Invisible Pacemakers? Intraoperative Care of Patients with Implanted Micro-sized Electronic Implants

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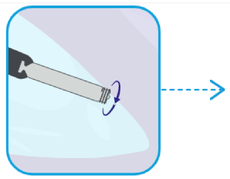
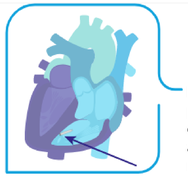
PURPOSE

- Micro-sized implantable electronic devices (MIEDs) represent a challenge for perioperative nurses due to the speed with which this technology changes and new items enter the market.[1,2]
- The role of the perioperative nurse is to assess each preoperative patient for the presence of implants and then plan for their surgery in a way that will protect both the patient and their implanted devices.[3]
- As technology rapidly develops, perioperative nurses must keep up to date with new information and learn to form partnerships with additional departments and providers as resources.



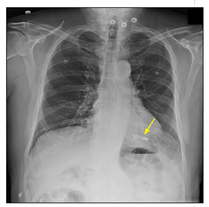
FIXATE the AVEIR VR Leadless Pacemaker to the ventricular endocardium using the screw-in mechanism



RELEASE AVEIR VR Leadless Pacemaker and withdraw delivery catheter

Fig. 1 Leadless pacemakers use corkscrew-like ends to attach directly to cardiac muscles and are implanted inside the heart. (From Abbott's AVEIR™ instructions for use)

BACKGROUND



- In our 10 room Orthopedic specialty hospital, a hip fracture patient presented with a very recent pacemaker. We did not see a typical pacemaker bump or an incision.
- Chart review revealed the implant was a "leadless pacemaker".
- We had never seen that before!
- We needed information to plan his care.
- We connected with nurses in our Cardiology Department and the implant industry representative for the necessary details.

- **How would our equipment (electrocautery) impact this new type of device?**

TYPES OF MICRO-SIZED IMPLANTS

LEADLESS PACEMAKERS

- Used in brady arrythmias when appropriate
- Located in the Right Ventricle
- Typically inserted through arterial access surgery (e.g. groin incision)
- Implanted directly into heart muscle on the inside of the heart
- Approximately the size of a quarter

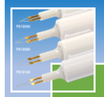
INTERNAL HEMODYNAMIC MONITORING DEVICES

- Often placed in a pulmonary artery
- Can be accessed for Hemodynamic information on a random or scheduled basis using electronic devices
- Device data and patient assessment allows identification of alterations in cardiac function before severe physical symptoms manifest
- Early detection facilitates timely treatment that minimizes symptoms and hospitalizations

INTERNAL RECORDING DEVICES

- Recording devices placed just under the skin to measure and record the cardiac rhythm
- No wires required
- Used when a dysrhythmia is suspected but was not identified using a short-term monitoring device
- Usually placed below xyphoid process
- Sometimes called a Loop Recorder
- Can last for years

TYPES OF SURGICAL ENERGY DEVICES



HEAT CAUTERY DEVICES

- Uses heat to cauterize, or burn tissue or blood vessels
- Includes battery style, disposable cautery pencils
- Local effect only - energy does not travel from these devices to other areas of the patient's body
- Device should not be applied within a few centemeters of any MIED
- Low risk to MIEDs unless used directly adjacent to or on device

ELECTROCAUTERY DEVICES

- Uses flow of electricity into tissues to heat surgical area
- Can be Monopolar or Bipolar
- Monopolar requires use of a return electrode or capacitive coupling return device to return electricity back to generator
- Surgical effects include cutting or coagulation and come in many varieties
- Monopolar energy poses **highest risk** of electromagnetic interference with susceptable MIEDs
- Neither should be used directly on or near MIED implants

ULTRASONIC DEVICES

- Electrical energy from the generator is converted to mechanical motion in the hand piece (e.g. Harmonic Scalpel™)
- Can have dual energy options (both bipolar & ultrasound - e.g. Thunderbeat™)
- Handpiece configurations vary for many types of surgery
- With Bipolar/dual functionality the energy used stays between the jaws of the handpiece and does not move through patient's body
- Lower risk to MIEDs, as long as not used directly adjacent to or on device

OPERATING ROOM CARE OF PATIENTS

Assess
- Full history
- Implant types & locations
- Surgery to be done

Find/ Activate Resources
- Interdepartmental Colleagues
- Industry Reps
- Implant company hotlines

Plan
- Involve all disciplines
- Discuss surgical options (bipolar vs mono)
- Where to place return pad

Monitor
- Use extra monitoring as appropriate
- Defibrillator pads can be placed as precaution

Recommendations for use of energy generating surgical equipment when a MIED is present[3]:

- Place return electrode away from implant
- Avoid direct path of electricity through implanted area
- Avoid direct contact with the MIED
- Consider parallel plate capacitor style return pads (example MegadyneTM)
- Use bipolar or heat cautery

CONCLUSION

- Stay curious and ask questions!
- We met new colleagues for consultation and leveraged the talent, skills and knowledge available to us to help our patient.
- Reach out to different departments and learn what resources are available in your hospital and area and ask lots of questions!
- We started this to learn more about leadless pacemakers and discovered a whole range of implanted devices.

REFERENCES

1. Acha, M.R., Soifer, E., & Hasin, T. (2020). Cardiac implantable electronic miniaturized and micro devices. *Micromachines*, 11 (902), 1-21. DOI: 10.3390/mi11100902
2. Beurskins, N., Breeman, K., Dasselaar, K., et al. (2019) Leadless cardiac pacing systems: current status and future prospects. Expert Review of Medical Devices, 16 (11), 923-930. DOI: 10.1080/17434440.2019.1685870
3. Association of periOperative Registered Nurses. (2023) AORN Guidelines for Perioperative Practice 2023 Edition. Denver, CO