How To Do Lead Extraction Using The Femoral Vein: Benefits and Complications

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Femoral Approach to Lead Extraction, Benefits and Complications: Internal Jugular Approach to Lead Extraction, is the Extra Effort Worth the Results?

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FEMORAL APPROACH

“INFERIOR APPROACH” ???
**FEMORAL APPROACH:**

**INDICATIONS**

- Failed Superior Approach
- Primary Approach

**History of Lead Extraction**

- Past: Traction applied by weights, elastic bands, or other inventive methods
- Dangers:
  - PVCs
  - Life-Threatening Arrhythmias
  - Potential Eversion of the RV Apex
  - Lead disintegration
    - Traction relies on tensile strength of lead insulation and conductor coils
- Leads implanted for < 6 months could be removed with traction alone.
EXTRACTION USING THE FEMORAL VEIN

- BYRD FEMORAL WORK STATION
- SNARE TECHNIQUES

Inferior Approach

- Deflecting Wire and Dotter
- Curry Loop Snare
- Amplatz Snare
- The Needles Eye
TRANSVENOUS LEAD EXTRACTION:
HEART RHYTHM SOCIETY EXPERT CONSENSUS ON FACILITIES TRAINING, INDICATIONS AND PATIENT MANAGEMENT

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• Definitions
• Extraction Tools
• Defining Outcomes
• Defining Complications
• Lead Management Environment
• Personnel, Qualifications, Training
• Indications
• Registry and Data Management
Personnel, Facility, and Equipment Requirements

Tools For Lead Preparation

- Lead Cutter
- Coil Expander
- Soft Grip Hemostat
- Locking Stylets
- Special Stylets (801)
MINIMAL FACILITY REQUIREMENTS

- FACILITY
- SUPPORT PERSONNEL
- EXTRACTION TEAM
- EQUIPMENT

EXTRACTION FACILITY OPERATING ROOM CATH LAB

- PHYSIOLOGICAL RECORDERS
- MINOR SURGICAL TRAY
- ECHO / TEE
- ELECTROCAUTERY
- PERICARDIALCENTESIS TRAY
MONITORING, PACEMAKER, ICD AND SURGICAL INSTRUMENTS

- ECG
- ARTERIAL LINE
- OXIMETRY
- PACEMAKER / ICD-PROGRAMMERS
- PM / ICD SPARE PARTS

- MINOR SURGICAL TRAY
- STERNAL SAW
- THORACOTOMY TRAY
- DRAINAGE SYSTEM
- PERICARDIALCENTESIS
- TEMPORARY PACING
- ECHO-TEE
Femoral Lead Extraction

- Failed superior approach
- Broken leads
- Floating free ends

Byrd Femoral Work Station

- Byrd femoral Sheath
- Deflecting wire and handle
- Amplatzer snare
- Curry snare
Byrd Femoral Work Station

BYRD WORK STATION
Amplatz Snare
Amplatz Snare
Femoral Approach Prep

- 18 Gauge Thin Wall Needle
- Byrd Femoral Work Station
- Sterile IV Tubing
- Heparinized Flush
Deflecting Wire and Dotter Retriever

- No Free End
- Potentially Irreversible
Deflecting Wire and Dotter
CURRY SNARE
FREE ENDS

Curry Loop Snare
Curry Snare
Curry Snare
Free end
Deflecting Wire /Catheter/Amplatz
Deflecting Wire /Catheter/Amplatz

Amplatz Snare
Byrd Femoral Work Station
Snaring Lead Tip
THE NEEDLES EYE
CASE # 1

- 83 y/o Female s/p AICD with Endotak transvenous lead -1990
- AICD IPG CHG – 2004
- Pocket revision,AICD removal and new AICD right pectoral area -3.29.04
- Multiple revisions left chest including removal of subcutaneous patch

- Continuous draining from wound with electrode remnant in left pectoral area
- Patient referred for removal of Endotak lead
- Proximal lead remnant prepared
- Locking stylet applied
- 16 french laser sheath with outer teflon sheath advanced over the ICD lead

The Distal Coil Broke
ATTEMPT TO RETRIEVE FROM BELOW

- Byrd Femoral workstation
- Deflecting wire
- Amplatz snare
Arrangements Made for Open Heart Surgery

- Extract AICD lead Remnant
- Reposition Atrial lead
- Reposition AICD lead
Lessons

- The ICD lead like barbed wire
- Never take anything for granted
- ICD lead can be very difficult and Challenging

CASE : 2

- 75 y/o s/p DCP 12/2/98 CHB
- S/P new atrial wire
- Upgrade to BiV AICD 11/2005
- Draining pocket 2/2006
Snaring with Amplatz and Deflecting Wire
5 LEADS

- Chronic Atrial #1-
- Chronic Atrial #2-
- Chronic Ventricular
- Recent RV AICD Lead
- Recent LV lead

Issues

- INFERIOR APPROACH REQUIRED
- LV LEAD EXTRACTION
- INFECTION ISSUES
- CHF REIMPLANTATION OF BIV
- TEMPORARY PACING
64 S/P BIV AICD 2004
CASE: BIV AICD RECURRENT SEPSIS

- 73 y/o s/p Pacemaker 2003
- AVN Ablation 2003 - AF
- Coagulase neg Staph Infection 2004
- AICD 2005 on right
- Erosion on Left - IPG Removed
- Removal of BIV AICD + 5 Leads
Lessons

- Don’t Pull on leads
- Don’t Cut Abandon Leads
Boone Extraction 32910

- 36 y/o s/p DDD 1999
- Left sided infection 2008
- New right sided system 2008
- Leads cut and buried
- Continuous drainage 11/2009
- Retained leads removed 32910
52 y/o with NIDCM, CRF on dialysis S/P AICD 1/5/05 with MDT 6949 Lead, referred for removal of the ICD System because of Staph Aureus sepsis.
• Lead Extraction
• Pisa Approach

• Maria Grazia Bongiorni, MD

• Director of Cardiovascular Division
• University Hospital of Pisa (I)
NEED OF JUGULAR APPROACH

- Narrow costo-clavicular space
- Tightness of binding sites at various sites
  - Superior vena cava
  - Atrium
  - Tricuspid valve
  - Ventricle
- Lead damage (no stylet)

- Tightness of binding sites
  - Tricuspid valve
  - Ventricle

Venous Entry Approach

Femoral Approach

TRANSVENOUS LEAD REMOVAL

THE INTERNAL TRANSJUGULAR APPROACH
Considering the outcome of the jugular approach for free-floating leads, since 1997 we performed this approach in case of failure of Venous Entry Approach.
TRANSVENOUS LEAD REMOVAL

THE INTERNAL TRANSJUGULAR APPROACH

Exposed unextracted leads

Internal Transjugular Approach

Personal Experience on Lead Extraction

Single Sheath Technique
Lead Extraction - Pisa Approach


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THE INTERNAL JUGULAR APPROACH

METHODS: The proximal end of the lead is cut; the lead is caught by the tip deflecting wire introduced via the femoral vein; the lead runs through the adherences and is made free-floating.
THE INTERNAL JUGULAR APPROACH

METHODS: The proximal end of the lead is caught by the lassos and the lead is then exposed through the Internal Jugular vein.
THE INTERNAL JUGULAR APPROACH

METHODS: A standard procedure is performed by using mechanical sheaths
The Pisa approach

Realizing that curved fibrotic leads are major obstacles, Bongiorni et al. devised techniques to avoid this problem. Left-sided leads are cut and dragged down into the inferior vena cava or lower by a femoral gooseneck snare catheter. The lead is grabbed again, but now from the right jugular vein, then pulled out and reinforced with a locking stylet. Finally, the lead is extracted using a mechanical sheath on a surprisingly straight line from the jugular vein to the atrium or ventricle. The straight line makes all the difference compared with the lead that originally followed the brachiocephalic curve. I have used the Bongiorni technique in combination with laser sheaths introduced through the right jugular vein and it has worked well on very fibrotic leads. This positive impression of the right jugular approach was reinforced when I extracted free-floating leads using special short Needle’s Eye snares.
### Mechanical – Laser – EDS Techniques

<table>
<thead>
<tr>
<th>Years Implanted</th>
<th>Complete Success</th>
<th>Partial Success</th>
<th>Failure</th>
<th>Major Complication</th>
</tr>
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<tbody>
<tr>
<td><strong>Mechanical (1994 – 1996)</strong> 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2338 Patients</td>
<td>4.3 ± 3.8</td>
<td>93%</td>
<td>5%</td>
<td>2%</td>
</tr>
<tr>
<td>3540 Leads</td>
<td></td>
<td></td>
<td></td>
<td>1.4%</td>
</tr>
<tr>
<td>1463 Patients</td>
<td>6.5 ± 4.2</td>
<td>90%</td>
<td>3%</td>
<td>7%</td>
</tr>
<tr>
<td>2249 Leads</td>
<td></td>
<td></td>
<td></td>
<td>1.9%</td>
</tr>
<tr>
<td><strong>Electrodissection (1999 - 2001)</strong> 3</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>265 Patients</td>
<td>7.5</td>
<td>95.9%</td>
<td>3.5%</td>
<td>0.6%</td>
</tr>
<tr>
<td>542 Leads</td>
<td></td>
<td></td>
<td></td>
<td>2.6%</td>
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<tr>
<td><strong>Personal Data (1997 – 2007)</strong> 4</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>1192 Patients</td>
<td>69.3(1-336)</td>
<td>98.4%</td>
<td>0.9%</td>
<td>0.6%</td>
</tr>
<tr>
<td>2065 Leads</td>
<td></td>
<td></td>
<td></td>
<td>0.7%</td>
</tr>
</tbody>
</table>

1 Byrd CL. PACE 1999  
2 Reiser C. PACE 1998  
3 Byrd CL. NASPE 2001  
4 Bongiorni. Eur Heart J 2008

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Transvenous removal of pacing and implantable cardiac defibrillating leads using single sheath mechanical dilatation and multiple venous approaches: high success rate and safety in more than 2000 leads

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Lead Extraction - Pisa Approach
CONCLUSIONS

- Transvenous lead extraction is today an effective and relatively safe procedure.
- The success rate and the incidence of complications are highly affected by the experience, techniques and materials.
- The Internal Jugular Approach enhances the effectiveness of the procedure with very low risk of major complications.
- The procedure and approaches must be well planned and, on occasion, tailored to the single case.

Is the extra effort worth the results?
FEMORAL LEAD EXTRACTION
“INFERIOR APPROACH”?
SAFER

- Less Risk of Perforation
- Less Risk of Vascular Laceration
- Less Risk RV Avulsion and Tamponade
- Control

FEMORAL VENOUS APPROACH

- IMPORTANT
- LIMITED APPLICATION
- SAFE
Factors influence the Outcome of Transvenous Lead-Extraction

1. CLINICAL FACTORS
   - Implant Duration
   - Multiple Leads
   - Age and Gender
   - PM/ICD leads

2. MECHANICAL CHARACTERISTICS
   - Adhesion
   - Calcifications
   - Vegetations
   - Fracture of lead
   - Protrusion
   - Insulation Failure
   - Damage from unsuccessful attempts

3. TOOLS FOR EXTRACTION
   - Simple traction
   - Snare, Catcher, Lassos
   - Styles
   - Mechanical, Laser, RF Sheaths

4. VENOUS APPROACHES
   - Venous Entry Approach
   - Femoral Approach
   - Jugular Approach

5. PHYSICIANS EXPERIENCE

Lead Extraction - Pisa Approach
1. Venous Entry Approach: using the implant vein
2. Inferior Approach or Femoral Approach
3. Internal Jugular Approach (personal technique from ‘97)
PACEMAKER INFECTION AND EROSION (0.7-1.0%)

PULSE GENERATOR CHANGES

• OBLITERATE THE POCKET
• DISSECT AWAY ENCAPSULATING FIBROUS SCAR
• REMOVE EXTRANEOUS MATERIAL
• CREATE A NEW PLANE
• CONSIDER SUBPECTORAL PLACEMENT
Debride! Debride! Debride!
Primary Closure

COMPLICATIONS
WHAT CAN MAKE FUTURE EXTRACTIONS EASIER AND SAFE

• NEW LEAD DESIGN - EPTFE COATING
• DON’T PULL THE LEAD (S)
• DON’T CUT THE LEADS
• ICD SINGLE COIL
• KNOWLEDGE OF THE HARDWARE

CONCLUSIONS

• SAFE - EXPERIENCE /PREPARATION
• DEDICATED CENTER
• TOOLS
• CVS BACK UP
• PATIENT SELECTION
• KNOW WHEN TO STOP!