Cell-phones are increasingly used as primary means of communication. Hospital policies vary from total bans of cell-phones to more selective guidelines restricting them to non-direct patient care areas. We present the current evidence on electromagnetic interference (EMI) with medical equipment in the operating room.

The Technology: Cellular phones and their base stations transmit and receive signals using electromagnetic waves or radiation. In North America, analogue TACS (Total Access Communication System) is being replaced by digital GSM (Global System for Mobile Communications). This operates in the 900 or 1800 MHz band. Digital telephones have stronger peak electromagnetic fields than older analogue models.

Electromagnetic radiation is produced even when the phone is in the stand-by mode, but power increases when an incoming call or other communication from the base station is received. Fluctuating signals are produced as rapid two-way communication continues, whether the call is answered or not. Any length of wire in a circuit or integrated chip can act as an antenna when exposed to electromagnetic waves, leading to abnormal currents and potential interference.

Interaction with equipment: Pacemakers: interference with pacemakers is a phenomenon of digital phones only, causing inhibition of pacing, reversion to asynchronous or other pacing mode, or changes in the rate delivered. The cellular phone should be kept at least 15 cm away from the pacemaker and used at the contralateral ear to the pacemaker implantation site. EMI may cause external or temporary pacing devices to sense false pulses in the demand mode leading to no paced output, or switch modes(1).

Ventilators: digital phones affect mechanical ventilators within a one-meter radius(2). Monitor and alarm system malfunction is common, including changing set limits and parameter display errors. However ventilator settings are also frequently altered, with significant changes in delivered minute volume and inspiratory peak pressure. Some ventilators are completely shut off and reset(3).

Monitoring: particularly at risk as very low-level signals are measured and device to patient wiring may act as an antenna. Laboratory testing has found that EMI affects 40-60% of monitors within a 1.5meter radius of the phone. Baseline noise and movement may occur, interfering with ECG monitoring and function of different devices, including intra-aortic balloon pumps, defibrillators, bedside and portable monitors(3,4). Units using telemetry have found that cell-phone use in the immediate area disrupts monitoring and alarm functions.

Infusion pumps: particularly prone to EMI; rate of delivery and alarm settings can be altered, with or without display changes. In laboratory testing, pumps are stopped requiring manual reset before normal function can be restored.

Discussion: Published evidence shows EMI is a real phenomenon within a 2-meter radius; changing to digital technology has increased the incidence of EMI. Devices affected are vital to patient care, and considerable harm may be caused if immediate action is not taken. The cardiac operating room and intensive care contains many such devices and hospital policies banning cellular phone use in these areas are justified. Phones may not be left in the stand-by or silent mode either.

Cellular phone detection devices are commercially available and designed to sense radiofrequency energy in the 400 to 2000 MHz range. These may have a place to help enforce bans in sensitive areas of the hospital. Third generation cellular technology that operates at higher frequencies will soon be introduced, and safety profiles have yet to be determined.

Anesthesiologists may play a key role in enforcing phone bans and should have a high index of suspicion for EMI when electronic devices malfunction.

References
(1) Electromagnetic compatibility of medical devices with mobile communications. Medical Devices Agency DB 9702; March 1997