Conundrums in Ambulatory Anesthesia II

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No Conflicts of Interest

Objectives

• Differentiate between pacemakers and ICDs
• Describe recent practice guidelines regarding CEIDs and recognize how they impact daily clinical practice
• Review the evidence on glucose control in diabetic surgical
• Describe the periop management of diabetic patients scheduled for ambulatory surgery

Patient With Implantable Cardiac Device (ICD)

Perioperative Concerns From EMI

• Pacemaker may malfunction
• ICD may interpret EMI as an arrhythmia and fire inappropriately
• Dual-chamber device malfunction

AHA/HRS Guidelines

• Use a magnet in most cases
• “Should VF/VT occur intraoperatively, simple removal of the magnet will cause ICD to resume detection and deliver therapy”
• “This approach avoids delays in reactivation of the ICD after surgery imposed by waiting for individuals skilled in use of ICD programmer”


Conflict Of Interests
Research Grants and/or Honoraria

• Pfizer Inc.
• Baxter Pharmaceuticals
• Cadence Pharmaceuticals
• Pacira Pharmaceuticals
• Edward Life Sciences
Practice Advisory for the Perioperative Management of Patients with Cardiac Implantable Electronic Devices: Pacemakers and Implantable Cardioverter-Defibrillators

An Updated Report by the American Society of Anesthesiologists Task Force on Perioperative Management of Patients with Cardiac Implanted Electronic Devices

- “...alterations may be accomplished by programming or applying a magnet when applicable”

- “Task Force cautions against the routine use of the magnet over an ICD”

Anesthesiology 2011; 114: 247-61

Evidence-Based Guidelines

Wait! You know all that stuff I just said was Good for you? Forget it! Now they can kill you! No, wait... Now they're just bad for you in huge doses! Hold it, This just in...

Practice Advisory for the Perioperative Management of Patients with Cardiac Rhythm Management Devices: Pacemakers and Implantable Cardioverter-Defibrillators

A Report by the American Society of Anesthesiologists Task Force on Perioperative Management of Patients with Cardiac Rhythm Management Devices

- “use of the magnet over an ICD”

Anesthesiology 2005; 103:186-98

Timing of CIED Check Preop

- Pacemakers checked within the past 12 mths
- ICDs checked within the past 6 months
- Earlier, if instability occurs in the interim

The Heart Rhythm Society Expert Consensus Statement on the perioperative management of patients with implantable defibrillators, pacemakers and arrhythmia monitors: Facilities and patient management

The document was developed as a joint project with the American Society of Anesthesiologists (ASA), and in collaboration with the American College of Cardiology (ACC), the American Heart Association (AHA), and the Society of Thoracic Surgeons (STS)

Crossley GH et al: Heart Rhythm 2011; 8: 1114-54

Crossley GH et al: Heart Rhythm 2011; 8: 1114-54
**Preoperative Preparation**

- "Neither re-programming nor magnet application is considered mandatory regardless of PM or ICD and regardless of PM dependency"

Crossley GH et al: Heart Rhythm 2011; 8: 1114-54

**Management of Pacemaker Patients**

- Rendering PM asynchronous - even in PM-dependent patients - not always required
- Render asynchronous, by programming or by a magnet, only if significant inhibition is observed
- Caution: pacemakers with special algorithms (e.g., rate responsive devices, MV sensors, search hysteresis/ capture, battery extenders)

Crossley GH et al: Heart Rhythm 2011; 8: 1114-54

**Management of ICD Patients**

- No intervention is necessary for below umbilicus procedures
- Inactivate ICD for all above umbilicus procedures if monopolar cautery used
- Inactivate ICD using a magnet, provided the pulse generator is accessible
- In a PM-dependent patient, rendering a PM asynchronous is preferable for most procedures above the umbilicus

Crossley GH et al: Heart Rhythm 2011; 8: 1114-54

**Preoperative Considerations**

- **Is EMI likely?**
  - **Yes**
    - Is the Procedure below umbilicus?
      - **Yes**
        - Proceed
      - **No**
        - Use a Magnet
  - **No**
    - Procede With Surgery

Modified From Crossley GH et al: Heart Rhythm 2011; 8: 1114-54

**ASA Advisory For Postoperative Care**

- Postoperative interrogation and restoration of ICD function are basic elements of postoperative management
- ICD should be interrogated to assess and restore postoperative device functions...
- Assure that all other settings of the CIED are appropriate

Anesthesiology 2011; 114: 247-61

**Interrogation Prior to Discharge**

- Patients with ICD programmed preop
- Patients undergoing major cardiovascular/thoracic procedures
- Emergent/urgent above umbilicus surgery
- Patients who were hemodynamically unstable, intraoperatively
- Logistical problems preventing reliable device evaluation within one month of the procedure

Crossley GH et al: Heart Rhythm 2011; 8: 1114-54
Postoperative Considerations

Was ICD reprogrammed preoperatively?

- **Yes** → Must interrogate and reprogram
- **No** → No EMI
  - No Magnet
  - Meets criteria → D/C
  - No clinical issues → Vital Signs OK → Consider D/C*
  - Clinical Problems Intraop → Must interrogate

Modified from Crossley GH et al: Heart Rhythm 2011; 8: 1114-54

Summary

- Rapid changes in CIED technology
- No "one size fits all" practice
- "Just use a magnet" is not all you need to know!
- Reduce baseline risk by minimizing EMI through appropriate placement of return pad and use bipolar diathermy
- Best defense is information

Clinical Problems Intraop

- EMI

Diabetic Outpatient

Society for Ambulatory Anesthesia

Consensus Statement on Perioperative Blood Glucose Management in Diabetic Patients Undergoing Ambulatory Surgery

Girish P. Joshi, Frances Chung, Mary Ann Vann, Shireen Ahmad, Tong J. Gan, Daniel T. Goulson, Douglas G. Merrill, Rebecca Twersky

Anesthesia and Analgesia 2010; 111: 1378

SAMBA: Consensus Statement

- Recommendations
- Recommendations were based on
  - General principles of blood glucose control
  - Drug pharmacology
  - Data from inpatient surgical population

Glycemic Control Guidelines
**Principles of Insulin Therapy**

- Basal insulin therapy: controls blood glucose levels between meals
  - (glargine) or long-acting (NPH, lente, ultralente)
- Prandial insulin therapy: controls blood glucose levels after meals
  - Mealtime bolus doses of short-acting or rapid-acting insulin

**Sick Day Rules**

- Never stop taking your insulin or tablet
  - Illness usually increases body’s need for insulin
- Drink at least 100 ml water/sugar-free fluid every hour – approximately 2.5 L/day
- Test BGL every 2 h
- Test urine or blood for ketones, if necessary
- Concern if BGL > 15 mmol/L (270 mg/dL) or urine ketones ++ or blood ketones > 1.5 mmol/L

**Oral Anti-Diabetic Medications**

- Increase insulin sensitivity (increase glucose utilization)
  - **Biguanides**: Metformin (Glucophage)
  - **Thiazolidinediones**: Rosiglitazone (Avandia), Pioglitazone (Actos)
- Decrease GI glucose absorption
  - **α-Glucosidase Inhibitors**: Acarbose (Precose), Miglitol (Glyset)
- Reduce breakdown of GI hormone-incretins (GLP-1), potentiate insulin secretion, decrease glucagon
  - **Dipeptidyl peptidase-4 (DPP-4) inhibitors**: Sitagliptin (Januvia), Saxagliptin (Onglyza)
- Stimulate endogenous insulin secretion from pancreas
  - **Sulfonylureas**: Chlorpropamide (Diabenese), Glyburide (Micronase), Glipizide (Glucotrol)
  - **Meglitinides**: Repaglinide (Prandin), Nateglinide (Starlix)

**Metformin**

- Merck Serono Package Insert
  - “Metformin must be elective surgery under general, spinal or peridural anaesthesia. Therapy may be restarted no earlier than 48 hours following surgery or resumption of oral nutrition and only if normal renal function has been established.”
- Royal College of Radiologists recommend that there is no need to stop metformin after contrast has been administered in patients with a normal serum creatinine and/or eGFR of > 50 ml/min/1.73m²

**Preoperative Oral Antidiabetic and Non-Insulin Injectable Therapy**

- No evidence that metformin causes hypoglycemia or lactic acidosis
- Hypoglycemia occurs occasionally with sulfonylureas or meglitinides
- Not necessary to discontinue oral antidiabetics prior to the day of surgery
- Withhold oral antidiabetics and non-insulin injectables on the day of surgery

www.diabetes.nhs.uk/our_work_areas/inpatient_care
**Insulin Preparations**

<table>
<thead>
<tr>
<th>Insulin type</th>
<th>Onset of action</th>
<th>Time to peak effect</th>
<th>Duration of action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid Acting: Lispro, Aspart, Glulisine</td>
<td>5-15 min</td>
<td>30-90 min</td>
<td>2-4 h</td>
</tr>
<tr>
<td>Short-acting: Regular</td>
<td>30-60 min</td>
<td>2-3 h</td>
<td>8-10 h</td>
</tr>
<tr>
<td>Intermediate-acting: NPH, Lente</td>
<td>1-2 h</td>
<td>4-10 h</td>
<td>10-18 h</td>
</tr>
<tr>
<td>Long-acting, peakless: Glargine, Detemir</td>
<td>2-4 h</td>
<td>No peak</td>
<td>20-24 h</td>
</tr>
</tbody>
</table>

**Preoperative Instructions For Insulin**

<table>
<thead>
<tr>
<th>Type of Insulin Therapy</th>
<th>Day Before Surgery</th>
<th>Day of Surgery</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulin pump</td>
<td>No change</td>
<td>No change</td>
<td>Use 'sick day' or 'sleep' basal rate</td>
</tr>
<tr>
<td>Long-acting, peakless</td>
<td>No change in AM dose</td>
<td>75-100% of AM dose</td>
<td>Reduce nighttime dose if history of nocturnal or morning hypoglycemia</td>
</tr>
<tr>
<td>Intermediate-acting</td>
<td>No change in AM dose</td>
<td>75% PM dose</td>
<td>AM dose may be given on arrival to ASC</td>
</tr>
<tr>
<td>Fixed combination</td>
<td>No change</td>
<td>50-75% of AM</td>
<td>Lispro-protamine available in combination, use NPH</td>
</tr>
<tr>
<td>Short- and Rapid-acting</td>
<td>No change</td>
<td>Hold the dose</td>
<td></td>
</tr>
</tbody>
</table>

**Modify Preoperative Insulin Therapy Based on Clinical Status**

- History of nocturnal or morning hypoglycemia
- Complex insulin regimens (e.g., twice-daily combinations of peakless or intermediate-acting insulins)
- Tight glycemic control (i.e., HbA1c <6%)
- Patient’s ability to check BG level and follow instructions
- Timing of surgery and the expected time to resumption of regular diet after surgery

**Diabetic Crisis**

<table>
<thead>
<tr>
<th>NKA (glucose mg/dL)</th>
<th>NKA (glucose mmol/L)</th>
<th>Severe ketosis</th>
<th>Severe hypoglycemia</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10</td>
<td>&lt;5.6</td>
<td>Variable</td>
<td>Variable</td>
<td>Variable</td>
</tr>
<tr>
<td>&gt;10</td>
<td>&gt;5.6</td>
<td>&gt;300 mg/dL</td>
<td>&gt;5.0 g/dL</td>
<td>Variable</td>
</tr>
</tbody>
</table>

**Is there a preoperative blood glucose level above which one should postpone elective surgery?**

- No evidence that any particular blood glucose level is harmful for outpatients
- Postpone surgery in patients with significant complications of hyperglycemia such as severe dehydration, ketoacidosis, and hyperosmolar non-ketotic states

**Preoperative Blood Glucose Level**

- Good long-term control: proceed with surgery
- Poor long-term control: consider comorbidities and risks of surgical complications (e.g., delayed wound healing and wound infection)
- Decision to proceed made in conjunction with the surgeon

**Proceed After BGL Correction or Correct BGL in the Operating Room**

- Rapid correction of BGL not necessary
- Timing of BGL correction based upon available time in the preop period duration of surgery

**What is the optimal intraop blood glucose level for ambulatory surgery?**

- Optimal intraop BGL is <180 mg/dl
- For poorly controlled diabetics, maintain BGL at preop values rather than temporarily normalizing them

**How should we maintain optimal blood glucose levels?**

**Perioperative Insulin Administration**

- Drug
  - Regular insulin
  - Rapid-acting insulin analogs
- Dose
  - Predetermined tables
  - Rule of 1500/1800
- Route of administration
  - Intravenous infusion
  - Intravenous bolus
  - Subcutaneous

**Intraoperative Insulin**

**Choice of Route of Administration Intravenous Vs. Subcutaneous**

- Rapid-acting insulin for subq use only
- Regular insulin half-life of IV bolus is <10 min, will require large doses (50-100 U/h) for adequate BG control
- SubQ insulin q 1-2 h provided similar BG control as IV infusion in patients with DKA
**Insulin Dosing Using Sliding Scale**

<table>
<thead>
<tr>
<th>Blood Glucose (mg/dL)</th>
<th>Insulin (units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;180</td>
<td>0</td>
</tr>
<tr>
<td>181-250</td>
<td>4</td>
</tr>
<tr>
<td>251-300</td>
<td>6</td>
</tr>
<tr>
<td>&gt;300</td>
<td>8</td>
</tr>
</tbody>
</table>

**Sliding Scale Insulin: Time to Stop Sliding**

- Assumes all patients have similar insulin sensitivities or no change in insulin sensitivity during different stages of acute illness
- Medline search from 1966-2003 revealed 52 trials of SSI with not even one showing benefit
  - Browning LA and Dumo P: Am J Health Syst Pharm 2004; 61: 1611-4
- Correction-dose algorithm should be based on total daily dose or body weight
  - Trence DL et al: J Clin Endocrinol Metab 2003; 88: 2430-7
  - Clement S et al: Diabetes Care 2004; 27: 553-7

**Dose Determination: Insulin Sensitivity/Resistance**

- Calculate total daily insulin requirements
- Divide 1500 (if you plan to use regular insulin) or 1800 (if you plan to use rapid acting insulin) by the total daily dose
- Value = expected decrease in BGL with 1 u insulin
- Daily dose of 60 u: each unit of insulin will reduce BGL by 25-30 mg/dl (1500/60 or 1800/60)

**Considerations in Diabetic Outpatients**

- Perform procedure early in the day (starvation time should be minimized)
- Avoid periop dehydration: encourage water intake until 2 h preop, intraop crystalloids
- Non-opioid analgesic technique, limit opioids
- Antiemetic therapy: dexamethasone 4 mg, frequent monitoring of BGL and correction of hyperglycemia
- Early mobilization with resumption of normal diet and return to usual diabetes management

**Thank You. Questions**

The Art of Anesthesia

If you can’t explain it simply, you don’t understand it well enough.

--- Albert Einstein