right ventricle volume is available with CCO /CEDV (continues CO and end diastolic volume measurement) Catheter, (Edwards Lifescience Inc.). Satisfactory inference of right ventricle volume has been proven by this catheter

Methods: After IRB approval, we studied 40 cases posted for SVR with or without CABG. EF was <35%, LV EDV>180 ml, LVESV >120 ml. 7 patients without CAD, required only SVR, 4 patients required Mitral valve replacement for MR. Rest required some form of mitral valve repair along with SVR and CABG. After endotracheal intubation, TEE probe was introduced and CCO/CEDV catheter was inserted. With TEE, we measured LVEDV, LVESV, mitral valve status, LV dyskinetic segments, ventricular septum motion, RV function and TR. Due to different geometry of the RV, RV volume measurement is not easily possible by ECHO, We measured RV EDV, RV ESV, RV Stroke volume, RVEF, RVCO, by CEDV Catheter on vigilance monitor (Edwards Lifesciences). After completion of SVR, we measured all parameters and compared data pre and post SVR and also in ICU. We used TTE in ICU. Ionotrope was IV.Dobutamine, infusion up to10mcg/kg/min, inj adrenalin infusion when required. IABP was inserted if EF<20% or sever biventricular failure.

Results: Pre SVR – RVCO & RVEF was correlating very well with TEE findings for LV, but LVEDV & LVESV was less than PRE.OP ECHO. This may be due to vasodilators and anesthetic agent effects to reduce vascular resistance (falls low measurement).

Immediate Post SVR – LV Volumes and EF was much improved, but RVEDV, RVESV, RVCO, RVEF, was fluctuating.

Those patients who had:
(A) high (RVEDV, PAP-S,PCWP), EF-20-30% ,SV >40ml - RV diastolic dysfunction – 18 patients / 40 patients
(B) high (RVEDV,RVESV, PAP-D,PCWP ) ,EF<20%,SV<30ml - RV SYSTOLIC & diastolic Dysfunction – 4 patients / 40 patients

(A) had long ICU stay and highly morbid condition. Up to 12 days stay at the end discharged home.
(B) had high mortality chances, all died.
Rest 8 patients discharged from ICU and subsequently home as per routine.

Conclusion: There is a role of RV volumetric parameters in predicting outcome. SVR itself is high risk procedure but if RV function is fair than chances of survival are good but associated sever RV diastolic dysfunction carries high risk & along with systolic dysfunction also—mortality is very high.

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COMPUTER GENERATED GLUCOSE MANAGEMENT IN THE OPERATING ROOM
Geller H; Burgess W; Coyle J
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Introduction: Recent medical literature demonstrates that tight glucose control (TGC) results in significant patient and hospital benefits: reduced infections, reduced acute renal failure, shorter ICU stays, reduced mortality, and reduced costs. The primary side effects of TGC are hypoglycemia and an increase in the workload and stress on those managing the blood glucose.

Hypothesis: EndoTool™ Glucose Management System is a computer-driven calculator for dosing intravenous (IV) insulin in critically ill patients with elevated glucose levels. EndoTool™ software will promptly correct the blood glucose to a goal set by the anesthesiologist with minimal episodes of hypoglycemia.

Study: An IRB approved study of the EndoTool™ software was performed at Carolinas Medical Center, Charlotte, North Carolina commencing in July of 2005. We report the results of four months of experience using this software in the cardiac operating rooms to dose insulin for patients with elevated blood glucose. Operating room data, including hemodynamic measurements, were analyzed and compared to historical controls.

Results: 147 patients received 580 calculated doses of insulin during this four-month study. The response relative to time is shown in Figure 1 for those patients with an initial glucose > 150 mg/dL. The dashed line in Figure 1 demonstrates the historical control of glucose for matched patients using conventional protocols used prior to the advent of EndoTool™ software dosing. The blood glucose response to EndoTool™ insulin dosing for patients starting with glucose > 150 mg/dL is shown in Figure 2, stratified according to starting glucose.

Anesthesiologists and anesthesia care team members have been enthusiastic about this computer driven approach to blood glucose management. The work and stress associated with TGC is subjectively reduced. Additionally, documentation is improved with the electronic medical record generated. Results from this protocol will be compared with literature reports of alternative TGC methods.

Conclusions:
- EndoTool™ provides improved glucose control in cardiac operating rooms,
- Optimal control of glucose levels are achieved when the software is started with an initial glucose below 150 mg/dL,
- The hypoglycemia incidence (i.e. < 75 mg/dL) was zero,
- A survey of participating anesthesiologists and anesthetists revealed a high degree of acceptance of the protocol when compared to conventional methods of glucose control,
- Medical record documentation is simplified and improved,
- Quality Assurance monitored by the medical and nursing directors is convenient and easy.
SCA47
QUANTITATIVE ASSESSMENT OF REGIONAL MYOCARDIAL FUNCTION USING 2D STRAIN
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Introduction: Intraoperative echocardiography is widely used to study myocardial segmental wall function. Conventional qualitative wall motion analysis is unable to identify small differences after therapeutic procedures. This, however, is of particular interest after coronary artery bypass grafting (CABG) for evaluation of revascularization quality. Recently developed techniques can quantify regional myocardial deformation (1) and distinguish between passive and active motion. We aimed to compare the results of qualitative analysis with peak systolic strain measurements immediately before and after CABG in patients with reduced left ventricular (LV) function.

Methods: Ten patients with reduced LV function undergoing coronary revascularization were studied before and immediately after procedure. Echocardiography studies were performed using Vivid 7 (GE). B-mode cineloops were acquired using standard 4- and 2-chamber views for computer off-line analysis and for visual wall motion scoring (WMS). Strain (S) is expressed as the percent change from the original dimension. To calculate S we used the non-Doppler-based method of 2-D strain (2). The software takes advantage of temporally stable acoustic speckles to determine velocity maps and to calculate the deformation parameter in the longitudinal and radial axis in each segment.

In addition myocardial wall segments were scored from the same B-mode cineloops according to the ASE recommendations: normokinesia (N, 1), hypokinesia (H, 2), akinesia (A, 3) and dyskinesia (D, 4).

Results: The mean ejection fraction using conventional biplane measurement was 25.8 ± 8.3 % preoperatively and 27.9±10.5% immediately after CABG. A total number of 120 myocardial segments were included in the analysis. In WMS there were 29 (N), 69 (H), 19 (A) and 3 (D) segments preoperatively and 26 (N), 65 (H), 21(A), 8 (H) after procedure. Values for radial peak systolic S were 39.7±10.9 (N) 15.4± 8.3 (H), 3.3± 5.5 (A), -17±1.5 (D) preoperatively and 41.7± 15, 7 (N), 13.8± 8.1 (H), 2.7± 3.3 (A) and -6.4± 4.9 (D) postoperatively. Values for longitudinal peak systolic S were -9.3± 4.9 (N),-7.1± 3.8 (H), -4.9± 4.1 (A), 3.3± 2 (D) preoperatively and -7.8± 6.5 (N), -6.3± 3.6 (H), -2.1± 3.6 (A), 2.0± 3.9 (D) postoperatively .Using linear regression analysis radial strain measurements revealed correlation with WMS of 0.83 with R2=0.68 preoperatively and 0.78, R2=0.62 postoperatively. As expected, the correlation between longitudinal strain and WMS was weak.

Conclusion: Two-dimensional strain allows non-Doppler-based calculation of deformation parameters using B-mode images. Lower peak systolic strain is associated with wall motion abnormalities. This simple and reliable method makes the intraoperative quantification of myocardial segmental function possible and may provide important information about the quality of revascularization and thus have immediate therapeutic implications.

References
SCA48

A COMPARATIVE STUDY BETWEEN ECG- AND TEE-CONTROLLED PLACEMENT OF CENTRAL VENOUS CATHETER

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Introduction: To reduce serious complication with central venous catheters (CVC) control of its correct position immediately after placement in the operating room (OR) is important. In the last years ecg-guided positioning of CVC is of growing interest not only in Europe (1) but also in the United States (2). This study was designed to compare the ecg-guided positioning of the CVC with TEE finding in the bicaval standard view.

Method: After approval by the local ethic committee and informed patient consent a total of 200 patients (pts) with sinus rhythm were enrolled in this prospective study. After routine induction of anesthesia the right internal jugular vein was cannulated and correct position of the catheter was done with intraatrial ecg (IECG)(Pajunk, Germany). In phase I the TEE probe was inserted and the ecg-guided position of the CVC was controlled by transesophageal echocardiography (TEE)(Sonos 5500, Philips) in the bicaval standard view, where the crista terminalis (CT) defines the transition between the right atrium and the superior vena cava (SVC). In phase II the position of the CVC was TEE-guided corrected, that the tip of the CVC was 1-2 cm above the crista terminalis. Changes in intratrial ecg were recorded. Differences of the position between phase 1 and 2 are expressed as mean with standard deviation.

Results: All CVC could be placed under ecg-guidance. In phase I the tip of the CVC could be seen 3.2 cm above the CT by TEE in 63 pts. In 137 pts the tip of the CVC could not be seen by TEE because the visible distance of the SVC cranial to the CT was 3.3 cm. In phase II all CVC could be placed under TEE-guidance 1.5 cm cranial to the CT. For this the CVC had to be advanced 2.7 cm as compared to the position in phase I (p<0.001). In this position the IECG shows elevated p-wave in all pts.

Conclusion: Correct ecg-guided placement of CVC according to the recommendations of the manufactures of these devices resulted in more cranial positioning of the tip of the CVC in the SVC as compared by positioning with the help of TEE.

References:
PATIENT SAFETY IN CARDIAC ANESTHESIA: DOES IT HAVE A SEPARATE IDENTITY?

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Introduction: Anesthesiology as a medical specialty has been generically touted as a model for risk reduction strategies and patient safety initiatives. Despite the advances and purported gains made, the need for further improvement in anesthesia patient safety, especially amongst ASA 3 and 4 patients has been noted (1,2). Cardiac anesthesia, surgery, and perfusion represent a cognitively complex, multiple task, high technology medical domain (3). Separate identification of anesthesiology determined risk reduction practices, unrelated to those involving cardiac surgery and the conduct of extracorporeal perfusion remain elusive goals (4). We sought to examine the level of peer reviewed literature specifically relating to patient safety concerns in the practice of cardiac anesthesia.

Methods: Two National Library of Medicine/Medline electronic database search engines, OVID® and PubMed®, were specifically queried over a 20 year period (1996-2005). The keywords combinations of cardiac/anesthesia/patient safety, and cardiac anesthesia/patient safety were run through both searches. All databases in the NCBI/NLM were queried. The first combination yielded six results, and the second combination zero. Review of the six results/articles was one editorial on risk management and the other five were safety assessment in combination with other efficacy trials. In addition, 565 citations were reviewed for relevance using the keywords cardiac, anesthesia, risk assessment, and outcomes. Finally, the ASA Practice Parameters were reviewed for the relevance to the clinical practice of cardiac anesthesiology.

Discussion: Within the realm of cardiac anesthesiology, there exists a body of literature describing risk assessment and clinical outcomes (86 and 137 citations respectively). However, there is a relative absence of investigative work specifically addressing patient safety in cardiac anesthesia. Most, if not all, practice guidelines and process improvement activities implemented into cardiac anesthesiology were developed from non-cardiac surgery anesthesiology data. Process of care improvements and patient safety initiatives uniquely designed for and implemented into cardiac anesthesiology practice are not demonstrated in this literature survey. These findings highlight the necessity for future investigative activity specifically related to performance improvement in cardiac anesthesia.

References

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THROMBIN SUPPRESSION REDUCES THE INFLAMMATORY RESPONSE TO EXPERIMENTAL CARDIOPULMONARY BYPASS.

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Introduction: Heparin anticoagulation is only partially effective at suppressing thrombin formation during cardiopulmonary bypass (CPB), often mediated by tissue factor (TF) on cellular surfaces. In contrast to the heparin-antithrombin III complex, direct thrombin inhibitors, such as bivalirudin, have access to clot and cell surface bound thrombin with the potential to more effectively inhibit thrombin formation during CPB. TF and the products of an activated extrinsic coagulation pathway exhibit cross-talk with cellular and cytokine aspects of the inflammatory response.[1] Therefore we tested the hypothesis that optimal thrombin suppression reduces the inflammatory response to CPB as measured by interleukin-6 (IL-6) levels after CPB.

Methods: With IRB approval, 32 male Sprague-Dawley rats were anesthetized, surgically cannulated for CPB and assigned to one of 4 groups: Sham (n=6 analyzed prior to others to validate model); Heparin (H; n=13) 0.3-0.4 units/g IV heparin prior to CPB with 50 units heparin in the pump prime [2]; full dose bivalirudin (B; n=13) 1mg/g bolus followed by 1mg/g/hr infusion. [3]. IL-6 levels were determined using ELISA at baseline (before CPB) and 60 minutes after 60 minutes of CPB. Values are expressed as pg/ml.

Results: Minimal IL-6 was measured at baseline in any group. Therefore a three group Kruskal-Wallis test compared IL-6 levels at the post CPB timepoint and indicated that the IL-6 levels among the 3 groups are significantly different from each other (p=.04). Post hoc paired comparisons indicated that IL-6 levels in group H are significantly higher than in groups B and Sham (p <0.05) after adjusting for multiple comparisons.

Discussion: IL-6 is the cytokine primarily responsible for TF expression on endothelial or mononuclear cells, thereby providing positive feedback for further uncontrolled hemostatic activation during CPB. The use of bivalirudin rather than heparin anticoagulation significantly reduced the postoperative IL-6 levels seen with experimental CPB. Whether the benefit of this anti-inflammatory effect is limited to reduced hemostatic activation or improvement in outcome will be the focus of future study.

References
SCA51
ACUTE RESPIRATORY FAILURE REQUIRING PRONE POSITION IN THE CARDIAC OPERATING ROOM
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Background: Deterioration in arterial oxygenation is almost imminent after cardiac surgery with cardiopulmonary bypass (CPB). Prone position is an effective treatment modality for improving alveolar-arterial O2 gradient after cardiac surgery [1,2]. We report on dramatic improvement in arterial oxygenation by utilizing prone position in the cardiac operating room (OR) after separation from CPB.

Patients: Two adult male patients age 48 and 58 years, underwent elective coronary artery bypass graft (CABG) and Bentall procedure plus CABG surgery respectively. Both patients had prior medical history of hypertension, recent myocardial infarction, heavy smoking (2 packs per day for 25 years), BMI = 30. Patients preoperative medication included beta-blockers, Ca channel antagonists and ACE inhibitors. Baseline arterial blood gases were PaO2=70mmHg and PaCO2=39mmHg with FiO2=0.21 in the first patient and PaO2=76mmHg and PaCO2=39mmHg with 6 L/min O2 via nasal prongs in the second patient. CPB times were 95 and 240 minutes respectively.

Methods: Anesthetic management before and during CPB was uneventful. Twenty minutes after separation from CPB, there was considerable reduction in SaO2 from 100% to 85%. Despite of increasing FiO2 to 1.0 and multiple alveolar recruitment maneuvers, patients SaO2 remained at 89%. Expansion of both lungs was confirmed under direct vision; both pleural cavities were opened. Bronchoscopy did not reveal any potential causes of respiratory failure. There was no wheezing on auscultation. Transeosophageal echography did not identify any intracardiac shunts. Addition of inhaled nitric oxide did not improve arterial oxygenation. Both patients received empiric antihistamines, epinephrine and hydrocortisone treatment. After chest closure, both patients were moved from the OR table onto intensive care bed in a prone position with immediate dramatic increase in SaO2 to 100%. Patients were transferred to intensive care unit in a prone position, which was discontinued after 4 hours of positive pressure ventilation with a PEEP=8 mmHg. Both patients were extubated within 11 hours after surgery and were discharged from intensive care unit on the second and third postoperative days respectively.

Conclusion: Prone positioning is usually reserved for management of patients with acute respiratory failure in the ICU. Our report identifies the efficacy of this treatment modality in an acute setting after separation from CPB in the cardiac OR.

References:
Introduction: Occlusion of a coronary artery during off-pump coronary artery bypass graft surgery (OPCAB) can cause significant myocardial dysfunction, especially in patients with poor collateral formation. Lesion of right coronary artery (RCA) in patients with right dominant coronary circulation has been known to be closely associated with right ventricular (RV) function. Although numerous studies have validated the efficacy of intracoronary shunt on reducing transient left ventricular dysfunction during OPCAB, there is lack of evidence supporting its role on RV function during RCA revascularization. Therefore we studied the effect of intracoronary shunt during distal anastomosis of RCA without collateral supply on RV function in patients undergoing OPCAB with a fast-response thermodilution pulmonary artery catheter.

Methods: With IRB approval, forty patients scheduled for OPCAB with right dominant coronary circulation without visible collateral supply to the RCA territory confirmed by angiography were randomized to RCA revascularization either with a shunt (n=20) or with the proximal RCA occluded by a soft snare (n=20). Hemodynamic variables including RV ejection fraction (RVEF) were recorded at baseline, 10 min after application of tissue stabilizer for distal anastomosis of the RCA and after sternum closure. Corresponding RV stroke work index (RVSWI) was calculated.

Results: RVEF decreased significantly during RCA revascularization and returned to baseline values after sternum closure in both groups without any significant difference between the groups. RVSWI and cardiac index (CI) also decreased during RCA revascularization and returned to baseline values but without any statistical significance in both groups at any point of measurement (Table 1).

Conclusions: The insertion of intracoronary shunt during RCA revascularization did not show any advantage on RV function over the soft snare during OPCAB, even in the absence of collateral supply. Considering the possibility of adverse events associated with insertion of intracoronary shunt, routine use of intracoronary shunt during RCA revascularization to minimize transient RV dysfunction is not recommended in OPCAB.

References

Table 1: Hemodynamic Data

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Group</th>
<th>RVSWI</th>
<th>CI</th>
<th>RVEF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Shunt</td>
<td>64 ± 31</td>
<td>2.0 ± 0.8</td>
<td>53 ± 17</td>
</tr>
<tr>
<td></td>
<td>Sham</td>
<td>72 ± 17</td>
<td>2.4 ± 0.3</td>
<td>53 ± 17</td>
</tr>
<tr>
<td>10 min</td>
<td>Shunt</td>
<td>77 ± 12</td>
<td>2.1 ± 0.1</td>
<td>51 ± 19</td>
</tr>
<tr>
<td></td>
<td>Sham</td>
<td>79 ± 10</td>
<td>1.9 ± 0.9</td>
<td>51 ± 19</td>
</tr>
<tr>
<td>10 min</td>
<td>Shunt</td>
<td>77 ± 11</td>
<td>2.0 ± 0.5</td>
<td>51 ± 19</td>
</tr>
<tr>
<td></td>
<td>Sham</td>
<td>77 ± 11</td>
<td>1.9 ± 0.7</td>
<td>51 ± 19</td>
</tr>
<tr>
<td>10 min</td>
<td>Shunt</td>
<td>90 ± 18</td>
<td>3.0 ± 0.8</td>
<td>53 ± 17</td>
</tr>
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<td></td>
<td>Sham</td>
<td>83 ± 17</td>
<td>2.9 ± 0.3</td>
<td>53 ± 17</td>
</tr>
<tr>
<td>10 min</td>
<td>Shunt</td>
<td>76 ± 17</td>
<td>2.9 ± 0.2</td>
<td>53 ± 17</td>
</tr>
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<td></td>
<td>Sham</td>
<td>74 ± 17</td>
<td>2.9 ± 0.2</td>
<td>53 ± 17</td>
</tr>
<tr>
<td>10 min</td>
<td>Shunt</td>
<td>54 ± 13</td>
<td>3.1 ± 0.8</td>
<td>53 ± 17</td>
</tr>
<tr>
<td></td>
<td>Sham</td>
<td>51 ± 17</td>
<td>2.9 ± 0.2</td>
<td>53 ± 17</td>
</tr>
</tbody>
</table>

Values are expressed as mean ± SD. RVEF: Right ventricular ejection fraction, CI: Cardiac index, RVSWI: Right ventricular stroke work index.

Table 1: Hemodynamic Data

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Group</th>
<th>RVSWI</th>
<th>CI</th>
<th>RVEF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Shunt</td>
<td>64 ± 31</td>
<td>2.0 ± 0.8</td>
<td>53 ± 17</td>
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<tr>
<td></td>
<td>Sham</td>
<td>72 ± 17</td>
<td>2.4 ± 0.3</td>
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<td>10 min</td>
<td>Shunt</td>
<td>77 ± 12</td>
<td>2.1 ± 0.1</td>
<td>51 ± 19</td>
</tr>
<tr>
<td></td>
<td>Sham</td>
<td>79 ± 10</td>
<td>1.9 ± 0.9</td>
<td>51 ± 19</td>
</tr>
<tr>
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<td>Shunt</td>
<td>77 ± 11</td>
<td>2.0 ± 0.5</td>
<td>51 ± 19</td>
</tr>
<tr>
<td></td>
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<td>77 ± 11</td>
<td>1.9 ± 0.7</td>
<td>51 ± 19</td>
</tr>
<tr>
<td>10 min</td>
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<td>90 ± 18</td>
<td>3.0 ± 0.8</td>
<td>53 ± 17</td>
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<tr>
<td></td>
<td>Sham</td>
<td>83 ± 17</td>
<td>2.9 ± 0.3</td>
<td>53 ± 17</td>
</tr>
<tr>
<td>10 min</td>
<td>Shunt</td>
<td>76 ± 17</td>
<td>2.9 ± 0.2</td>
<td>53 ± 17</td>
</tr>
<tr>
<td></td>
<td>Sham</td>
<td>74 ± 17</td>
<td>2.9 ± 0.2</td>
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<td></td>
<td>Sham</td>
<td>51 ± 17</td>
<td>2.9 ± 0.2</td>
<td>53 ± 17</td>
</tr>
</tbody>
</table>

Values are expressed as mean ± SD. RVEF: Right ventricular ejection fraction, CI: Cardiac index, RVSWI: Right ventricular stroke work index.
CALCULATION OF LEFT VENTRICULAR MASS:
TRANSESOPHAGEAL VERSUS TRANSTHORACIC
ECHOCARDIOGRAPHY

Murphy S; Wirkus J; Christie A; Forsberg E; Morris R; Swaminathan M
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Introduction: Assessment of left ventricular (LV) structure and function is an integral part of cardiovascular disease management. Intraoperative echocardiographers are hampered by lack of consensus on measurement of LV dimensions by transesophageal echocardiography (TEE). Current standards exist for measurement of LV dimensions by transthoracic echocardiography (TTE). However, no equivalent standards exist for TEE. Therefore, we hypothesized that equivalent TEE measurements for LV mass correlate with established guidelines for TTE. Validation of TEE-derived measurement of LV dimensions will enable intraoperative echocardiographers to reliably report cardiac dimensions according to accepted standards.

Methods: After IRB approval and informed consent, 34 adult elective cardiac surgery patients were prospectively enrolled in this study. Patients with known hypertrophic cardiomyopathy, in non-sinus cardiac rhythm and those scheduled for assist device placement were excluded. All patients had a TTE examination prior to induction of anesthesia by a qualified sonographer. Comprehensive TEE exam was performed after induction according to SCA/ASE guidelines. Calculations for LV mass were made off-line from stored digital images. TTE and TEE measurements were separately performed by two blinded investigators. Left ventricular mass was calculated using the following formula:

\[ \text{LV mass (gm)} = 1.05 \times \left\{ \frac{5}{6} \times (A_{\text{epi}} \times L_{\text{epi}}) - (A_{\text{endo}} \times L_{\text{endo}}) \right\} \]

Where A_{\text{epi}}/A_{\text{endo}} equal LV end-diastolic epicardial/enocardial area in short axis and L_{\text{epi}}/L_{\text{endo}} equal LV end-diastolic epicardial/enocardial length in the long-axis. Pearson correlation was used to describe the relationship between the TTE and TEE derived LV mass measurements. A Bland-Altman analysis was used to detect any bias within the data and/or calculations. A p-value of <0.05 was considered significant.

Results: The mean LV mass per unit body surface area by TTE was 86.2 (± 29.7) gm/m², and 84.4 (±26.7) gm/m² by TEE. Using the Pearson method, there was significant positive correlation between the two methods (r = 0.93; p<0.0001). The Bland-Altman analysis revealed negative bias in LV mass measurements by TEE of 2.1 gm/m² (95% confidence interval -6.4 to 2.1) compared to TTE. A detailed analysis of the data revealed that TEE measurements tended to underestimate linear measurements while overestimating area measurements compared to TTE.

Conclusion: We confirmed the hypothesis that equivalent TEE measurement for LV mass correlate with established guidelines for TTE. This validation of TEE-derived LV measurements will enable intraoperative echocardiographers to reliably report LV structure and function according to accepted standards. This will also enable longitudinal assessment of LV remodeling in patients with hypertension, LV hypertrophy and various cardiomyopathies by either TEE or TTE without the need for relying exclusively on TTE studies.
EFFECT OF TRICUSPID ANNULOPLASTY ON POSTOPERATIVE TRICUSPID REGURGITATION FOLLOWING LEFT VENTRICULAR ASSIST DEVICE IMPLANTATION

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Massachusetts General Hospital, Boston, MA, USA

Background and Purpose: Ventricular assist device (VAD) implantation is an advanced mechanical treatment for end stage congestive heart failure. Echocardiography plays an important role in pre-, intra- and post-operative management of left ventricular assist device (LVAD) placement. Tricuspid regurgitation (TR) is an important factor for optimization of right ventricular (RV) performance following LVAD due to its relation to RV volume overload with potential worsening of RV systolic function. However, there is conflicting information on the effects of LVAD implantation on tricuspid valve function. In this study, we aimed to quantify the degree of TR following ventricular assist device implantation with and without tricuspid annuloplasty.

Methods: We retrospectively studied 29 LVAD patients admitted to the Massachusetts General Hospital, Boston, MA, USA, between 1996 and 2005. Patients were divided in 2 groups with (10/29) and without (19/29) tricuspid annuloplasty at the time of surgery. Tricuspid regurgitation was evaluated either by intraoperative transesophageal echocardiography pre- and post-LVAD implantation (8/10 patients with and 12/19 patients without annuloplasty) or by transthoracic echocardiography performed pre- and postoperatively within 1-3 days of surgery. TR was quantified with the same echocardiographic modality pre- and post-LVAD insertion. Tricuspid regurgitation (TR) was graded based on color flow Doppler images as absent (0), mild (1), moderate (2) and severe (3).

Results: Patients were 24 men and 5 women with average age of 52±15 years, and reason for heart failure including ischemic cardiomyopathy (14 patients), idiopathic dilated cardiomyopathy (10), amyloidosis (2), valvular disease (1), heart transplant failure (1) and postpartum cardiomyopathy (1). Tricuspid annuloplasties comprised 6 Carpentier-Edwards and 3 Edwards MC3 annular rings, and 1 Kay annuloplasty. Results are presented in the table. Patients receiving tricuspid annuloplasty during LVAD implantation had a significant reduction in their degree of TR (p<0.02). In contrast, no significant change in the average degree of TR could be demonstrated for the group of patients receiving an LVAD without concomitant tricuspid valve annuloplasty (p=n.s.), although some patients did show a reduction in their degree of TR.

Conclusions: Isolated implantation of an LVAD does not produce a consistent change in the degree of peri-operative TR as assessed by echocardiography. In contrast, performance of a tricuspid valve annuloplasty leads to a reduction in the degree of TR. These results are in agreement with previous observations of changes in TV function following LVAD placements and suggest that TV annuloplasty should be considered when reliable improvement in TR could represent a significant factor for outcome following LVAD implantation.
SCA55

EVIDENCE-BASED PREDICTION OF TRANSFUSION REQUIREMENTS FOR AORTOCORONARY BYPASS GRAFT SURGERY

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Background: Blood transfusion costs $4 billion per year in the United States, [1] and cardiac surgery consumes 20% of all transfusions. [2] Routine preoperative coronary artery bypass graft (CABG) surgery crossmatching is a significant source of resource utilization and cost but is rarely individualized or evidence-based, and typically exceeds need for all but the high risk patient. [3] We tested the hypothesis that risk factors could be identified to predict blood transfusion requirements for CABG surgery.

Methods: With IRB approval, demographic, risk factor and transfusion data for all non-emergent primary CABG procedures from Feb 1992 – Sept 2003 at one institution were gathered. Packed red blood cell (PRBC) transfusion was a four-level categorical outcome (none, 1-2, 3-4, >4 units) based on PRBCs transfused from incision to 24 h postoperatively. The dataset was randomly divided into “development” and “validation” subgroups. Based on previous studies, [3-5] 18 risk factors were selected for analysis. The primary model was developed using ordinal logistic regression analysis of 500 separate samples, each developed by sampling all patients with replacement (bootstrap) from the development group, in a method to identify robust risk factors for transfusion. The primary model was then tested by assessing its predictive value in the validation dataset.

Results: Demographic and transfusion risk factor variables in the development (n=3391) and validation (n=2011) datasets were similar to those seen in other CABG surgery populations. [3-5] A model of transfusion risk with good predictive value was developed for the development group (Table, c-index = 0.79). Testing of the model in the validation subgroup confirmed its good predictive value (Table, c-index = 0.78). Tolerance and variance inflation factor analysis indicated that collinearity of variables was not a concern in the model.

Conclusions: We identified risk factors that were good predictors of CABG surgery transfusion requirements. A validation analysis confirmed the validity of the predictive tool. This type of preoperative risk stratification may contribute to cost-containment (US$68/unit crossmatched) without increasing risk and facilitate more rational allocation of blood bank resources.

References:
1. Anesthesiology 2005;103:A:425
4. Transfusion 2001; 41:1193-203
ISOFLURANE-INDUCED ANESTHETIC PRECONDITIONING IN PATIENTS UNDERGOING AORTIC VALVE REPLACEMENT

Duncan A; Koch C; Pitas G; Starr N
Cleveland Clinic Foundation, Cleveland, OH, USA

Introduction: Volatile anesthetics have been shown to have cardioprotective effects that cause reductions in myocardial injury in patients undergoing coronary artery bypass grafting (CABG) surgery. Because patients with left ventricular hypertrophy (LVH) are more vulnerable to myocardial injury induced by aortic cross clamping, they may receive greater benefit from anesthetic preconditioning. However, the effects of isoflurane-induced preconditioning in patients with LVH has yet to be reported. Our objective was to perform a randomized, controlled pilot study designed to collect preliminary data on the effects of anesthetic preconditioning in patients with LVH undergoing aortic valve replacement (AVR) in order to assist in planning a larger, clinical investigation.

Methods: After institutional review board approval and informed consent, 33 patients with LVH undergoing AVR for aortic stenosis or insufficiency with or without CABG were enrolled. All patients received an anesthetic induction consisting of etomidate (20 mg) and fentanyl (5–15 mcg/kg) IV followed by a propofol infusion (50–150 mcg/kg/min). Patients were randomized to either anesthetic preconditioning (isoflurane titrated to end-tidal of 1.15% for 30–60 minutes before aortic cross clamping, N = 17) or control (no isoflurane, N = 16). Standard operative procedures, routine surgical techniques and cardioprotective strategies were used in all patients. Blood samples for troponin T were measured at baseline, on arrival in intensive care unit, and 12, 24, and 36 hours after removal of aortic cross clamp. The groups were compared on post-operative troponin T levels.

Results: Isolated AVR, AVR-CABG, AVR-CABG-myectomy, and AVR-CABG-ascending aorta replacement were performed in 17 (8 isoflurane, 9 control), 12 (7 isoflurane, 5 control), 2 (1 isoflurane, 1 control), and 1 (control) patients, respectively. Aortic cross-clamp times were similar between groups [isoflurane 60 (52, 90) vs. control 70 (54, 88), P = 0.759]. Troponin T concentrations did not differ significantly between treatments. (Table 1) Peak troponin T concentrations were 0.41 (0.27, 0.78) and 0.58 (0.28, 1.06) ng/dL [median (25th, 75th %)] (P = 0.637) in the isoflurane-preconditioned and control groups, respectively.

Conclusion: Troponin T concentrations were similar in patients preconditioned with isoflurane before AVR and those who were not. However, our small sample size does not rule out a potential benefit.

<table>
<thead>
<tr>
<th>Time of Troponin measurement</th>
<th>Isoflurane Preconditioning</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>0.41 (0.27, 0.78)</td>
<td>0.58 (0.28, 1.06)</td>
</tr>
<tr>
<td>12 hrs post-AVR O2 Clamp</td>
<td>0.41 (0.27, 0.78)</td>
<td>0.58 (0.28, 1.06)</td>
</tr>
<tr>
<td>24 hrs post-AVR O2 Clamp</td>
<td>0.31 (0.17, 0.47)</td>
<td>0.56 (0.16, 1.10)</td>
</tr>
<tr>
<td>30 hrs post-AVR O2 Clamp</td>
<td>0.29 (0.14, 0.46)</td>
<td>0.56 (0.16, 0.80)</td>
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</tbody>
</table>
COMPARISON OF MIXED VENOUS SATURATION- SVO2 (PULMONARY ARTERY) AND SCVO2 (CENTRAL VEIN) AND RELEVANCE TO HAEMODYNEMICS IN OPCAB SURGERY. STUDY OF 50 CASES.
Shastri N
Heart Care Clinic, Ahmedabad, Gujarat, India

Introduction: Many Studies have already proved satisfactory correlation between SVO2 (PA sample) and ScvO2 (central venous). No study has shown this correlation in OPCAB surgery as SVO2 measured by PA catheter by photospectrometrically in blood depends up on so many variables like handling of the heart in different situation and displacement of the sensor tip of the PA catheter with haemodynamic instability in OPCAB surgery.

Method: After IRB approval, 50 patients with stable haemodynamics, more than 45% EF, HCT between 33% – 45%, planned for OPCAB surgery were included in this study. Svo2 monitoring was established by combo catheter (Edwards Life Sciences. Inc.) which measures continues cardiac output (CCO) and SVO2 monitoring. Calibration of the optical sensor was done first time after insertion of catheter and then before distal grafting started. Anaesthetic agents and fluid infusion was same in all patients.

Venous blood samples were taken from proximal port of catheter during every graft and sent for lab analysis. Simultaneously continues CO, CI (Cardiac index) and Svo2 was monitored on the Vigilance monitor (Edwards Lifesience Inc.) and compared the results.

Results: After calibration of optical sensor all Patients had SVO2 and ScvO2 in between 62 – 79% at the time of insertion of catheter. There was maximum 13% variation between SVO2 and ScvO2 at that time. CO and CI was ranging between 3.5 – 5.6 lit/min and 2.2 – 3.2 respectively.

At the time of optical sensor recalibrated, we found marginal 4 – 7% reduction of SVO2 and Scvo2 due to haemodilution. During the LAD, RAMUS and distal RCA branch grafting there was a good correlation between SVO2 and ScvO2 and difference was insignificant. At this time CI was also maintained in the acceptable range.

OM, on the left side and PD and PLB branch, on the right side, we found significant fluctuation and variation in the SVO2 as compared to ScvO2. SVO2 was ranging between 39% – 85% against ScvO2 53% – 73%. CO and CI remained between 2.2 – 3.9 lit/min and 1.3 – 2.3 respectively. The fall of the CI was due to displacement of the heart. The fall in the CI was not always correlating with the SVO2. Compared to that, Scvo2 has shown acceptable correlation to the CI at the time of handling of the heart. After releasing the displaced heart, there were erroneous errors in the SVO2 reading for couple of minutes. That was never a case with ScvO2.

Conclusion: There may be acceptable correlation between SVO2 and ScvO2, but in OPCAB reliability of the SVO2 is really questionable. Loss of correlation might be due to progression of tip in branch PA or interference in sensor. This fluctuation becomes exaggerated in presence of haemodynamic instability.

So in OPCAB surgery SVO2 monitoring (BY PA photospectrometrically) is useful monitoring tool but ScvO2 is having better reliability over SVO2 even with the same technique.

Reference:
1 Critical care June 2005, 11:3
2 Respiration. 2001;68(3):279-8548
ACUTE HIGH OUTPUT FAILURE FROM AN AORTO-VENTRICULAR FISTULA DUE TO A RUPTURED SINUS OF VALSALVA ANEURYSM FOLLOWING BLUNT CHEST TRAUMA

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Blunt chest trauma can lead to rupture of preexisting Sinus of Valsalva aneurysms into the cardiac chambers (1, 2). However, acute high output failure has not been described. We present a case an acute aortoventricular fistula from blunt trauma leading to rapid high output right heart failure and massive pulmonary edema.

Case Presentation: An 18-year old man suffered chest trauma after hitting the handle bar of his all terrain vehicle. On post accident day 3, he complained of severe progressive dyspnea. Chest x-ray showed massive pulmonary edema and he was subsequently intubated.

A transesophageal echocardiogram (TEE) revealed a small subpulmonic ventricular septal defect (VSD) and a ruptured right sinus of valsalva aneurysm with aortic regurgitation into the right ventricle (Figures 1 & 2), and normal biventricular systolic function. Pt was scheduled for emergency repair.

Intraoperative TEE confirmed the preoperative findings. Pulmonary artery catheterization revealed high flow pulmonary hypertension. Surgical findings revealed a windsock deformity of the right coronary sinus into the preexisting VSD (Figure 3). The windsock of the Sinus of Valsalva aneurysm was resected. A bovine pericardial patch was used to close the aortic opening.

A second patch of bovine pericardium was then laid on the right-ventricular outflow tract incorporating the pulmonary valve annulus and the edge of the VSD. The patient was weaned from cardiopulmonary bypass without incident and taken to the intensive care unit. The patient continued to improve and was discharged on post-operative day 20.

Discussion: We report the first case of acute high output heart failure from a ruptured Sinus of Valsalva aneurysm into the right ventricle after minor chest trauma. We postulate that the preexisting VSD predisposed the aneurysm to rupture into the right ventricle, and was a significant contributor to this patient’s pulmonary edema.

References:
SCA59

THE ASSOCIATION BETWEEN MANNITOL DOSE AND POSTOPERATIVE ACUTE RENAL INJURY IN AORTOCORONARY BYPASS SURGICAL PATIENTS

Szabo T; DeSimone N; Moaref K; Phillips-Bute B; Lawson S; Sinsir S; Stafford-Smith M
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Introduction: Acute renal dysfunction is a major complication of cardiac surgery that is associated with significant morbidity and mortality. Two small randomized studies have not confirmed the value of CPB mannitol prime (0.5 and 1.0g/kg) in preventing post coronary artery bypass (CABG) surgery acute renal injury. However the value of other mannitol doses have not been investigated. Although the use of this agent for renoprotection is widespread, no formal CPB mannitol dosing guidelines exist and dosing varies widely among practitioners. Therefore, we tested the hypothesis that increasing CPB mannitol dose is associated with reductions in postoperative acute renal dysfunction.

Methods: With IRB approval, demographic, mannitol and renal data were gathered between May 95 and Mar 01 for 878 primary non-urgent CABG surgery patients. Peak postoperative fractional serum creatinine rise (%ΔCr) was the primary outcome variable, defined as the difference between the preoperative and the highest postoperative serum creatinine as a percentage of the preoperative value. Analyses were performed using SAS v8.0. P<0.05 was considered statistically significant.

Results: Demographic variables were similar to those in other studies. Mannitol doses ranged from 0 to 1.8 g/kg. In a multivariable linear analysis, we did not confirm a relationship between CPB mannitol dose and %ΔCr (Figure; p=0.21), but known renal risk factors, including weight (p=0.002), baseline creatinine (p=0.01), and female gender (p=0.03) were significantly associated with renal dysfunction. A similar analysis in the patient subset with baseline renal dysfunction found similar results.

Conclusions: We did not find a relationship between CPB mannitol prime dose and post-CABG renal dysfunction. Our data does not support the use of mannitol in the CPB prime for the protection of the kidneys.

References:
DETECTION OF INTERNAL CAROTID ARTERY FLOW WITH TEE DURING RETROGRADE CEREBRAL PERFUSION

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¹University of Tokyo, Bunkyo, Tokyo, Japan; ²Maimonides Medical Center, Brooklyn, NY, USA

Background: It has been shown that detection of internal carotid artery (ICA) flow is possible with TEE probe using either the upper esophageal or pharyngeal approach. Recently, we succeeded in detecting significant flow in the ICA during retrograde cerebral perfusion (RCP).

Methods: After induction of anesthesia and completion of routine preoperative TEE examination, TEE probe is slowly withdrawn from the upper esophageal aortic arch short axis view while following the color Doppler of common carotid artery flow. In most of the patients, when the tip of TEE probe is positioned at the uppermost esophagus or pharynx, carotid bulb and proximal internal and external carotid arteries are visualized. Differentiation of the two arteries can be achieved using pulsed wave Doppler. The ICA has much lower pulsatility index than the external carotid artery. When RCP is initiated, the pulsed wave Doppler cursor is placed at the proximal ICA and flow is continuously monitored.

Results: We could detect the flow in the ICA during RCP. The flow rate is 1 to 3 cm per second. In our institution, ‘flow augmentation’ is employed during RCP, in which central venous pressure is intermittently raised up to about 40 mmHg by increasing retrograde CPB flow rate. We found that the Doppler measured ICA flow was also increased by 20 to 40% during the periods of ‘flow augmentation’ (Fig 1, 2).

Discussion: Detection of retrograde blood flow in the ICA during RCP using TEE probe has never been reported. It can be performed in the operating room relatively easily. There is a great range of variability among patients in the velocity of ICA flow during RCP even with the same level of central venous pressure. Further study has to be done about the relationship between neurologic outcome and ICA velocity during RCP.
SCA61
IMPROVING PATIENT SAFETY: IMPLEMENTATION OF A LOCALLY-DEVISED NOMOGRAM VS. EMPIRIC VANCOMYCIN DOSING IN THE POST CARDIAC SURGERY PATIENT
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1Medical University of Ohio, Toledo, OH; 2St. Luke’s Hospital, Maumee, OH, USA

The Disease-Specific Care National Patient Safety Goals of JCAHO include the goal of “improving the safety of using medications”. Vancomycin is used in antibiotic prophylaxis in the penicillin-allergic cardiac surgery patient and under conditions of life-threatening gram positive infection in the intensive care unit (ICU) where the possibility of multi-resistant bacterial isolates exists. Problems with vancomycin include the necessity of drawing peak/trough levels, renal dysfunction, ototoxicity, dosing and clearance issues in obese patients and in those receiving inotropes and diuretics. Dosing regimens and nomograms are the two most frequent methods for the initiation of vancomycin therapy. St. Luke’s Hospital, Maumee, Ohio (< 200 beds) had recently initiated a cardiac surgery program and was a low-volume procedure hospital. Empiric vancomycin dosing in the ICU was identified as a patient safety issue because the post coronary artery bypass grafting (CABG) patients in the institution had increased rates of elevated serum creatinine (renal dysfunction not requiring dialysis) and atrial fibrillation when compared to other hospitals in the Society of Thoracic Surgery (STS) database. While dosing nomograms have been available for years we report an intervention by a critical care anesthesiology-pharmacy team that implemented a mandatory, evidence-based program for vancomycin administration in the ICU; a program in which nomogram use supervised by a pharmacist was required for vancomycin use. This nomogram’s novelty was not only that it was developed locally through a review of the hospital database, but also that its success was due to a public relations campaign led by anesthesiology critical care and pharmacy focusing on patient safety. A retrospective study of the hospital’s STS database was undertaken for two groups: 1) patients who had CABG surgery and received empiric vancomycin (N = 55, pre-intervention group) and 2) patients who had undergone CABG and received vancomycin dosing by nomogram (N = 35, post-intervention group). In the pre-intervention group 41/55 (74.5%) of patients received initial empirical dosing of one gram of intravenous vancomycin every 12 hours and in the post-intervention group only 5/35 (14.3%) received this dose because of nomogram implementation (p < .001). Before the intervention 22/41 (53.7%) of those receiving initial empiric vancomycin dosing had a decreased creatinine clearance (< 50 ml/minute) and the post-intervention group had 21/35 (60%) with a decreased creatinine clearance (p = 0.3). However, behavior was changed in regard to the at-risk patients; only 3/21 (14.3%) of these post-intervention patients with a low creatinine clearance received an empiric vancomycin dose (i.e., without nomogram), whereas 15/22 (68.2%) of the pre-intervention group with a decreased creatinine clearance received this dose (p < .001). Nomogram use in at-risk patients resulted in decreased empiric dosing with subsequent reduction in peak/trough orders and vancomycin usage. The nomogram was subsequently applied hospital-wide and its use resulted in over $80,000 in annual hospital savings. Also, nomogram use did not increase the infection rate in post CABG patients above those previously documented.
MYOCARDIAL PERFORMANCE INDEX AND TISSUE DOPPLER SYSTOLIC VELOCITY IN CARDIAC SURGERY PATIENTS

Beathe J; Brown N; Ryjikov N; Girardi L; Lee L; Skubas N
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Introduction: The Tei index, or myocardial performance index (MPI), is relatively easy to obtain and has been proposed as a superior measure of overall cardiac function (1). The left ventricular (LV) MPI is equal to the sum of isovolumetric contraction (ICT) and isovolumetric relaxation times (IRT), divided by the LV ejection time (ET). It is measured as [(a-b)/b], where a is the interval from cessation to onset of trans-mitral inflow (TMF), and b is the ET of the LV outflow velocity. The systolic tissue velocity (Sm) of the base of the LV (recorded at the mitral annulus with tissue Doppler) has been found to correlate with global systolic function in both healthy and diseased individuals (2). We investigated the LV MPI association with hemodynamics and the Sm of the posterior LV wall.

Methods: Echocardiographic and hemodynamic data were analyzed from 31 adult cardiac patients who underwent elective coronary revascularization surgery, at two time points: after induction of anesthesia (PRE), and post bypass, following chest closure (POST). Pulsed wave Doppler was used to measure time interval a in the mid esophageal 4 chamber view, and time interval b in the deep transgastric LV long axis view. The Sm of the posterior LV wall was measured in the mid esophageal long axis view. Regression analysis and paired Student’s t-test were used for statistical analysis, with p < 0.05 significant. Data is shown as mean±SD in the table below.

Discussion: No statistical association was found between the MPI and hemodynamics or Sm. The MPI remained within normal values (3) and did not reflect the apparent clinical improvement of global LV function, as revealed by the increased CO POST. The absence of MPI changes may be explained by its preload-dependency (1) and HR-independency (4). In the population studied, the MPI may conceal abnormalities in both ICT and IRT and will not accurately describe global LV function intraoperatively. The decrease in Sm may provide additional information about systolic performance, even when hemodynamics appear normal.

References


<table>
<thead>
<tr>
<th></th>
<th>PRE</th>
<th>POST</th>
<th>P</th>
</tr>
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<tbody>
<tr>
<td>a (ms)</td>
<td>475.54</td>
<td>433.51</td>
<td>0.001</td>
</tr>
<tr>
<td>b, ET (ms)</td>
<td>323.42</td>
<td>277.35</td>
<td>0.000</td>
</tr>
<tr>
<td>MPI</td>
<td>0.31 0.09</td>
<td>0.35 0.08</td>
<td>0.060</td>
</tr>
<tr>
<td>HR (bpm)</td>
<td>60 10</td>
<td>75 10</td>
<td>0.000</td>
</tr>
<tr>
<td>CO (l/min)</td>
<td>3.8 1.1</td>
<td>5.7 1.8</td>
<td>0.000</td>
</tr>
<tr>
<td>SV (ml)</td>
<td>62 22</td>
<td>68 31</td>
<td>0.339</td>
</tr>
<tr>
<td>Sm (cm/s)</td>
<td>7.1 2.1</td>
<td>5.7 1.7</td>
<td>0.022</td>
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</tbody>
</table>

HR: heart rate, CO: cardiac output, SV: stroke volume.
GLUCOSE MANAGEMENT FOR THE CARDIAC RECOVERY ROOM
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Introduction: The rationale for tight glucose control (TGC) has been established in recent medical literature that demonstrates significant patient and hospital benefits: reduced infections, reduced ARF, shorter ICU stays, reduced mortality, and reduced costs. The primary side effects of TGC are hypoglycemia and an increase in the workload and stress on the critical care staff.

Hypothesis: EndoTool™ Glucose Management System is a computer-software calculator for intravenous (IV) insulin dosing and blood glucose (BG) management for critically ill patients with an elevated BG. EndoTool™ software should promptly control the BG to goals set by the medical director with minimal hypoglycemic episodes and reduce the workload and stress on the staff (RN & MD). EndoTool™ for IV insulin dose calculation has been in use in the cardiovascular recovery unit for three years at Carolinas Medical Center, Charlotte, NC. The data collected over the past year in the cardiovascular recovery room are analyzed and presented.

Results: 807 patients have received 18,715 insulin dose calculations during the past twelve month period. The distribution of all BG readings is shown in Figure 1. The incidence of BG ≤ 40 mg/dl was 0.12%. The average time required to lower the BG to < 150 mg/dL is illustrated in Figure 2. The time required for BG control was dependent on the initial BG.

The recovery room staff is enthusiastic about this software application to patient care. The work and stress associated with TGC is subjectively reduced. Documentation is improved with an electronic medical record and the label for the bedside record. Phone calls to the attending physician are minimal. Results from this protocol will be compared with literature reports of alternative TGC methods.

Conclusions:
- A computer software program (EndoTool™ Glucose Management System) provides outstanding blood glucose control in the cardiac recovery room,
- The hypoglycemia incidence (BG < 40 mg/dL) was low (0.12% of all readings with over half associated with a late BG determination or no insulin the hour before the low reading),
- The recovery staff strongly recommend this method of TGC compared to paper protocols from the past and were instrumental in having the software installed in other critical care units,
- Medical Record documentation is simplified and improved,
- Physician calls are nearly eliminated,
- Quality Assurance monitored by medical director and nursing director is convenient and easy.
SCA64
DIFFERENCES BETWEEN ECHOCARDIOGRAPHIC CLASSIFICATIONS OF AORTIC ATHEROSCLEROSIS SEVERITY AND THEIR IMPACT ON CARDIAC SURGICAL TECHNIQUE

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Background: Criteria used for evaluating thoracic aortic atherosclerosis severity (TAAS) have included a variety of echocardiographically determined measurements including plaque thickness and mobility, or extent of the aortic lumen occupied by atheroma. The purpose of this study was to compare these different criteria obtained by intraoperative echocardiography, and to determine their impact on cardiac surgical technique.

Methods: Data from the intraoperative echocardiographic examinations of 281 patients undergoing coronary artery bypass graft surgery was evaluated to determine TAAS. The aortic root and ascending aorta were evaluated by epiaortic scanning, and transesophageal echocardiography was used to evaluate the aortic arch and descending thoracic aorta. TAAS was graded I-V by intimal or plaque thickness and mobility (I: <1 mm; II: 1 - <3mm; III: ≥3 - <5mm; IV: ≥5 mm; V: mobile components), and by percentage of aortic lumen occupied by atheroma for each segment. The impact of TAAS on the cardiac surgical approach (i.e., change in cannulation or cross-clamp site or technique) was also determined. Statistical analysis included Spearman’s correlation, test of variances, ROC analysis, and logistic regression.

Results: In evaluating TAAS, the two methods were moderately correlated (r= 0.44-0.74). However, the variability in percent atheroma for Grade V lesions was significant in the aortic arch (p= 0.0002). There was significant correlation by grade and percent atheroma between all aortic segments, however the correlation was stronger between aortic root and ascending aorta (r= 0.56-0.78), and between the aortic arch and descending aorta (0.52-0.72). In 11 patients the surgical approach was modified based on the echocardiographic findings. These included an off-pump approach (N=5), a change of the cannulation site (N=5), and aortic cross clamp avoidance (i.e., hypothermic fibrillatory arrest; N=1). Both grade and percent atheroma correlated with modification of surgical approach (ROC area 0.81-0.95). However, percent atheroma in the aortic root was significantly better in predicting this outcome (p=0.002).

Conclusions: Measurements of TAAS by grade and percent atheroma were moderately correlated, however differences were observed between aortic segments and in their impact on cardiac surgical technique. Further investigation is warranted to determine their correlation with other clinical outcomes.

References:
ECHOCARDIOGRAPHIC EQUIVALENTS OF PATHOANATOMY DIRECTING BICUSPID AORTIC VALVE REPAIR
Savage R; Alfirevic A; Pettersson G; Blackstone E; Wallace L; Apostalakis J; Starr N
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Introduction: Bicuspid aortic valve (BAV) disease is the most common congenital valve abnormality. Limitations of aortic valve replacement (AVR), have led to renewed interest in aortic valve repair (AVRp) in patients with BAV and isolated aortic regurgitation (AR). BAV reparability is associated with valve configuration, adequacy of normal tissue, and degree of root distortion (1-3). This study compared patients undergoing successful AVRp with those receiving AVR using intraoperative echocardiography (IOE) equivalents of these anatomic variables.

Methods: A systematic BAV assessment was applied prospectively to 25 consecutive BAV patients with isolated AR. A detailed 2 dimensional (2-D) assessment of the right (RCC), left (LCC), non (NCC, reference (RfCC) and fused (FCC) coronary cusps was compared with direct surgical inspection. This analysis included: 1) cusp morphology (size, thickness, integrity, height, and mobility), 2) commissural structure, and 3) aortic root geometry. Color flow Doppler (CFD) characterization of AR jet origin-direction was assessed. Due to absence of quantifiable measures of cusp tissue normality, cusp tissues were assessed using a cusp Tissue Normality Index (TNI): TNI = End Diastolic Area - End Systolic Area/ End Diastolic Area in ME SAX Imaging Plane. Similarly, the adequacy of coronary cusp height for AVRp was determined by the Diastolic Deficiency Index: DDI = ACC Height - PCC Height/ Annular Diameter in ME LAX Imaging Plane.

Results: 20 patients (80%) underwent successful AVRp and 5 (20%) received an AVR based on direct surgical inspection. All attempted AVRp were successful. Mechanisms of AR included cusp abnormalities (restriction, prolapse, perforation) commissural splaying, and annular dilatation with AVRp procedures were directed to corresponding abnormalities. Insufficient normal cusp tissue as determined by direct surgical inspection was the predominant factor leading to AVR. The TNI and DDI correlated with assessments of normal cusp tissue adequacy for AVRp. In this group of patients undergoing AVRp vs. AVR, the TNI was RCC 52±11% vs. 19±3.3%; LCC, 52±17% vs. 24±12%; NCC 61±18% vs. 26±7.3% and RCC 60.8% vs. 39.5%; FCC 50.2±8% vs. 21±7%. The DDI in AVRp vs. AVR patients was 100±1% vs. 81.5±5.3%.

Conclusions: Systematic analysis of anatomic morphology by IOE may be used to distinguish BAVs considered repairable vs. not repairable by direct inspection. IOE may provide anatomic equivalents of surgical inspection thereby permitting patient referral of to experienced AVRp surgeons. Given the inherent limitations of 2-D imaging, prospective studies utilizing 3-D guided measurements are warranted.

References
FIBEROPTIC BRONCHOSCOPY ASSISTED NASAL INTUBATION FOR INTRAOPERATIVE TEE IN LOW BODY WEIGHT PATIENTS
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Introduction: Accidental extubation is a serious concern complication of when doing transesophageal echocardiographic (TEE) examination during cardiac surgery in low body weight pediatric patients. If it happens in the middle of surgery with sterile drapes on the patient, performing endotracheal intubation is very difficult and disastrous sequelae can occur. After we had experienced such accident, we had instituted a policy of that required exchanging replacing the original oral endotracheal tube (ETT) to with a nasal one when intraoperative TEE examination is requested performed in pediatric patients weighing less than 3.5 kg. We believe that nasally intubated ETTs are much more stable than orally intubated ones because patient’s own nasal tissue holds the tube. One problem with exchanging ETTs under direct laryngoscopy is that it is very cumbersome to manipulate the guiding forceps in tiny oral cavity with the original oral tube obstructing the working space. For this reason, we use fiberoptic bronchoscope (FOB) instead of direct laryngoscope and forceps. In order to demonstrate that this approach can be employed safely, we retrospectively analyzed our performance of FOB-guided endotracheal tube exchange.

Methods: Between September 2004 and September 2005, we performed twenty-four FOB-guided endotracheal tube exchanges in twenty-one patients. A 2.2 mm diameter FOB was passed from the nostril to upper pharynx followed by advance of the ETT using FOB as a guide, just above the larynx. With vocal cords visualized under FOB, the original orally intubated ETT was pulled out. Then the FOB was advanced to the carina before final positioning of ETT into the trachea. During the procedure, once if patient’s pulse oximetry number oxygen saturation drops more than 20% of baseline, tube exchange was abandoned and the patient was re-intubated orally under direct laryngoscopy. Images of FOB during tube exchange were digitally videotaped throughout the procedure for subsequent analysis.

Results: Patients’ ages were between 2 days and 4 months (mean 35 days) and weights were between 2.2 and 3.5 kg (mean 2.8 kg). The period of apnea was between 9 and 57 seconds (mean 30 seconds). In two cases, tube exchange was abandoned due to technical difficulty and patient’s desaturation. But in all the other cases, it was performed safely with minimal change of pulse oximetry number oxygen saturation. There were neither any accidental extubations during the TEE exam in any of the nasally intubated patients nor any episode of perioperative epistaxis.

Conclusion: FOB-guided ETT exchange from oral to nasal position can be performed safely with consequent comfort during prior to intraoperative TEE examination. By using FOB, you can avoid stimulation and possible vagal reflex associated with direct laryngoscopy. Also you can use FOB to confirm the position of ETT tip. For successful FOB-guided ETT exchange, thorough suctioning of larynx and neck extension are the keys.
INOTROPIC EFFECT OF VOLATILE PRECONDITIONING
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Introduction: Anesthesia with volatile agents has been shown in many well-designed animal studies to be of inotropic benefit to the heart exposed to intraoperative ischemia. However, a positive inotropic effect of volatile anesthetics for volatile preconditioning in humans has not yet been demonstrated. A recent review (see reference) concludes that the studies so far have been too small to demonstrate inotropic significance.

Methods: Using meta-analysis, the studies that look at inotropic effects in humans are analyzed for a cumulative significance of effect on cardiac index and the need for inotropic support. Assessment of publication bias was also completed.

Results: A significant positive effect of volatile anesthetics on cardiac index (Fig 1) and less need for inotropic support (Fig 2) is demonstrable by doing a cumulative analysis of the available studies using meta-analysis. Analysis was negative for effect of publication bias.

Conclusions: Using volatile anesthetic agents as part of the anesthetic regime will result in significantly increased cardiac index and significantly decreased need for inotropic support in humans. However, long-term effect on morbidity and mortality is yet to be determined.

Reference
THE ADVANTAGES OF COMBINED EPIDURAL AND GENERAL ANESTHESIA VS. CONVENTIONAL GENERAL ANESTHESIA IN OFF PUMP CORONARY ARTERY BYPASS SURGERY

Objective: Conventional general anesthesia is routinely used for off pump coronary artery bypass surgery (OPCAB). The purpose of this study was to compare the results from combined high epidural thoracic anesthesia (HTEA) with general anesthesia vs. conventional general anesthesia.

Material and Methods: Total of 110 patients were operated on in our center using OPCAB technique between 03/2003 to 03/2004. 56 patients were randomly selected for the combined anesthesia group (1st group), 54 in the conventional general anesthesia group (2nd group). The second group as addition to the general anesthesia received high thoracic epidural anesthesia (HTEA). We compared the need for analgesia, ventilatory support, early mobilization, and hospital stay.

Results: An average of 9.2±0.6 ml Fentanyl was used in the 2nd group vs. 31.6±3.2ml in the 1st group (p<0.05). The patients in the 2nd group were extubated 3.5±0.8h vs 6.8±0.7h in the 1st group (p<0.05). The presence of pain according to the 10 point visual analog scale in the 2nd group was 2.0±0.3 vs. 5.4±1.2 in the 1st group (p<0.05). Patients in the 2nd group were mobilized 18±2h postoperatively, as compared to 24±3h in the 1st group (p<0.05). The hospital stay was 4.8±0.9 days in the 2nd group vs. 6.0±1.0 in the 1st group (p<0.05).

Conclusion: The combined anesthesia in OPCAB surgery allows analgesia with less analgesics and less pain, faster extubation and mobilization, with fast track recovery and shorter in hospital stay.
THE EFFECT OF MILRINONE ON BLOOD FLOW OF THE Y-GRAFT COMPOSED WITH THE RADIAL AND INTERNAL THORACIC ARTERY IN PATIENTS WITH CORONARY ARTERY DISEASE
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Objective: Milrinone has been known to dilate the internal thoracic artery (ITA) and the radial artery (RA) (1,2). The effect of milrinone, however, on respective graft flows is unclear when the left ITA (LITA) and the RA compose a Y-graft. This study evaluated the changes in blood flows in a composite Y-graft using the LITA and the RA in response to milrinone.

Methods: With IRB approval, informed consent was obtained from thirty-two patients undergoing isolated coronary artery bypass graft surgery using arterial composite Y-graft of the LITA in which a free RA graft was attached to the proximal side of the LITA. Graft flow was measured by opening the graft end freely for thirty seconds with clamping the opposite graft end, in turn. And then, respective grafts flows were measured with releasing both clamps simultaneously. Collected blood amount was converted into the form of ‘ml/min’. Graft flow and hemodynamic data were recorded before and 10 min after intravenous milrinone (50 µg/kg) administration. Data measured before and after milrinone administration were compared using the paired t-test. A ‘p’ value of less than 0.05 was considered as statistically significant.

Results: Milrinone did not change mean arterial pressure. Milrinone increased heart rate and cardiac index and decreased systemic vascular resistance index. The RA graft flow with clamping the LITA graft end and total Y-graft flow was significantly increased in response to milrinone. The flows of respective grafts, however, were not increased by milrinone when both clamps were released simultaneously, despite significant decrease in resistances of both grafts. Milrinone did not change the ratio of the RA and LIMA graft flows, which were measured with releasing both clamps.

Conclusion: Milrinone significantly reduced resistance of the RA and the LITA composing a Y-graft and increased the total Y-graft flow. Milrinone might dilate respective arterial grafts in a different degree. Milrinone, however, did not change the ratio of the RA to LIMA graft flows when they were measured simultaneously. Milrinone, therefore, does not seem to divert graft flow to one side significantly in a composite Y-graft.

References

Table: Changes in Hemodynamic Data and Y-graft Flows after Milrinone Administration

<table>
<thead>
<tr>
<th>Light</th>
<th>Pre-milrinone</th>
<th>Post-milrinone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RA-01 (ml/min)</td>
<td>110 ± 29</td>
<td>110 ± 29</td>
</tr>
<tr>
<td>LITA-01 (ml/min)</td>
<td>66 ± 31</td>
<td>73 ± 35</td>
</tr>
<tr>
<td>RA-01/CO (%)</td>
<td>0.14 ± 0.03</td>
<td>0.14 ± 0.03</td>
</tr>
<tr>
<td>LITA-01/CO (%)</td>
<td>0.14 ± 0.03</td>
<td>0.14 ± 0.03</td>
</tr>
<tr>
<td>Flow 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RA-02 (ml/min)</td>
<td>88 ± 48</td>
<td>98 ± 46</td>
</tr>
<tr>
<td>LITA-02 (ml/min)</td>
<td>52 ± 22</td>
<td>62 ± 24</td>
</tr>
<tr>
<td>Total Y-graft flow (ml/min)</td>
<td>138 ± 55</td>
<td>190 ± 55</td>
</tr>
<tr>
<td>RA-02/LITA-02</td>
<td>1.98 ± 1.42</td>
<td>1.69 ± 0.96</td>
</tr>
<tr>
<td>RA-02/CO (%)</td>
<td>0.17 ± 0.10</td>
<td>0.16 ± 0.11</td>
</tr>
<tr>
<td>LITA-02/CO (%)</td>
<td>0.11 ± 0.07</td>
<td>0.11 ± 0.03</td>
</tr>
<tr>
<td>Total Y-graft flow/CO (%)</td>
<td>0.25 ± 0.14</td>
<td>0.25 ± 0.14</td>
</tr>
</tbody>
</table>

All values are expressed as mean ± standard deviation. Pre-milrinone: before milrinone administration, Post-milrinone: 10 minutes after milrinone administration. Flow 1: flow measured with clamping the opposite graft. RA-01: the radial artery (RA) graft flow with clamping the left internal thoracic artery (LITA) graft. LITA-01: the LITA graft flow with clamping the RA graft. CO: cardiac output. Flow 2: flow measured with releasing both clamps simultaneously. RA-02: the RA graft flow measured simultaneously with LITA flow. LITA-02: the LITA graft flow measured simultaneously with RA flow. Total Y-graft flow = RA-02 + LITA-02. * P < 0.05 versus Pre-milrinone value by paired t-test. ** P < 0.05 versus LITA-02 by paired t-test.
ECHOCARDIOGRAPHIC ASSESSMENT OF AORTICATHEROMA BURDEN AND IMPACT ON ADVERSE OUTCOMES AFTER CARDIAC SURGERY: A SYSTEMATIC REVIEW AND ANALYSIS OF GRADING SYSTEMS


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Introduction: Aortic atheromas are strongly associated with neurological complications after cardiac surgery. Echocardiographic grading systems rely on quantitative or qualitative atheroma characteristics. There is no agreement on the use of a single grading system. Therefore we conducted a systematic review and analysis of data from studies that investigate the association between atheroma grade and adverse neurological outcome after cardiac surgery. The objective was to propose guidelines on echocardiographic grading of atheroma based on available data.

Methods: A Medline® search with keywords “atheroma, aortic, echocardiography, epiaortic, grading and stroke” was performed for all English language and human studies. A combination of Boolean modifiers was used between search terms. Review articles and non-cardiac surgery studies were excluded. ISI Cited Reference Search® was used to identify studies that cited unique systems. Those systems that were not cited by other investigators were not analyzed. Studies that modified surgery were separated from those that did not. Odds ratios for risk of adverse neurological outcome were computed for different atheroma sizes, including those with a mobile component. Incidence of adverse neurological outcome were compared between groups with atheroma size less than 3 mm with groups with size less than 5 mm using logistic regression. This analysis was performed to determine whether atheroma size between 3 and 5 mm conferred added neurological risk. ‘P’ values were based on exact tests.

Results: Nine unique categorical grading systems were identified. Of these, two grading systems were used in 17 studies involving 10,300 cardiac surgery patients from 1992 to 2005. The remaining grading systems were not validated by other investigators and not included for analysis. Two distinct features were identified. Mobile atheroma conferred the highest risk of adverse neurological outcome (odds ratio 27.9). There was no statistically significant difference in adverse neurological deficit between patients with an atheroma less than 3 mm compared to those with atheroma less than 5 mm (odds ratio 1.3; 95% confidence interval 0.51-3.3; p = 0.58). However, since the <5 mm group also includes <3 mm, it is likely that most patients in the < 5mm group were, in fact also < 3mm. Therefore, the analysis was underpowered to detect a significant risk in the 3-5 mm subgroup.

Conclusion: Risk of adverse neurological outcome increases exponentially with atheroma size greater than 5 mm. Mobile atheromas are associated with the highest risk of adverse neurological outcome regardless of size. There is no difference in outcome between atheromas less than 3 mm compared with those less than 5 mm. However, this finding may be attributable to lack of sufficient data on number of patients and outcome incidence in this subgroup (3-5 mm). Intervention decisions should be based on size/mobility and location rather than only atheroma grade.

IMAGE MISSING
Purpose: Although remarkable advances have been made in coronary artery surgery in the past decade, complications due to neurological injury continue to have a devastating impact on the overall outcome.

Aim of this study was to evaluate the impact of various preoperative and intraoperative screening protocols and surgical strategies on the incidence of neurological injury in patients undergoing Coronary Artery Bypass Grafting (CABG) over the last 15 years.

Method: Retrospective analysis was made of 33,009 patients who underwent CABG over a 15 years period from January 1990 through June 2005. We divided the overall time period into three groups of five years each: Group I (1990 – 1994), Group II (1995 – 1999) and Group III (2000 – 2005) to observe the trend of events.

Over a period of time we adopted various preoperative and intraoperative screening protocols, based on which the surgical technique was individualized: total arterial revascularization, CABG with transmyocardial lazer revascularization, hybrid procedure etc.

Results: Incidence of Neurological Injury & Early Mortality

Conclusions: Preoperative and intraoperative screening can detect the patients at a higher risk for neurological injury. Selective use of surgical techniques in this high risk group of patients can significantly reduce adverse neurological sequelae and mortality while achieving complete myocardial revascularization.

Reference
EMERGENCY AVR IN PREGNANCY - THE USE OF NOREPINEPHRINE AFTER CARDIOPULMONARY BYPASS

Cooper L; Barron M; Gallagher C
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Case Report: 28 yo female, who underwent AVR for severe AI of congenital bicuspid AV at age 24, was maintained on warfarin until she became pregnant. Warfarin was stopped and enoxaparin was initiated. Ultrasound showed a normally developing fetus at 23 weeks gestation. She presented to the ER with worsening chest pain and shortness of breath. TTE showed thrombosis with near-complete occlusion of the prosthetic valve with LV distension. Labs were within normal range. Ultrasound showed an active fetus with a FHR of 140-150 and good beat-to-beat variability.

Patient was rushed emergently to the OR for redo AVR using CPB. BP was 60/40. Rapid sequence induction was accomplished with 14mg etomidate and 100mg succinylicholine. BP immediately following induction was 64/45. 20mcg epinephrine were given peripherally. BP improved to 75/50. Within seconds of being placed in Trendelenberg position for central line placement, BP was 40/25. 100mcg epinephrine were given without response. BP fell to 25mmHg and chest compressions were begun. Sternotomy was performed, with intermittent chest compressions continuing, and epinephrine boluses given at 1-minute intervals.

TEE showed AV prosthesis with non-mobile leaflets stuck in the almost-closed position, distended LV, and LVEF of 5%. CPB was instituted after heparinization. Flows were kept high at 6L/m, and mean BP was maintained high at 90-100mmHg. Upon weaning from CPB, TEE showed an LVEF 30% on 0.1 mcg/kg/min epinephrine. However, BP could not be maintained above 70mmHg. Increase of epinephrine rate caused ventricular dysrhythmias. Norepinephrine 0.05 mcg/kg/min was instituted. BP increased to 110/65; the remainder of the case was uneventful.

Subsequent ultrasound showed fetus with FHR in the 120’s. The patient carried fetus to term and delivered a normal, healthy baby boy.

Discussion: Severe hemodynamic compromise is a well-known complication in acute mechanical prosthetic valve thrombosis, sometimes leading to LV distention and failure, often resulting in death. The Trendelenberg position may cause further LV distention, which may result in acute LV failure. Although the fetal survival rate during CPB only approaches 50%, the survival rate for a pre-term infant at 23 weeks gestation is only 1.8%. A C-section would not be tolerated nor indicated with acute mechanical valvular thrombosis in this stage of gestation.

Although vasopressin causes splanchnic arterial vasoconstriction, it is unknown whether it causes uterine artery vasoconstriction. Uterine vessels in sheep are more sensitive to constriction from α-agonists than are systemic vessels. Infusion of phenylephrine, epinephrine, and norepinephrine all decrease uterine blood flow in pregnant sheep and produce parallel decreases in myometrial and placental blood flow. Studies have cited the use of ephedrine for prophylaxis against hypotension in regional anesthesia. Phenylephrine has been associated with improved umbilical cord gases at bolus doses up to 50 mcg. There are no human studies with norepinephrine in pregnancy, and it is indicated only if the risk to maternal survival outweighs the potential harm to the fetus.

Reference:
INTRAOPERATIVE DIAGNOSIS OF A PULMONARY ARTERY THROMBUS USING CONTRAST-ENHANCED TRANSESOPHAGEAL ECHOCARDIOGRAPHY

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Introduction: Pulmonary embolism (PE) is associated with significant morbidity and mortality. Intraoperatively, the clinical management of patients with PE can be enhanced by the use of transesophageal echocardiography (TEE) to visualize emboli, assess pulmonary artery (PA) anatomy, and monitor the function of the right ventricle (RV). However, the sensitivity of intraoperative TEE to detect thromboemboli is reported to be low. In this report, we describe the use of contrast-enhanced (CE)-TEE to improve visualization of PE.

Case report: A 44-yr-old female with decompensated chronic thromboembolic pulmonary hypertension was scheduled for pulmonary thromboendarterectomy. The pre-CPB TEE exam demonstrated signs of PA obstruction and RV dysfunction, but the borders of the thrombus in the right PA (RPA) were only minimally visualized. Perflutren lipid microspheres (Definity™, Bristol-Myers Squibb, N.Billerica, MA), composed of octafluoropropane encapsulated in an outer lipid shell, were then injected as a 0.3 cc intravenous bolus while visualizing the RPA with harmonic ultrasound imaging (second harmonic at 5.8 MHz). CE-TEE clearly visualized a large mobile thrombus (Fig.1) along with a distinct pattern of pulmonary flow obstruction. The post-CPB CE-TEE confirmed thrombus evacuation and absence of PA flow abnormalities.

Discussion: To our knowledge, this is the first report in the literature on the use of CE-TEE for the intraoperative detection of PE. Since the RPA is easily visualized, TEE is well suited to detect most of the cases of massive PE. Moreover, since the RPA is in greater flow continuity with the pulmonary trunk, emboli are consistently found on the right. Secondary PE signs also facilitate diagnosis. These include RV dilatation (end-diastolic diameter >30mm), RV/LV diameter >1, RV hypokinesis, tricuspid regurgitation, paradoxical motion of interventricular septum, and leftward bowing of interatrial septum. Nevertheless, the sensitivity of intraoperative TEE to detect PE was reported to be below 50% and attributed to the difficulty in achieving optimal conditions for echo-interrogation in hemodynamically unstable patients. In such situations, the use of CE-TEE may lead to a long lasting, homogeneous distribution of microbubbles that not only enhances border demarcation but also reduces imaging artifacts. CEU may also facilitate the diagnosis of interatrial and interventricular shunts producing paradoxical embolism. Also, secondary signs of PE, such as swirling flow proximal to an obstruction, may be seen.

Conclusions: In summary, TEE as a rapid, inexpensive, bedside test remains the primary imaging modality for PE diagnosis in the OR. CE-TEE may decrease operator dependency and increase method sensitivity necessary to detect central, surgically accessible PE.
SHOULD TEE BE ROUTINELY USED PRIOR TO CENTRAL LINE INSERTION?
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Introduction: Complications during central venous catheter (CVC) insertion persist. The effect of routine use of TEE to confirm proper guide wire location during CVC insertion has not been previously studied in the adult cardiac surgical patient.

Methods: Following IRB approval and informed consent, this prospective observational study evaluated adult patients undergoing cardiac surgery. A bicaval TEE view was obtained after induction of anesthesia and the patients were then prepped and draped for internal jugular or subclavian access. Seldinger’s technique was used and intraatrial guide wire position was confirmed by TEE before CVC insertion.

Results: 20 patients were studied (13 male, 7 female, mean age 61.1 years). Central venous access was safely performed in all patients without complication. Internal jugular (17) or subclavian (1) cannulation was performed in 18 patients. Femoral vein cannulation was performed in 2 patients. In one of these patients, a large SVC thrombus was detected via TEE, and the femoral vein was chosen as the desired approach. In the other patient, the advanced guide wire was not visible by TEE after difficult right internal jugular cannulation, and left internal jugular and subclavian cannulation attempts similarly failed.

Discussion: Most commonly, CVC insertion occurs before TEE probe insertion or even before induction of anesthesia for cardiac surgical cases. In this study, we placed the TEE probe before CVC insertion in order to evaluate the utility of TEE guidance. A previous clinical study involving TEE guidance of CVC insertion in pediatric congenital heart surgery patients revealed added safety. In the adult surgical population, only case reports of TEE guided CVC insertion can be found. This prospective clinical investigation establishes that insertion of the TEE probe before central line insertion reliably offers excellent bicaval views to confirm proper guide wire insertion. We also observed that TEE allows one to easily distinguish between indwelling rhythm management device wires and ‘J’ tipped guide wires. Our study also reveals that TEE may help prevent complications resulting from improper guide wire position or dislodgement of unanticipated SVC thrombus. The patient found to have a mobile SVC thrombus visible on TEE had recently recovered from a subclavian dialysis catheter related blood stream infection the week prior. Without TEE, our customary internal jugular venous access attempts may have resulted in stroke from paradoxical embolism, pulmonary thromboembolism, bacteremia, or multiple unsuccessful attempts of wire passage. We feel that TEE offers the best confirmation of proper guide wire insertion for internal jugular and subclavian cannulation. Furthermore, visualization of the intraatrial guide wire may represent a new confirmatory gold standard, having substantial advantages over pressure transducing, estimating SaO2 by color, or percutaneous ultrasound guidance (which is not useful for the subclavian approach). These findings suggest that when both TEE and CVC insertion are to occur in the immediate perioperative period, the benefit of TEE use should be maximized by routine TEE guidance of CVC insertion.

Reference
SCA75

ANESTHETIC CONSIDERATIONS IN PATIENTS WITH THE 3RD GENERATION VENTRASSIST LV AS DEVICE PRESENTING FOR NON-CARDIAC SURGERY.

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Introduction: The VentrAssist™ left ventricular assist system (LVAS) is a third generation device currently under investigation in clinical trials as both bridge to transplantation (BTT) and destination therapy (DT)(1). It is a fully implantable centrifugal pump that generates continuous, non-pulsatile flow. The device has been placed in 17 patients in our institution since June, 2003; 9 of these have subsequently required anesthesia for non-cardiac surgery. The unique nature of the VentrAssist make it important to describe the anesthetic considerations in these patients presenting for non-cardiac surgery.

Case Series: We reviewed the records of the first 15 patients at The Alfred Hospital (Melbourne, Australia) in whom the VentrAssist device was implanted. There were 22 episodes of anesthesia for non-cardiac surgery, 15 of which were in patients from the general ward. Of the ward patients, 8 received general anesthesia while in 7 cases sedation only was required. Five were managed with invasive arterial pressure monitoring while in 10 cases there was no monitoring of blood pressure.

Discussion: The VentrAssist has features making subsequent anesthesia for non-cardiac surgery uniquely challenging. The continuous flow of the device means conventional non-invasive blood pressure measurement is impossible and pulse oximetry is unreliable.

For patients undergoing minor procedures we have generally not inserted arterial lines. In these cases, circulatory monitoring is based on the flows derived by the VentrAssist device along with an understanding of changes in the pulsatility index (PI) and overpumping index (OI), each of which is displayed on the laptop screen.

Patients undergoing procedures with the potential for blood loss or fluid shifts all require invasive monitoring of arterial pressure. The function of the device is dependent on left ventricular preload. If the preload reaches a critical low-point, the suction created by the pump may produce complete collapse of the left ventricle, causing a sudden rise in PI and dramatic drop in pump flows.

The pump flow that is displayed is a derived number that varies with the viscosity of blood. Therefore, the calculation must be adjusted for changing hematocrit.

The flow generated by the VentrAssist is sensitive to changes in afterload. We generally maintain the mean arterial pressure between 70 – 95 mmHg.

Unless ongoing blood loss or fluid shifts are an issue post-operatively, patients are returned to the same level of care they were at pre-operatively. This includes extubation in the standard fashion and removal (if sited) of an arterial line in the PACU.

Conclusions: The anesthetic considerations in a patient supported by the VentrAssist device are unique and include the monitoring of blood pressure and oxygenation in the absence of a pulsatile systemic circulation. Our experience suggests that patients undergoing minor surgery can be managed without the risks and difficulty of invasive pressure monitoring in a pulseless patient.

References:
Background: Both apoptosis and necrosis occur in the cardiac tissue following an acute ischemia. Apoptosis appears to be associated with a mild inflammatory response when compared to necrosis. Previous findings indicate that sevoflurane (SEV) attenuates local inflammatory response and improves myocardial function following an ischemia. We have examined the role of SEV on apoptosis in the heart tissue.

Methods: This animal study protocol was reviewed and approved by the ICAUC. The Long Evan rats were anesthetized with i.p. injection of Ketamine. The experimental group was treated with SEV 2% for 15 min before induction of ischemia. Anesthesia was maintained with i.p. Ketamine in both experimental and control groups. Ischemia was induced by ligating the left coronary artery (distal to the first diagonal branch) over 30 minutes. The animals were allowed to recover following surgery and sacrificed at 24th hour after ischemia. The hearts were harvested and the ischemic regions were separated from the non-ischemic area. Both the annexin V (AN5) binding and terminal deoxynucleotidyl transferase (TdT) labeling of DNA fragments were used for detection of apoptosis. For flow cytometry, the myocytes from either ischemic or non-ischemic tissue were isolated using collagenase digestion technique and were labeled with AN5-FITC. The isolated myocytes from normal rat hearts served as negative controls. For DNA fragment labeling assays, the tissues were immediately fixed in 3.7% formaldehyde overnight and processed for paraffin embedding. Tissue slices (5µm) were prepared and labeled with TdT in situ, following the manufacture’s protocol. Normal heart tissue pretreated with endonuclease served as a positive control. The slides were evaluated under light microscopy in a semi-quantitative fashion.

Results: Myocytes from the ischemic region in both SEV and control groups were positive for apoptosis using in situ TdT labeling. DNA fragmentation was higher in the hearts treated with sevoflurane when compared to those from controls. Myocytes from the non-ischemic region were negative for DNA fragmentation. Flow cytometric assays confirmed the presence of AN5+ myocytes in both ischemic 13.6±1.3% and non-ischemic zones although the rate of apoptosis was higher in the non-ischemic regions31.5±0.8%. Similarly, apoptosis was more evident in the animals treated with SEV (26.7±1.3%) when compared to controls(13.6±1.3%).

Conclusion: Although there is disconnect between DNA fragmentation and cell surface expression of phosphatidyl serine in the process of apoptosis in the non-ischemic regions of the heart, our data suggest that APC with SEV increases apoptosis in the hearts following myocardial ischemia. We conclude that necrosis is predominant in the ischemic regions while apoptosis playing an important role in cardiac remodeling in the border zone and non ischemic regions of the heart.
**SCA77**

**COMPARISON OF SVO2 AND ETCO2 AS RELIABLE FUNCTIONAL HAEMODYNEMIC PARAMETER FOR ADEQUACY OF CARDIAC OUTPUT IN OPCAB SURGERY**

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**Introduction:** Mixed venous saturation (SvO2) is considered as a reliable parameter to show adequacy of cardiac output, but still it has many influences which can alter the value. EtCO2 is another functional parameter which is routinely used and gives many information for anesthesiologist in intubated patient. Both parameters are easily monitored. In this study we have tried to check the reliability of its use in frequent changes of hemodynamic while handling the heart mechanically in OPCAB surgery.

**Method:** After IRB approval, we studied 50 patients subjected for OPCAB Surgery with fair LV and lung function, HCT>33%, stable hemodynamic. Patients who required conversion to conventional CPB technique were excluded. For SVO2 we used combo catheter which measures continuous SvO2 (CSvO2) and Cardiac Output – CCO (Edwards Lifescience, Inc.). For EtCO2 we used main stream EtCO2 sensor (Datex-Ohmeda Inc). Both sensors had been calibrated after endotracheal intubation. Sodalime in rebreathing circuit in anesthesia machine checked before every case. Anesthetic agents, FiO2, Respiratory rate, and fluid infusion were administered as per routine protocol in all cases and was same in all patients. low flow technique was not used. We calibrated SvO2 optical sensor again just before grafting coronary arteries. We compared CSvO2 and online EtCO2 with CCO.

**Result:** After endotracheal intubation, SvO2 was ranging 62 – 77%; EtCO2 30 – 41 mm of Hg against CCO 3.6 – 4.7 lit/min. These remained stable till grafting started. When the position of the heart was not altering the CO significantly (more than 20% of average CO for that patient), till that time, CSvO2 and EtCO2 did not show any significant difference. But when grafting Posterior-lateral and inferior arteries like OM, Ramus, PD, PLB, where CCO went down more than 20% of its CO, EtCO2 dropped down to more than 25-30% as compare to its standard value. At that time CSvO2 was fluctuating a lot (39-82%) irrespective of CO in 27 cases. Continuous Downhill of EtCO2 irrespective of fluid and ionotropic support was not tolerated by patients with even CO was showing more than 2.7lit/min. in many occasion which required reposition of heart. Sameway after reposition, when the recovery of the EtCO2 was very fast, to back to 80% to its standard value, usually hemodynamic settled very fast.

**Conclusion:** Though EtCO2 needs endotracheal Intubation, the reliability of its online value with mainstream sensor is better for checking adequacy of CO. As, position of heart may alter the value of SvO2 due to migration of tip of optical sensor in PA or artifacts at the tip. CCO though it is continuous it has its limitation and time factor. Where EtCO2 directly reflects amount of blood pushed in to the lung for gaseous exchange by RV. SO low EtCO2 is indication of low cardiac output, same way it is useful tool to diagnose the effectiveness of resuscitation measures. It is quick and carries less complications as compare to other parameter to monitor functional status of CO. Positioning of heart during OPCAB surgery is a major drawback, by help of EtCO2, we can have better idea.
Withdrawn
SCA79

DOES RESPIRATION WITH A HIGH FRACTION OF INSPIRATORY OXYGEN INCREASE THE PULMONARY BLOOD FLOW IN CASES WITH LEFT-TO-RIGHT SHUNT?

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Introduction: When managing patients with left-to-right (LR) shunt, the fraction of the inspiratory oxygen (FIO2) is kept as low as possible above the fraction of the room air in order to minimize the risk of increases in the shunt flow. It remains unclear, however, how a high FIO2 can be used to manage respiration in LR shunt patients without significant increases of shunt flow. In this study we analyzed the pulmonary vein (PV) flow profiles obtained by transesophageal echocardiography (TEE) in order to examine whether a high FIO2 increases the pulmonary blood flow.

Methods: Fourteen LR shunt patients undergoing corrective surgeries were enrolled in this study. A pediatric biplane probe was used for patients weighing less than 15 kg and an adult multiplane probe was used for larger patients. The patients were ventilated with 50% FIO2 to maintain normocapnia and normal pH for at least 0 minutes following the induction of anesthesia. The PV flow profile of each pulmonary vein was obtained to measure the peak S velocity (pS), peak D velocity (pD), mean velocity (mV) and velocity-time-integral (VTI-PV). Shunt flow profiles were also obtained to measure the peak velocity (pV) and VTI-S. The patients were ventilated with room air for 10 minutes without changing any other ventilation parameters prior to the beginning of the operation. Upon the completion of this 10-minute period, all parameters of each flow profile were measured a second time to compare with the values with 50% FIO2. The rate of change of each parameter was calculated by a formula similar to the following: Change in pS =00[(pS50%−pSRA)/pSRA]. The data were analyzed using the paired T test and Spearman’s rank correlation. P<0.05 was considered statistically significant.

Results: The subjects ranged from 4 months to 12 years in age and from 4.1 kg to 48.4 kg in weight. Diagnoses included ventricular septal defect (VSD) in 0 patients, atrial septal defect (ASD) in 3, and patent ductus arteriosus (PDA) in 1. No significant changes were observed in any of the PV parameters or shunt flow profiles, though clear decreases in some of the parameters were observed in a few cases. There were no significant correlations between the changes in any of the parameters and the ratio of the pulmonary blood flow to the systemic flow (Qp/Qs) in the preoperative cardiac catheterization. It was impossible to identify the patients who responded to the change of the FIO2. No significant changes were observed in the hemodynamic parameters, i.e., blood pressure, heart rate, and central venous pressure, during the course of the study.

Conclusion: In conclusion, increases of the fraction of the inspiratory oxygen by up to 50% induced no significant changes in the amount of left-to-right shunt in our study. This indicates that an FIO2 of less than 50% can be used without any significant hemodynamic changes in the respiratory management of patients with LR shunt. However, there are some patients who respond to changes of the FIO2. Further studies will be required to identify these responders.
SCA80

BYPASSING THE ICU AFTER OPCAB: A PROSPECTIVE AUDIT
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Purpose: We evaluated feasibility and safety of immediate operating room extubation (ultra-fast-track-anesthesia-UFT) after off-pump coronary artery bypass grafting (OPCAB) followed by a short-term stay in the regular postoperative anesthesia care unit (PACU) and direct transfer to cardiac ward, without stay in the intensive care unit (ICU).

Methods: Sixty-three patients undergoing OPCAB were included in this prospective audit. Anesthesia was induced by fentanyl 2-3 µg/kg, propofol 1-2 mg/kg, and maintained using sevoflurane titrated to a bispectral index of 40-50. Analgesia regimens consisted of either high thoracic epidural analgesia (TEA) installed preoperatively and removed after 72 h, or low-dose fentanyl during surgery followed by PCA with morphine (1 mg; lockout: 6 min). After UFT, the patients were transferred to the PACU for at least 4 h, after which they were transferred to the cardiac ward. Criteria for discharge from PACU: alert patient, respiratory frequency <25/min., PO2>80 mmHg and PCO2<45 mmHg, T >36°C, hemodynamic stability, no active bleeding, no signs of ischemia, no need of temporary pacing (TP) and low pain scores (<4/10).

Results: Mean age was 62.7 ± 9.6 (range: 45 - 83), M/F-ratio 52/11, and preoperative mean NYHA class 3.5 ± 0.7.

Preoperatively 8 patients presented with acute myocardial infarction (MI), 11 with previous MI, 17 were actively smoking, 9 with peripheral vascular disease, 4 chronic renal failure (no dialysis), 4 COPD, and 28 obese. Left ventricular ejection fraction was 59 ± 13% (23 - 79%). The average number of grafts was 3 ± 1 (1 to 6), operative time was 104 ± 28 min, and ischemic time was 18 ± 7 min. All patients were successfully extubated in the operating room within 15 min., core temperature was 35.4°C, analgesia consisted of TEA in 56, PCA in 7 patients. From the PACU, mean time 403 ± 115 min., only 4 patients were sent to ICU; 2 for TP, and 2 for sleep apnea or elevated troponine. One patient returned to the ICU at day#1 for low output syndrome. Postoperative complications included: atrial fibrillation in 10 (16%), MI in 1, bradycardia in 3, gastrointestinal in 3, low output in 1, and acute renal failure in 1 patient. Only 3 patients received blood transfusion (1 unit), no complication occurred related to TEA placement, such as hematoma or neurological sequels. Pain scores were significantly lower during the first 24 h when TEA was used in comparison to PCA morphine. Length of hospital stay was 5 ± 1 days.

Conclusion: This study indicates that UFT with discharge to cardiac ward is possible and safe. However, for such a routine protocol to be successful, it requires a short period in the PACU to assess stability and eligibility for patients with strict criteria, along with good surgical/anaesthetic techniques. UFT protocols may reduce costs and improve resource utilization.
SCA81

EFFECT OF ROUTINE INTRAOPERATIVE TEE ON SURGICAL MANAGEMENT IN PATIENTS UNDERGOING CARDIAC SURGERY
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Introduction: While not routine, TEE is widely used because it is perceived to provide information that substantially influences clinical management and likely improves patient outcome. However, there is limited scientific evidence to substantiate such perception. This prospective observational study investigates the effect of routine intraoperative TEE on surgical management in patients undergoing cardiac surgery.

Methods: Following IRB approval and informed consent, all patients scheduled for and undergoing cardiac surgery (CABG, valve, thoracic aortic, etc.) at our institution received intraoperative TEE following induction of general anesthesia. After a complete TEE exam, appropriate surgical management was determined jointly by the cardiac surgeon and cardiac anesthesiologist. Data collected included original scheduled surgery, new intraoperative TEE findings (not detected preoperatively), whether or not new TEE findings affected surgical management, and performed surgery.

Results: 181 consecutive patients scheduled for cardiac surgery were prospectively studied (122 male, 59 female, mean age 62.8 years). 55 patients (30.4%) were found to have new (not detected preoperatively) cardiac pathology via intraoperative TEE examination. After a complete TEE exam, appropriate surgical management was determined jointly by the cardiac surgeon and cardiac anesthesiologist. Data collected included original scheduled surgery, new intraoperative TEE findings (not detected preoperatively), whether or not new TEE findings affected surgical management, and performed surgery.

Discussion: At the present time, TEE is used in only approximately 60% of patients undergoing cardiac surgery(1). Previous studies investigating use of routine TEE have been small in number, poorly designed, and have not involved patients undergoing off-pump CABG(2). This clinical investigation reveals that routine use of intraoperative TEE substantially affects (one in four cases) surgical management and likely improves patient outcome. Most surgical alterations involved the mitral valve (24/55 patients) and 5 surgical alterations involved decisions regarding use/non-use of cardiopulmonary bypass. An unexpected finding was the relatively large number of patients who demonstrated undiagnosed (preoperatively) tricuspid valve disease (14/55). These findings support the view that all patients undergoing cardiac surgery (on-pump or off-pump) should receive the benefits of a complete intraoperative TEE examination.

References:

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IMPLANTATION OF THE VENTRASSIST LV AS - ANESTHETIC MANAGEMENT
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The Ventrassist left ventricular assist system [LVAS] is a novel centrifugal pump with a hydro-dynamically suspended rotor designed with the potential for application in bridge to cardiac transplantation [BTT] or as permanent cardiac replacement - “destination therapy” [DT]. The REMATCH trial highlighted the deficiencies of first generation implantable pumps; 2nd or 3rd generation “small format” LVAS rotary blood pumps like Ventrassist may represent the best direction for the future[1]. The “pilot” trial of nine device implants was performed at our institution; further implants are part of an ongoing international multi-centre clinical trial of the pump - we report on the anesthetic management of our first 15 patients.

All were NYHA IV, receiving maximal medical therapy; 8 were in ICU on inotropes, with 3 on IABP support. Mean ages for DT vs BTT groups were 55/72, EF 16.3 vs 18.3% and mean PAPs 35 vs 39mmHg.

Anaesthetic drug management was standardized. TEE examination was performed to assess ventricular function, aortic valve competence and to exclude clot in the LV apex and absence of a PFO.

The surgical procedure is described elsewhere [2]; all were performed on cardiopulmonary bypass. After TEE aided de-airing weaning from CPB occurred with infusions of epinephrine, norepinephrine and lungs ventilated with Nitric Oxide [NO] at initially 10–20ppm added to gas-mix. Device flow commenced at 1800 rpm, bypass pump flows reduced and the pump flows gradually increased to achieve mean [SD] flows of 4.9+/0.9l/min. Post bypass TEE was used to monitor RV function, confirm position and flow in device cannulae, and monitor LV cavity size.

The Ventrassist, like all LVASs, is sensitive to preload, afterload and exhibits dependence on RV function to maintain outputs once implanted. These were managed with filling, vasoactive drug adjustment and NO to manipulate RV performance.

Unique features in the management of this device are: 1. potential occurrence of LV collapse or “suck-down” when the LV is under-filled [fig 1]; TEE monitoring and the device “PI” or pulsatility index are useful to predict / prevent / manage this; 2 outputs from the device are not measured but calculated using an algorithm that is haematocrit dependent; 3 availability of a “low-speed” [1500rpm] “CPR” mode that provides enough forward device flow to overcome the shunt potential enabling effective ECM / CPR.

Overall, cumulative support time is 6 years, with 2 DT alive and at home [22 and 15months support], 5 BTT alive and 2 successfully transplanted.

References
2.  Esmore DS, Kaye D, Salamonsen RF, Buckland MR et al, “First clinical implant of the Ventrassist left ventricular assist system as destination therapy for end-stage heart failure” J Heart Lung Transplant. 2005, 24[8];1150-1154

![Intracardiac TEE mid-epicaleral 4 chamber view showing (A) RV and LV with normal device function and (B) collapse of LV during episode of “suckdown” – note almost complete obliteration of LV cavity.](image)
OFF PUMP CORONARY ARTERY BYPASS ON AWAKE PATIENTS USING A NOVEL TECHNIQUE

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Objective: To examine the feasibility of off pump coronary artery bypass (OPCAB) on awake patients. This study, the first in Canada and probably in North America, presents our initial experience, and we report a novel technique consisting of combined femoral block/high thoracic epidural anesthesia (TEA).

Methods and Results
Nine male patients undergoing OPCAB were included in this study. Mean age was 61 ± 10 years (range: 49-80), weight 74 ± 12 kg (2 were obese), NYHA class was 3.5 ±0.7, 2 patients were active smokers and 5 quit for at least 3 months, and 2 were diabetic. Left ventricular ejection fraction (LVEF) was 59 ± 12% (30-70). Patients received high T2/T3 TEA installed preoperatively and removed after 72hrs. To harvest saphenous vein, local analgesia was achieved using a femoral 3:1 block. No problem occurred during midline sternotomy, thoracic chest tubes were installed before left internal thoracic artery (LITA) harvesting. Operative time was 103 ± 22 min, and cardiac ischemic time during distal anastomosis was 18 ± 7 min (9-26), the number of grafts performed was 2.8 ± for complete revascularization in all patients. There was no respiratory problem, surgeries underwent without complication (Fig. 1). Two patients needed endotracheal intubation: in one patient, TEA did not achieve proper pain control. In another patient, with LVEF of 30%, low blood pressure and hemodynamic instability during the first anastomosis required cardiopulmonary bypass and was rapidly intubated. Those 2 patients were extubated immediately in the operating room. All patients were transferred to postoperative anesthesia care unit (PACU) for 7 hours, and transferred to cardiac ward, without stay in the intensive care unit (ICU). Postoperative complications included: atrial fibrillation in 1 patient, and another one presented low blood pressure requiring ICU transfer for monitoring 24 hours after surgery. Length of stay was 4.8 ± 1 days.

Conclusion: Awake OPCAB is feasible using a combined femoral block/high TEA-technique which allows routine cardiac surgery including harvesting of the LITA and saphenous vein. In case of complication, patient can be rapidly and safely intubated. Further cases are scheduled to be done in our hospital to define the technical limitations and prove the safety of this technique before randomized studies should better delineate the role awake cardiac surgery will play in the future of less invasive cardiac surgery.

Fig. 1: Representative hemodynamic variables and peripheral oxygen saturation, sternotomy starts at time 0.
DOES SODIUM BICARBONATE REDUCE POST-OPERATIVE RENAL FAILURE AFTER CARDIOPULMONARY BYPASS?

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Introduction: Acute renal failure (ARF) after cardiopulmonary bypass (CPB) is reported to be as high as 22.1%(1), with up to a 60% mortality rate(2). There is no established therapy to reduce the incidence of post-CPB ARF. Recently, Sodium Bicarbonate (SB) administration was reported to reduce ARF after contrast dye administration(3). The hypothesis of this study is that SB administration in high risk surgical candidates requiring CPB would reduce the incidence of renal dysfunction, dialysis, and death.

Methods: 273 consecutive study group (SG) patients presenting for surgery with CPB from 11/1/2004-7/15/2005 were studied. These patients were compared to historical controls (HC) requiring surgery and CPB from 1/1/1999-12/31/2002. In the SG and the HC group, high risk candidates met the following criteria: 1) Evidence of pre-existing renal disease (one of the following): a. chronic renal insufficiency, b. Elevated pre-operative Creatinine (Cr), or c. Cr clearance < 40 mL/min, or 2) Any combination of at least 2 of the following: a. Age > 70, b. Complex surgical procedures (two or more valves, combined CABG/Valve, DHCA, Redo, or emergency), c. History of peripheral vascular surgery, d. Ejection Fraction < 35%, or, e. Diabetes Mellitus. In the SG, high risk patients received 0.4 meq/kg SB load and 0.15 meq/kg/hr infusion continuing until six hours after surgery. In addition, these patients received 12.5 grams mannitol, fluid loading (CVP>10mmHg, PAD > 10 mmHg), and maintenance of mean arterial pressure on CPB > 70mmHg. In the low risk SG patients and all of the HC group patients, intraoperative care was not controlled, and no SB was administered. The primary outcomes were: 1) new-onset renal insufficiency based on either a post-operative Cr of 2.0 mg/dL in a patient with a previously normal Cr (< 1.5 mg/dL), or an increase of 50% over an abnormal pre-operative Cr (> 1.5 mg/ dL), 2) requirement for new hemodialysis, and 3) death.

Results: There was a significant difference in both the SG and the HC groups between the low and high risk patients for post-CPB renal failure, dialysis and death, p<0.05 (Figure 1). There was no difference between the high risk HC and the high risk SG receiving SB for these same outcomes, p>0.05, (Figure 1).

Discussion: These data do not support SB use as an adjunct therapy to reduce the incidence of post-CPB renal failure, dialysis, or death in high risk cardiac surgical candidates. These data are limited by the lack of a randomized, prospective study design and by the broad inclusion criteria. As with contrast dye nephropathy, SB may have beneficial effects in a subgroup of patients presenting for surgery with CPB. Randomized, controlled trials are required to address this question.

References
2) Thakar CV et al Am J Kidney Dis 2003;41:742-51
SCA85
PULSE PRESSURE IS A BETTER PREDICTOR OF STROKE VOLUME THAN PULMONARY ARTERY DERIVED PARAMETERS
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Introduction: One of the most vital and common questions in critical care medicine is: Can we increase cardiac output by giving fluid? To answer it clinicians rely heavily in parameters such as central venous pressure (CVP) and pulmonary artery (PA) pressures: PA Diastolic and PA Occlusion Pressure (PAOP). These pressures are supposed to approximate Left Ventricular End Diastolic Pressure (LVEDP), an indicator of cardiac preload. Despite over 30 years of experience, the PA catheter is still challenged based on studies suggesting it is more harmful than useful.

Methods: After IRB approval, 10 dogs weighting 12-14Kg were anesthetized with Pentobarbital 30 mg/kg and placed on a continuous infusion at 10-30 mg/hr. A femoral arterial line was placed, as well as a pulmonary artery catheter and EKG electrodes. A left thoracotomy was done and a Transonic aortic flow probe was placed. The left anterior descending artery (LAD) was exposed and a transonic flow probe was placed around it to measure LAD flow. A vascular occluder was placed around the LAD proximal to the flow probe and inflated to decrease LAD flow to 10-30% of baseline. After a 15 minute stabilization period the animals were randomized to receive Perfluorocarbon (n=5) (Pher O2, Sanguine Corp, Pasadena, CA) or Hetastarch (n=5) 10 ml/Kg over 15 minutes. The animals were then subjected to different maneuvers to increase myocardial oxygen demand: hypovolemia by draining 10 cc/kg blood and others maneuvers. Post Hoc analysis of the hemodynamic data during the hypovolemia maneuver was done.

Statistical Analysis: Pearson Correlation Coefficient was used to analyze 15386 heart beats.

Results: During the 15’ hypovolemia maneuver the animals Mean Arterial Pressure was 84 ± 2 mmHg, range[46,50], and their dPdT was 1443 ± 600 mmHg/sec, range[509,3605], HR 146 ± 23, range[87,197], Stroke Volume (SV) correlation with Pulse Pressure (PP) was r²=0.44, with LVEDP r²=0.04 and with CVP r²=0.02.

Conclusion: PP is a dynamic parameter that is a much better predictor of SV under a wide range of situations than both CVP and surprisingly LVEDP. The poor correlation between LVEDP and SV may be due to the induced ischemia, and underlines the difference between a pressure-based preload and fluid responsiveness.

Reference
1. JAMA 1996;276:889
AWAKE OFF PUMP CORONARY ARTERY BYPASS SURGERY: INITIAL EXPERIENCE
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Objective: To describe our initial experience in awake off pump coronary artery bypass surgery (ACAB).

Material and Methods: Ten patients were selected for ACAB, based on their preoperative status and assessment for increased risk for complications or contraindication for general anesthesia and endotracheal intubation. High thoracic epidural catheters were inserted in all patients prior to surgery and high thoracic epidural anesthesia (HTEA) was administered during surgery, and in the immediate postoperative period.

Results: Mean preoperative NYHA classification was 2.7±0.5. All patients underwent ACAB with 10-point visual analog scale pain index of mean 2.1±0.8. Median sternotomy was used in all patients with average surgery duration of 71±22 minutes. All patients received left internal mammary artery (LIMA) to left anterior descending artery (LAD), one patient received additional left radial artery to left marginal branch of the left circumflex artery. Left pleural spaces were accidentally entered in two patients during LIMA dissection, which required placement of pleural drainage. There were no additional respiratory complications or hemodynamic instability during surgery and in the postoperative period. There was no mortality. Using only HTEA, all patients were mobilized in the first 4 hours after surgery, with 10-point visual analog scale pain index of 1.3±0.5. Average in hospital stay was 4.2±1.1. Mean patient follow up was 24±6 months.

Conclusion: Awake off pump coronary artery bypass surgery can be safely done using HTEA, in selected group of patients in which there is a increased risk of complications from general anesthesia. ACAB with HTEA has shown to be safe for patients during surgery and postoperative period, with minimal pain and no complications, with early mobilization and short hospital stay.

References:
THE PREVALENCE OF PLATELET FACTOR FOUR HEPARIN COMPLEX ANTIBODIES IN A HETEROGENEOUS CARDIAC SURGERY POPULATION

BACKGROUND: Heparin induced thrombocytopenia (HIT) has a significant impact on the post-operative outcome of cardiac surgery patients. The incidence of HIT may be related to the formation of platelet factor 4 heparin complex (PF4-H) antibodies, and can be a prognostic indicator. Increased levels of PF4-H antibodies have correlated in some preliminary studies with myocardial infarction, length of hospital stay and even death. We hypothesized that PF4-H antibodies was not a rare event and that subsequent post-operative platelet count decrease was a surrogate for and a consequence of PF4-H antibodies.

METHODS: From 11/1/04 through 4/30/05, 198 patients underwent 199 procedures requiring cardiopulmonary bypass at our institution. It was the intent that every patient have ELISA testing for HIT during some point of their hospitalization, preferably in the pre-operative period. Timing of HIT testing was evaluated, as well as platelet counts pre- and post-operatively (day 5). The delta platelet count was calculated and compared between ELISA positive and negative groups using student’s T-test.

RESULTS: 42 patients did not receive any HIT testing. Of the 157 other cases, 135 received pre-operative testing and 22 were tested only post-operatively. 36 patients were tested twice, of these, 8 had a third test. In total, 19 patients tested positive and 9 patients were “indeterminate”. In 5 cases the presumed diagnosis of HIT was seen early enough to change the intra-operative management to include a direct thrombin inhibitor (bivalirudin) rather than heparin. Each subgroup had a decrease in platelet count post-operatively, with the smallest decrease in patients treated without heparin (i.e. bivalirudin).

CONCLUSIONS: Of 157 procedures, 19 (12%) were found at some point to be PF4-H antibody positive. Pre-operative recognition of ELISA, with subsequent alteration in treatment, preserved platelet numbers and allowed better platelet preservation.
BLOODLESS THORACIC AORTIC SURGERY REQUIRING DEEP HYPOTHERMIC CIRCULATORY ARREST: CASE SERIES FROM A HIGH-VOLUME UNIVERSITY CENTER

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Introduction: Thoracic aortic surgery requiring cardiopulmonary bypass (CPB) and deep hypothermic circulatory arrest (DHCA) is associated with significant mortality (10-20%) and morbidity, including major blood loss and major blood component transfusion (BCT). Protocol-based CPB/DHCA can optimize perioperative outcome. DHCA/CPB for aortic arch repair without BCT has been described in exceptional circumstances. The purpose of this study was to define the characteristics of a CPB/DHCA subgroup who had no perioperative BCT.

Methods: With IRB approval, 349 adults (1999-2002) undergoing thoracic aortic surgery requiring CPB/DHCA with retrograde cerebral perfusion were studied. All medical records were archived in an Access database and statistically interrogated with Stata 8 software. All patients received an antifibrinolytic and were cooled during CPB with a standard protocol. Anticoagulation with heparin was titrated for an activated clotting time (ACT) greater than 400 seconds (celite ACT for aminocaproic acid; kaolin ACT for aprotinin). All BCT data were checked with the blood bank records. Renal dysfunction was defined as a 25% or greater decrease in creatinine clearance.

Results: 9.5% (33/349) of the DHCA cohort received no BCT. No study patient participated in preoperative autologous blood donation. The mean age was 50.6 years (p < 0.05). The gender breakdown was 76.5% male and 23.5% female. Antifibrinolytic exposure was as follows: none 14.7%; aminocaproic acid 38.2%, and aprotinin 47.1%. The case profile was as follows: 94.1% ascending aorta and hemiarch; 5.9% hemiarch and descending aorta; previous cardiac surgery 5.9% (p < 0.05); emergencies 5.9% (p < 0.05). Mean CPB and DHCA times were 175 and 26.9 minutes respectively (p < 0.05). Mean mediastinal drainage in the first 24 hours was 444.4 ml (p < 0.05). Mortality was 0% (p < 0.05). Mean ICU and hospital stays were 1.5 (p < 0.05) and 6.4 days (p < 0.05) respectively. The incidences of atrial fibrillation and renal dysfunction were 23.5% (p < 0.05) and 11.8% (p < 0.05) respectively.

Discussion: DHCA for aortic arch repair without BCT is possible in 10% of cases. The typical patient is younger and very likely to receive an antifibrinolytic. The surgical procedure will likely be an elective aortic arch repair via a first time sternotomy with a shorter CPB/DHCA time. The postoperative course is uncomplicated with a fast-track profile.

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IMPACT OF AGE AND GROWTH HORMONE ON ANESTHETIC-INDUCED ALTERATIONS IN CARDIAC PERFORMANCE

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Introduction: Elderly surgical patients often come to the operating room with structural and functional changes of aging that influence their physiologic response to various anesthetic techniques and agents (1). Two universal and interrelated correlates of mammalian aging that may be involved are a reduction in growth hormone (GH) secretion or its circulating mediator, insulin-like growth factor-1 (IGF-1) and diastolic dysfunction (2). Whether age-related changes in GH/IGF-1 have a role in anesthetic-induced alterations in cardiac function are not known. Accordingly, using a rodent model of aging, we compared LV performance during general anesthesia with ketamine to halothane. We hypothesize that the old rat will be more sensitive to the depressant effects of the potent halogenated anesthetic, halothane, than the young and that long-term GH replacement will attenuate halothane-induced abnormalities in systolic and diastolic function.

Methods: After ACUC approval, anesthetic-induced alterations in cardiac function were compared among Brown Norway x Fisher 344 old (22 months of age, n=7), GH replete old (Old GH) (200 mcg s.c., twice daily from 18 to 22 months, n=5), and adult (6 months, n=5) male rats. Each animal underwent two echocardiograms fourteen days apart, using 1.5% halothane and ketamine/xylazine (60:5 mg/kg intramuscularly), respectively. LV function was quantified using a new combined systolic/diastolic variable of global LV performance (myocardial performance index [MPI]), fractional shortening [FS] and Doppler indices of diastolic function. Data are expressed as mean ±SEM. P<0.05 was considered significant (repeated measures ANOVA).

Results: In comparison to ketamine/xylazine, global myocardial performance was reduced (indicated by an increased MPI) with halothane in all treatment groups (Fig. 1) (P<0.05). This response to halothane was associated with reductions in FS by 34 ±8%, 34 ±6%, and 18 ±6%, increases in heart rate by 29 ±3%, 20 ±8%, and 35 ±3% and increases in early deceleration slope by 57 ±7%, 40 ±18%, and 63 ±3% in adult, old, and old GH rats, respectively. E/e’, an index of filling pressure, was elevated only in the halothane-anesthetized adult.

Conclusions: Halothane produced LV dilation, systolic depression and a restrictive diastolic filling pattern in all animals regardless of age and GH. In contrast, global myocardial performance was relatively preserved in the ketamine/xylazine-anesthetized adult and old GH replete rats while it was reduced in the untreated old rats, likely due to age-related diastolic dysfunction. These data suggest a differential anesthetic-induced effect on global myocardial performance that may be related to advanced age and GH status.

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Figure 1
Withdrawn
THE USE OF CT GENERATED 3D MODELS FUSED WITH TEE IN THE COMPLEX CARDIAC PROCEDURE: HELPING CLINICIANS EXPERIENCE ANATOMIC ANOMALY IN A VIRTUAL REALITY ENVIRONMENT.
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At the University of Maryland, we have developed a novel method to review anomalous cardiac anatomy prior to, during, and after transesophageal echocardiography (TEE) imaging. Using Computerized Volumetric Analysis Systems (CVAS) we are able to compare and fuse intraoperative TEE images with Computer Tomography (CT) generated surface models of the myocardium and associated vessels. We are then able to assist the TEE operator in determining their relative position, relative to a model of the patient’s actual heart. Due to an inherent capacity for disorientation when using the TEE system, we show how a simple overlay might be used to help with or train for specific spatial orientation issues that exist when using TEE.
HEMOSTASIS FOR ROBOT ASSISTED LAPAROSCOPIC PROSTATECTOMY: OUR EXPERIENCE WITH MICROPOROUS POLYSACCHARIDE HEMOSPHERES
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Introduction and Objective: Microporous polysaccharide hemospheres (MPH) are a novel hemostatic agent made from purified plant starch. MPH absorbs plasma, increasing the concentration of clotting factors and platelets and acting as a matrix for clot formation. These properties produce clot propagation useful for hemostasis in the surgical setting. We present our experience with this hemostatic agent in the setting of robot assisted laparoscopic prostatectomy (RLP).

Methods: We retrospectively reviewed a consecutive series of 49 patients who underwent RLP by a single surgeon (MTG). Excluded from analysis were 3 patients due to use of an alternative hemostatic agent and 1 patient who underwent open conversion due to adhesions associated with a previous appendectomy. Persistent bleeding after standard RLP neurovascular bundle dissection was noted in 22 patients and MPH was administered. The remaining 23 patients appeared to have adequate hemostasis and did not receive MPH. Preop hemoglobin (Hb), postop Hb, and decrease in Hb were compared using the two-sample t-test. Transfusion, continence, and erectile function (EF) rates were evaluated for both groups. Continence was defined as no pad use, and EF was defined as erections of sufficient rigidity to allow penetration.

Results: Patients receiving MPH had subjective improvement in hemostasis after application to the site of surgical bleeding. Preop, postop, and decline in Hb were similar in both groups. No transfusions were administered in either group. Continence data was available for 18 patients in each group and 14 of 18 were continent in each group during this brief follow-up period. Analysis of EF was restricted to patients undergoing bilateral neurovascular bundle preservation and 10 of 15 patients in each group had EF sufficient for penetration.

Conclusions: MPH is a novel hemostatic agent that subjectively improves hemostasis on the neurovascular bundles during RLP. Short term functional results are similar between the MPH and no MPH groups, suggesting that MPH does not have a significant adverse effect on the neurovascular bundles. Additional clinical studies are warranted to establish the efficacy and safety of this promising hemostatic agent.
SCA93
ANESTHETIC DRUG ADMINISTRATION ERRORS REPORTED TO A UNIVERSITY HOSPITAL CQI SYSTEM
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Introduction: The prevention of medical errors is widely believed to be a critical strategy for improving the quality and reducing the cost of health care. Errors related to administration of drugs are thought to be particularly important, but there is relatively little information about drug errors that occur in anesthetic practice. In a previous prospective study focused on drug error, based upon anonymous self-reporting, we reported a rate of drug administration error of 0.68% in our university hospital(). We are now reporting the drug errors found by our continuous quality improvement (CQI) system.

Methods: Our CQI system has been previously described (2,3). Incidents self-reported to the system are investigated and presented at a weekly CQI meeting. Cases are classified according to a formal scheme that includes an assessment of whether there was an error in anesthetic management. On a monthly basis a group of at least 3 anesthesiologists revisits the cases classified as errors, and renders a final judgment regarding whether there was an error.

Results: During June 2004 through May 2005 there were 158 incidents classified as errors, from a total anesthetic volume of 18,976 cases. Of these 158 incidents of error, there were 25 incidents involving errors related to drug administration in 24 patients. Drug administration errors were distributed in the following categories (definitions in [ ]; numbers of cases in parentheses): incorrect dose (12), substitution [incorrect drug instead of intended drug] (5), insertion [drug never intended] (5), incorrect route (1), incorrect label (1), other (1). Drug administration errors resulted in physiologically significant unintended drug effects in 13 cases. Errors in the operation of programmable infusion pumps were involved in 3 cases.

Conclusions: Drug administration errors constituted 16% of the total cases of error in anesthetic management found by our CQI system during the period June 2004 through May 2005. About half of the drug errors resulted in significant unintended effects. Based on our previous prospective study of self-reported drug administration errors(), approximately 29 drug errors would have been expected (0.68% of 18,976=129), while only 25 were actually found by our CQI system. A previous study of our CQI system found that the rate of self-reported incidents underestimated the rate of incidents identified by chart audit(4). Self-reporting is an essential aspect of most CQI systems, but will likely result in underestimation of actual event rates.

References:
SCA94
IMPACT OF CARDIAC INDEX ON CEREBRAL REGIONAL OXYGEN SATURATION
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Introduction: Compensatory mechanisms have been believed to adequately regulate cerebral blood flow in humans. It has been suggested that patients with left ventricular dysfunction and low cardiac output syndrome [LCOS] suffer from cerebral hypoperfusion. The brain is especially sensitive to circulatory changes that reduce oxygen delivery and moderate to severe cognitive impairment in patients with chronic heart failure is common. This study was designed to determine the effects of change in cardiac index [CI] on Near-infrared Spectroscopy [NIRS] assessment of cerebral oxygenation while other determinants of cerebral blood flow [mean arterial pressure, CO2, hematocrit, FIO2, temperature] were constant

Methods: After informed consent was obtained, 25 patients [mean age: 69 years, male: female 17:8] undergoing general anesthesia for CABG were monitored using continuous cardiac output [CCO/SVO2] and Near-infrared Spectroscopy [NIRS]. The

INVOS 4100. After baseline hemodynamics and NIRS were obtained, patients were treated with dopamine 5ug/kg/min. Repeat values were obtained after 15 minutes. Data are presented as mean +/- S.D. Statistical analysis was performed with repeated measures ANOVA and student’s t-test with p<0.05 considered significant.

Results: Dopamine 5ug/kg/min. significantly increased cardiac index from 1.8 +/- 0.21 to 2.8 +/- 0.45 l/min. LrSO2% 53.0 +/- 7.7 to 70.2 +/- 7.7, and RrSO2% 52.67 +/- 7.5 to 69.4 +/- 9.5 [p<0.0001]. No significant changes from baseline were observed for etCO2, mean arterial pressure, hematocrit, or temperature.

Conclusions: This data suggests that patients with low cardiac index despite generally normal mean arterial pressure, hematocrit, etCO2, temperature and FIO2 1.0 have low rSO2% [cerebral oxygen delivery] and this value can be significantly improved with improving cardiac index. The data also suggests that cerebral autoregulation may well be impaired in this subset of patients and flow becomes more of a critical factor. Maintaining cardiac index and rSO2% may be an important element in reducing the incidence of postoperative neurocognitive dysfunction.
SCA95
INCIDENCE OF MASSIVE BLEEDING IN A BLINDED RANDOMIZED CONTROLLED TRIAL OF ANTIFIBRINOLYTIC DRUGS IN HIGH RISK CARDIAC SURGERY

Mazer D1, Fergusson D2, Hebert P2, Rodger M2, Pretorius R2, Teoh K1, MacAdams C4, Robblee J3, Bussieres J6, Karski J7, Karkouti K2, Arellano R8, Duke P9, Blajchman M10, Murkin J11, Karkouti K7, Arellano R8, Duke P9, Blajchman M10, Murkin J11, Fremes S2

St. Michael’s Hospital, University of Toronto, Toronto, ON, Canada1; Ottawa Health Research Institute, University of Ottawa, Ottawa, ON, Canada2; Hamilton Health Sciences Centre, McMaster University, Hamilton, ON, Canada3; Foothills Medical Center, Calgary, AB, Canada4; University of Ottawa Heart Institute, Ottawa, ON, Canada5, Institut Universitaire de cardiologie et de pneumonie, Quebec, PQ, Canada6, Toronto Hospital-General Division, University of Toronto, Toronto, ON, Canada7, QE II Health Sciences Centre, Halifax, NS, Canada8, University of Manitoba, Winnipeg, MB, Canada9, McMaster University, Hamilton, ON, Canada10, London Health Sciences Centre, London, ON, Canada11, Schulich Heart Centre, University of Toronto, Toronto, ON, Canada12

Introduction: Massive blood loss (MBL) is associated with prolonged hospitalization and significant morbidity and mortality. Antifibrinolytic drug therapy has gained wide acceptance as a means for reducing MBL and patient exposure to blood products. The BART (Blood conservation using Antifibrinolytics: Randomized Trial in high-risk cardiac surgery) study is a Canadian multi-center RCT designed to determine whether aprotinin is superior to epsilon-aminocaproic acid and tranexamic acid in decreasing massive postoperative bleeding in high-risk cardiac surgery (ie redo CABG, redo aortic or mitral valve replacement, initial mitral valve replacement, combined cardiac or ascending aortic artery procedures).

Methods: With informed consent, study patients are randomized to receive either: aprotinin (2 million kallikrein inhibitory unit (KIU) bolus + 2 million KIU in the pump prime + 0.5 million KIU/hr infusion until sternal closure), tranexamic acid (30mg/kg loading dose + 2mg/kg in pump prime + 16mg/kg/hr infusion) or epsilon-aminocaproic acid (10g loading dose + 2g/hr infusion). The prespecified primary outcome of Massive Bleeding was defined as any of:

1. Bleeding from chest tubes exceeding 1.5L over a 8 hour period
2. Massive transfusion (replacement of blood exceeding 10 RBC units over 24 hours)
3. Death due to hemorrhage (evidence of bleeding for at least 2 hours prior to death or confirmed as a cause on autopsy)
4. Reoperation for massive post-op bleeding (bleeding in excess of 200 mL/hr for more than 2 hours and/or tamponade).

Secondary outcomes include transfusions, and fatal/life threatening or serious post-operative complications.

Results: Of the 1210 patients included in the blinded interim analysis, 64% underwent combined procedures and 13% had Redo CABG. The incidence of massive bleeding as defined by any of the 4 outcomes above was 11.2%

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<td>Massive Transfusion</td>
<td>30 (2.5)</td>
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<td>Death due to Hemorrhage</td>
<td>9 (0.7)</td>
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<td>Reoperation for Massive Post-Op Bleeding</td>
<td>87 (7.2)</td>
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<td>Total Massive Bleeding Events</td>
<td>219 (18.1)</td>
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<td>Any Massive Bleeding Event</td>
<td>135 (11.2)</td>
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Fatal/life threatening adverse events (excluding troponin MIs) occurred in 12.2%, and serious events in 36.0% of patients. The overall mortality was 5.0%. After review of the first interim analysis, the external DSMB recommended continuation of the trial without change in protocol.

Conclusions: This is the largest randomized trial of antifibrinolytic drugs in high risk cardiac surgery, with predefined massive bleeding as the primary outcome. The target enrollment of 2970 patients is powered to detect at least a 3% absolute difference between groups in the primary outcome. Massive bleeding occurs in approximately 11% of these procedures, and is associated with a high incidence of adverse events. The rate of massive bleeding represents a two-fold increase (11.2% versus 5%) from original estimates suggesting either previous estimates were not appropriate and/or a higher-risk population has been enrolled.

Funded by the Canadian Institutes for Health Research and the Ontario Ministry of Health
SCA96
Withdrawn
PATIENT SAFETY IN CARDIAC ANESTHESIOLOGY - DO AUTOMATED ANESTHESIA MEDICATION DISPENSING SYSTEMS DELAY ACCESS TO EMERGENCY MEDICATIONS?

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Background: In the late 1980’s, automated medication dispensing systems were introduced into the US healthcare market. These systems meet all regulatory agency compliance requirements (JCAHO, DEA, and FDA) by limiting availability and controlling access of specific medications. In 2000, the Pyxis® Anesthesia System was designed to control access, limit availability, increase billing capture, improve inventory control, and allow for automatic reordering of frequently used, emergency, and high-cost medications administered in the operating room. Many hospital and pharmacy administrators have made the decision to automate anesthesia medication delivery in the operating suites, sometimes without consulting the anesthesia providers or soliciting their opinions. Concern regarding controlled access and limited availability to anesthesia providers in emergency situations and complex cases requiring immediate delivery of medication to the patient has necessitated review of the systems currently in use at a large tertiary care, university affiliated, urban hospital.

Objective: To determine if automated anesthesia medication dispensing systems hinder access to cardiac or emergency medications or delay patient therapy.

Methods: An email questionnaire was sent to 46 anesthesia providers consisting of 6 trauma anesthesiologists, 8 cardiothoracic anesthesiologists, 8 solid organ transplant anesthesiologists, 2 cardiovascular anesthesiologist fellows, and 22 anesthesiology residents who have rotated on the CVT, Trauma, or Liver Transplant service in the past 6 months. Survey participants were asked multiple questions related to their level of training and experience, their comfort level using an automated system to obtain medications, the number of times per week they use the automated system, and their impression of whether any cardiac or emergency medication has been unavailable or had limited access in an emergency situation. Participants were also asked if they felt patient care had been hindered in any way.

Results: Results suggest that in cardiac, trauma, and transplant cases, users are relatively satisfied that patient care is not delayed with the use of an automated anesthesia medication dispensing system. Emergency medication is available when needed. Mechanical drawer failure rate appears to be low, and practitioners feel comfortable with where and how to obtain emergency medications in the event of mechanical or electrical failure.

Conclusion: Our results suggest that the implementation of automated anesthesia medication dispensing systems that meet all JCAHO, DEA, and FDA regulatory requirements for controlled access and limited availability does not hinder patient access in emergency situations, and patient therapy is not delayed. A prospective time-motion study should be performed to measure absolute time requirements needed to access emergency medications from the automated system compared to accessing medications from standard drug trays.

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