Role of the Surgeon in the EP Lab

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Division Cardiothoracic Surgery
Disclosures

Proctor: nContact Convergent Hybrid Ablation Procedure

Honoraria: nContact
Dwight Harken

- Army Cardiologist-Paul Zoll, MD
- External pacing
  - Epicardial stimulation
- Shrapnel removal
Pioneers of Cardiac Surgery

C Walton Lillehei

- 15% VSD in heart block $\rightarrow$ 100% fatal
- Grass Stimulator (J Johnson PhD)
- Epicardial leads Jan 1957
  - Extension cords
- Battery-powered pacemaker
  - Earl Bakken 1958
Levi Watkins, MD

- Mentor at Hopkins
- Died April 2015
- Implanted 1st automatic defibrillator 1980
  - Vivien Thomas
William Sealy, MD

- WPW/AVNRT tract division 1968
- Clinical electrophysiology
  - Andrew Wallace, MD
- Catheter electrode disruption AV node conduction
  - Shineman, MD
EP Catheter Ablation
Dominant Procedure for Symptomatic AF

- PVI
- PVI plus linear lesions
- PVI plus CFAE ablation
- PVI plus posterior wall isolation
- PVI plus additional triggers
- PVI plus gangionated plexus ablation
- PVI plus rotors
- PVI plus boxed ablation of low voltage LA
Pioneers of Cardiac Surgery

James Cox, MD

• 1987

• Cox-Maze procedure

• Ushered in modern era of arrhythmia surgery
Modern Interactions Between Cardiac Surgery & Cardiac Electrophysiology

- Turn pacemaker off
- Turn pacemaker on
- Turn rate up
- Turn rate down
- Damn *%$ atrial fibrillation!!!
Interdisciplinary Collaboration

- Blurring Boundaries between professions
  - Wire skills
  - Minimally Invasive/Percutaneous hot topics in media
  - Allows sharing of professional pie

- Divisions are merging into Institutes or Centers

- Administrators and patients like to be part of a “Team”

- Establishing Collaborative Programs
  - Institutional Goals
  - Procedural Volume/Operator Experience
  - Institutional Model: private practice/hospital-employment
  - EP/CT Surgery Relationship
  - History of collaboration
EP Docs in the Operating Room

• **Cardiac Rhythm Management Devices**
  • Over 2 million devices worldwide
  • Over 4 million leads worldwide
  • ½ million systems implanted annually
  • 1 million leads implanted annually

• **Increased Use = Increased Removal**
  • Infection
  • Lead-breakage/Nonfunction
  • Venous occlusion/Lead Thrombosis
  • Lead arrhythmogenesis

• **Lead extraction capability essential for any high volume center**

Improving Safety of Laser Assisted Lead Removal Over Time

<table>
<thead>
<tr>
<th>Year</th>
<th>PLEXES</th>
<th>Total US</th>
<th>LEELCon</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>2%</td>
<td>0.65%</td>
<td>0.27%</td>
</tr>
<tr>
<td>2002</td>
<td>1.9%</td>
<td>0.6%</td>
<td>0.78%</td>
</tr>
<tr>
<td>2009</td>
<td>1.4%</td>
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</table>

PLEXES: 153 pts, 9 centers
Total US: 1684 pts, 89 centers
LEELCon: 1449 pts, 13 centers

Procedural MAEs
Procedural Mortality

Lahey Hospital & Medical Center
Lead Extraction Programs

EP Society Recommendations

- Procedural Considerations:
  - Continuous ECG and Arterial Pressure Monitoring
  - High Quality Fluoroscopy
  - Defibrillator
  - Rapid Peri-cardiocentesis Capability
  - **Rapid Surgery Availability**

- Learning Curve Steep
  - Primary Operator: 40 supervised cases/20 cases per year
  - Operator Trainer: > 75 cases
Hybrid Operating Room

- Increasingly common in most hospitals
- Adjacent to:
  - Open Heart Operating rooms
  - Perfusionist services
  - OR Equipment Pyxis
- Cardiopulmonary bypass pump in room
- OR Nurse staffing
- Spacious
Hybrid OR Limitations

- Equipment Transfer from EP Lab increasingly complex
- OR Scheduling:
  - Surgeon availability
  - Surgeon amenability
  - Surgeon Interest
  - Cardiac OR Nursing Staffing

- Results:
  - Sick patients-last case of the day
  - Staff dissatisfaction & resentment

- Roadmap for future collaboration
Convergent Procedure

- True Interdisciplinary Collaborative Program

- 2-in-1 Procedure:
  - Closed chest transdiaphragmatic minimally invasive epicardial ablation
  - Standard catheter ablation
  - Staged versus same-setting

- Time Course for Lahey Clinic:
  - Discussion February 2013
  - Site Visit Richmond June 2013
  - 1st Case December 2013
Transdiaphragmatic Laparoscopic Approach

Access to the Abdominal Cavity
Convergent Procedure

Persistent Atrial Fibrillation

- 4 Randomized Control Trial Studies
- Evaluated single-procedure, drug-free clinical success with ablation approaches
- Outcomes have not been ideal
  - 5-year freedom from AF 30-40%
  - Posterior LA catheter ablation difficult
Convergent Procedure Published Results

**Catheter Ablation**

*Sinus Rhythm & Repeat Ablation Procedures*

<table>
<thead>
<tr>
<th>% Sinus Rhythm @ 1 Year</th>
<th>% Repeat Procedures @ 1 Year</th>
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<tbody>
<tr>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>80%</td>
<td></td>
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<tr>
<td>60%</td>
<td></td>
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<td>40%</td>
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<tr>
<td>20%</td>
<td></td>
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<tr>
<td>0%</td>
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Published Catheter Ablation Articles / Presentations

**Combination Endocardial/Posterior Epicardial Ablation**

*Sinus Rhythm & Repeat Ablation Procedures*

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Published Convergent Articles / Presentations
Convergent Procedure Outcomes

- Total # Patients: 55
- Average # Epicardial Lesions: 22
- Length of Stay: 4.1 days

- Procedural Mortality: 0%
- Procedural Morbidity:
  - Ventral Hernia (4/55) [0 since Optiview technique]
  - Pericarditis (1/55)
  - Bleeding (1/55) [managed conservatively]
  - IVC Laceration (1/55)
  - Atrio-esophageal fistula (0/55)
  - Vascular Access complications (1/55) [groin hematoma; managed conservatively]

- Normal Sinus Rhythm
  - 1 month: 47/52 (90.3%) [2 in a-fib; 3 a-paced s/p AV ablation]
  - 6 month: 33/36 (91.6%) [3 a-paced s/p AV ablation]
  - 1 year: 22/25 (88%) [3 a-paced s/p AV ablation]
  - 13 inside 3 month blanking period
Convergent Program Development

• Tedious Process
  • 10 months
  • Meetings with: Administration, Nursing, mid-level practitioners, cardiac anesthesiology, outpatient referrals
  • Program not a procedure
    • TAVR program as a model
  • Surgeon role represents the change
    • “Invading” EP lab
Evolution of Our Convergent Procedure

- 1-10 patients
  - Epicardial Ablation performed in cardiac operating room
  - Transported intubated to EP lab for endocardial ablation
  - Extubated in EP lab
  - Transported to Cardiac Surgery ICU
  - Transferred to EP inpatient floor POD #1

- 11-15 patients
  - Epicardial Ablation and Endocardial Ablation performed in EP lab
  - Extubated in EP lab
  - Transported to CCU on CCU team
  - Transferred to EP inpatient floor POD #1

- 15- present
  - Full procedure in EP lab
  - Extubated in EP lab
  - Recovered in post-EP recovery room (arterial line removed)
  - Transferred to EP inpatient floor night of surgery
Convergent Program Development

- Surgeon Considerations
  - Collegiality with EP physicians
  - EP division pride with ablation
  - Credentialing process
    - SAGES certification
    - Concerns of General Surgeons
  - Laparoscopic Comfort
    - General Surgeon assistance
    - Resident Teaching
Convergent Program Development

- Perfusion/Facility Engineering
  - Bypass Capability in EP lab
    - Medical Gas, Vacuum and Electrical source location
  - Pump position
    - Circuit modification/Extension
  - Extra equipment in case of contamination or pump failure
  - Mechanism for Blood/Medication Delivery
  - Circuit Breaker Panel

- Adequate OR lighting
- Suction canisters

- DRY RUNS INCLUDING EMERGENCY SCENARIOS ARE ESSENTIAL
Convergent Program Development

- OR-EP Nursing Considerations
  - Case scheduling
    - OR versus EP
    - Case start times
      - Pre-op holding
      - Transfer to EP lab
      - Case preparation
  - Equipment budget and storage
  - Equipment transportation
    - Case cart storage
  - Nursing communication
    - Face-to-face communication/Sign-out
    - Case documentation systems

- DRY RUNS INCLUDING EMERGENCY SCENARIOS ARE ESSENTIAL
Convergent Program Development
Convergent Program Development

- Administration/Department Billing
  - Annual Department Case Projections/Estimations
    - EP lab vs OR
    - RVU-based salary adjustments/annual bonuses
  - Initial costs associated with start-up programs
    - Staffing/Equipment
  - Billing differences EP lab versus OR
    - Total costs higher in the operating room
    - Net margin similar
    - Benefit to patient doesn’t come with a number value
  - Case-Mix Index: Convergent 4.46; AVR 4.63

- Insurance Coverage
  - Regional variability
  - Pre-authorization a must
Convergent Program Development

- Procedure Considerations
  - Outpatient Referrals
    - EP then CTS
  - Pre-operative evaluation
    - Treat as a Cardiac Surgery patient
  - Management of Anticoagulation
    - Warfarin: INR < 3.5
    - Eliquis/Pradaxa: hold 2 doses
    - Xarelto: hold 1 dose
  - Owning Service post-procedure
    - Manage anti-arrhythmics/anti-coagulation
  - Follow-up appointments
    - 2-4 weeks: Cardiac Surgery
    - 2-3 months+: EP
# SPECIFIC POST-OP ORDER SETS

## POST CONVERGENT PROCEDURE ORDERS

<table>
<thead>
<tr>
<th>ATTENDING PHYSICIAN (Electrophysiology)</th>
<th>Pager:</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARDIOTHORACIC SURGEON</td>
<td>Pager:</td>
</tr>
<tr>
<td>Prescribing provider</td>
<td>Pager:</td>
</tr>
</tbody>
</table>

- [ ] Assign to Observation
- [ ] Extended Recovery
- [ ] Admit to Inpatient: I certify that inpatient services for duration of greater than 2 minutes are medically necessary for the patient or are on the Inpatient On Call Procedure sheet. See NAP and MD Progress Notes.

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>[ ] CCU</td>
</tr>
<tr>
<td>[ ] SW</td>
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<tr>
<td>[ ] Other:</td>
</tr>
</tbody>
</table>

**Date/Time:**
Attesting co-signature

**CODE STATUS**
Confirm there is documentation supporting code status in progress notes PRIOR to checking box.
- [ ] DNR

Attesting co-sign if not Full Code

<table>
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**ALLERGIES**
- [ ] NKA
- [ ] Latex
- [ ] Other: |

**NURSING CARE**
- Vital signs & distal pulses every 15 min x 4, then 30 min x 4, then 60 min x 2 then every 4 hours
- Daily weights
- Pericardial drain to bulb suction, record pericardial drain output hourly x 4 hours then every 4 hours
- Continuous telemetry monitoring, monitor O2 sat continuously for 4 hours, then every 4 hours
- Check EP access site with vital signs until AM POD 1 and then every shift
- Remove abdominal dressings POD 2; if dry, leave open to air; if wet, cover with DSD, change PRN drainage
- In holding area, routine arterial line care if in place; discontinue arterial line before transfer to floor
- Central line care - change needless connectors every Monday and record on MAR
- Discontinue urinary catheter at 0500 POD 1

**NOTIFY ELECTROPHYSIOLOGY PROVIDER if:**
- Heart rate less than 40 bpm or greater than 130 bpm
- Rhythm change
- In holding area: mean arterial pressure less than 60 or greater than 100
- Systolic blood pressure less than 90 or greater than 160
- O2 sat less than 90%
- Temp greater than 38.3 C (101 F)
- Urine output less than 20 cc/hour

**PAGE CARDIOTHORACIC SURGERY AT 0516 IF:**
- Drain output greater than 50 cc/hour

**ACTIVITY**
- Bedrest until AM POD #1, then advance activity as tolerated with assist PRN
- Other: |

**NUTRITION**
- [ ] NPO
- [ ] NPO except meds
- [ ] 2 Calorie, Controlled Carbohydrate (for diabetes)
- [ ] 2 Gm Sodium
- [ ] Heart Healthy
- [ ] Other: |

<table>
<thead>
<tr>
<th>DATE &amp; TIME (required)</th>
<th>Provider Signature</th>
<th>Beeper #</th>
</tr>
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</table>
PROGRAM OUTREACH

• Identify a Program Coordinator!!!

• Marketing
  • Inside institution
  • Public

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Our Convergent Team:

Torin P. Fitton, MD
SPECIAL INTERESTS: Atrial Fibrillation, Aortic Dissection, Aortic/Mitral Valve Repair, Ascending and Aortic Arch Aneurysms, Benign/Malignant Pulmonary Disease, Coronary Artery Bypass, Ross Procedure, Surgical Ventricular Restoration/Ventricular Aneurysms, Valve Replacement, Valve-Sparing Aortic Root Replacement
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FELLOWSHIP: Hospital of the University of Pennsylvania (Cardiology; Electrophysiology), Philadelphia, PA

To learn more about the Convergent Approach visit Lahey.org/Convergent or call 781.744.8863

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Lahey Hospital & Medical Center

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What Surgeons can teach EP doctors

Physical Examination
  • Ventral hernia
  • Lap vs Open Chole
  • Chevron incision
  • Lift up the shirt!!!!

• Concept of an 8 am incision time

• STERILE TECHNIQUE
What EP doctors can teach CT Surgeons

Electrophysiology
- Limited residency exposure
- New language: Rotors, CFAE, ganglionated plexi

- EP techniques
  - ICE
  - Transeptal puncture
  - Voltage mapping

- Open adaptation
Convergent Program Development