INTERNAL ELECTRONIC DEVICES - IEDs

Type - Cardiac		**Indication**
Permanent Pacemaker	PPM	Bradyarrythmias; AV node ablation
(Automatic) Internal Cardiac Defibrillator	AICD	Ventricular arrhythmia history or prophylaxis
Cardiac Resynchronization Therapy	CRT-P	Biventricular pacing to improve EF in HF
CRT with defibrillator	CRT-ID	Same as above, plus antiarrhythmic function

Type – Neural		**Indication**
Deep Brain (*Activa*)	DBS	Parkinson's and other movement disorders; psychological disorders
Spinal Cord	SCS	Chronic pain
Dorsal Root Ganglion	DRG	Chronic pain
Intrathecal Pumps		Chronic pain; spasticity
Vagal Nerve (*Aspire*)	VNS	Refractory seizures
Hypoglossal Nerve (*Inspire*)		OSA
Phrenic Nerve	PhNS	Impaired respiratory drive (e.g. high cervical injury)
Sacral Nerve (*Interstim*)	SNS	Incontinence
Gastric Nerve (*Enterra*)		Gastroparesis
Retinal Nerve (*Argus*)		Retinitis pigmentosa

PRE-OPERATIVE PREPARATION

- Obtain device type and manufacturer
- Obtain year of placement and date of last check
- Obtain contact info for the product rep and physician overseeing management
- Cardiology consult required for AICD with no check-up in last 6 months, or PPM with no check-up in last 12 months
- Consult neurologist if DBS or VNS. RNS and PhNS patients should be done at a tertiary center

MANAGEMENT ISSUES

Electromagnetic interference (EMI) – suppression of pacing; activation of anti-arrhythmia or anti-seizure functions

- Unipolar electrocautery
- Ligasure – form of cautery that can be unipolar or bipolar
- Radiofrequency ablation (RFA)

Diathermy - thermal tissue damage at site of neural leads (whether device is on or off)

- Radiofrequency ablation (RFA)
- Microwave Ablation (MWA)
- Short wave ablation (SWA)
- Therapeutic ultrasound - Harmonic Scalpel, Cavitron, CUSA, Autosonix, Sonosurg, phacoemulsification
- Diathermy (with the exception of phacoemulsification) is contraindicated in all Medtronics neural stimulators
- MWA and SWA are contraindicated in all Medtronics cardiac devices

Generator alteration – potential reprogramming or damage from energy exposure (these are indications for postop interrogation)

- Unipolar cautery if generator is in the path of the current (which should be avoided by correct dispersion pad placement)
- Diathermy sources listed above
- ECT
- External defibrillation or pacing
- Spinal monitoring stimulation
- ESWL (should not be used 10-15 cm from generator)
- Magnet placement

MANAGEMENT PRECAUTIONS

General

- Never have generator between surgical site and dispersion pad
- Use bipolar cautery whenever possible – bipolar is compatible with all devices

Pacemaker

- Magnet is only indicated if patient can not tolerate EMI suppression
- Turn off before cardiac surgery
- Avoid exposure to microwaves and short wave radiation
- ILRs (internal loop recorders) require no special management

AICD

- Magnet indicated for surgery with EMI at or above umbilicus
- Magnet indicated for EGD and ERCP with EMI
- Turn off before cardiac surgery
- Consider placing defib pads if AICD turned off
- Avoid exposure to microwaves and short wave radiation
- Subcutaneous AICD is more susceptible to EMI than a standard transvenous AICD; use magnet in all cases

Spinal Cord Stimulator and Interstim

- Avoid all diathermies except phaco
- Avoid epidurals
- Avoid spinals if leads are below T12
- Do not turn off

Deep Brain Stimulator and Inspire

- Surgery with EMI at or above umbilicus is contraindicated
- EGD and ERCP with EMI is contraindicated
- ECT contraindicated
- Do not turn off
- Avoid all diathermies including phaco

Vagal Nerve Stimulator

- Surgery with EMI at or above umbilicus is contraindicated
- EGD and ERCP with EMI is contraindicated
- ECT contraindicated
- Turn device off to avoid anti-seizure function discharge
- Avoid all diathermies including phaco

-	***PPM***	***ICD***	***SCS***	***DBS***	***VNS***	***Interstim***	***Inspire***
Unipolar cautery **Contraindicated**	No	No	No	Yes, for surgery above umbilicus, EGD, ERCP	Yes, for surgery above umbilicus, EGD, ERCP	No	Yes, for surgery above umbilicus, EGD, ERCP
Magnet required for unipolar cautery?	Only if pacer inhibition occurs	Yes, for surgery above umbilicus, EGD, ERCP	na	na	na	na	na
Should device be turned off in PAA	Only for open heart surgery	Only for open heart surgery	No	No, can result in severe dystonia	Yes, EMI can discharge anti-SZ function	No	Yes
Is diathermy (other than phaco) **contraindicated**	Only MWA, SWA	Only MWA, SWA	Yes	Yes	Yes	Yes	Only MWA, SWA
Is device compatible with ECT?	Yes	Yes	Yes	No	No	Yes	No
Is device compatible with phaco?	Yes	Yes	Yes	No	No	Yes	Yes
Notes			No epidurals, but can have spinal if SCS is above L1		Possible vocal cord paralysis and brady	Can have spinal, but not epidural	