

# Why Adult Devices Don't Work in Children

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By permission Charlie Berul

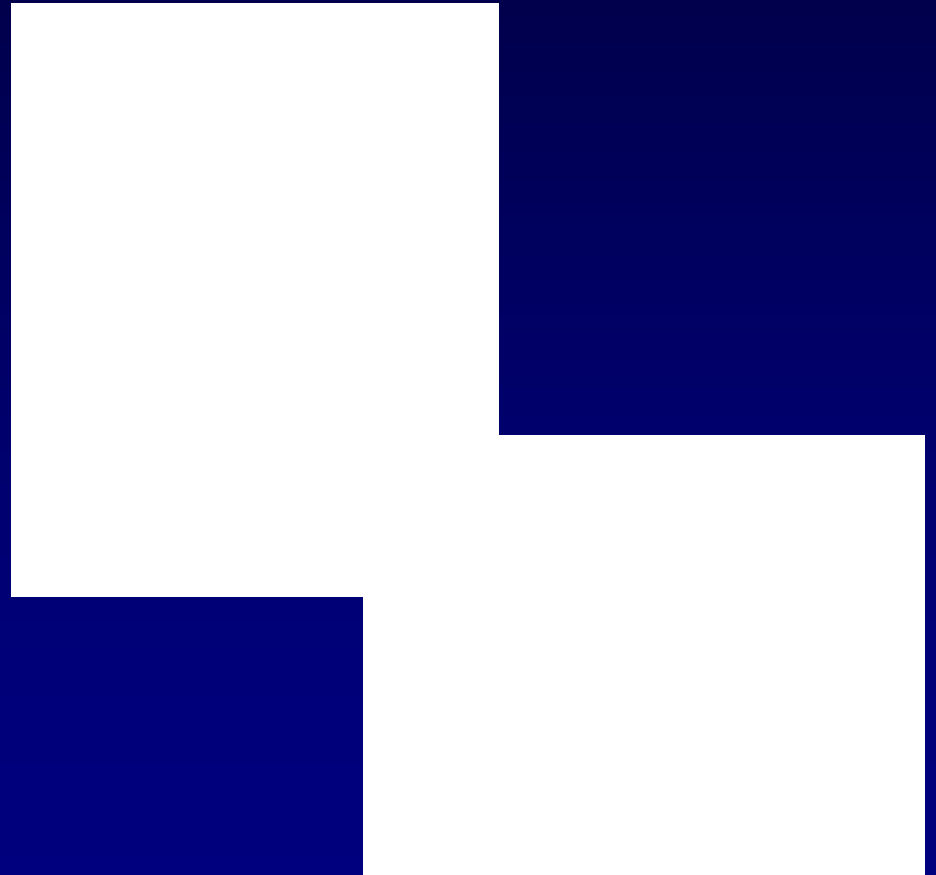
# Problems in pediatric devices

- Extra challenges introduced by:
  - Small patient size
    - Thoracic/Abdominal cavity
    - Blood vessels
  - Patient growth
  - Greater expected longevity
  - Complex cardiac anatomy



# Patient longevity and growth

- Long expected patient longevity means that hardware will undergo more stress over time
- Therefore, lead removal becomes an issue
  - Active vs passive fixation leads
  - Silicone vs. polyurethane
- Rapid growth may require lead advancement



# Patient longevity

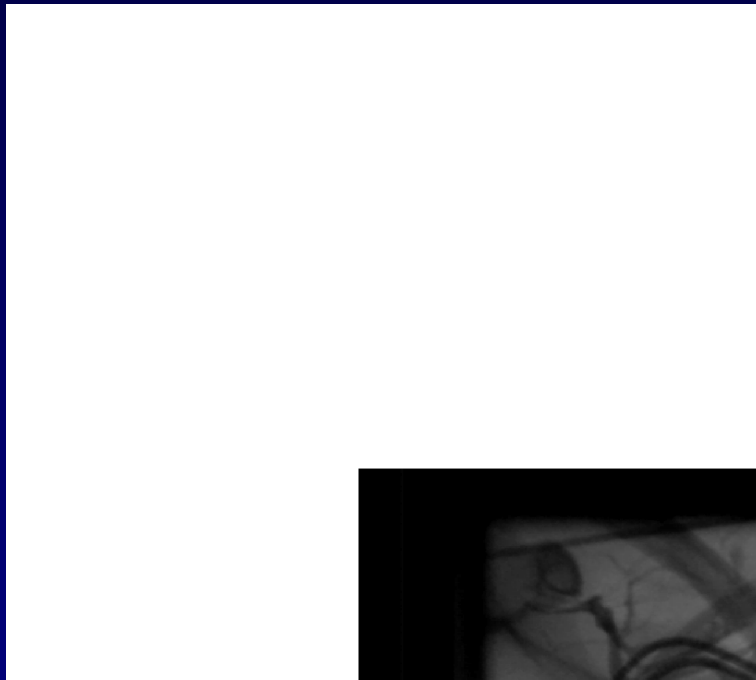
- Battery longevity
  - Higher heart rates in children which use up battery life -1-2 yrs
- Lead durability
  - Lead dislodgement or breaks
  - Lead ‘stretch’



# Activities



# Venous obstruction



- 20% of pediatric patients had clinical evidence of obstruction with transvenous leads (Figa et al PACE 1997)
    - Need to consider size of patient relative to size of lead
- Flow model may help further lead development

Lonya et al 2010



# Complex cardiac anatomy

- Venous pathways
  - Stenosed SVC-RA junction s/p Senning or Mustard reconstruction
  - LSVC-CS connection
- Pacer lead targets
  - Lack of atrial appendage following surgery
  - Active fixation needed in anatomic LV (L-TGA, D-TGA post surgery)
- R -> L shunting
  - Risk of embolism with transvenous leads





# Nonconventional ICD

- ICD therapy in small children now possible but has major disadvantages
  - Rate of unanticipated re-interventions 3x higher in nonconventional ICD



Stephenson 2006  
Radbill 2008



# Nonconventional ICD

- Non-transvenous system survival at 12, 24 and 36 months was 73%, 55% and 49%
- Transvenous survival was 91%, 83% and 76%



# Inappropriate discharges

- Inappropriate discharges
  - Between 15-30% inappropriate discharge rate seen in pediatrics
    - Sinus tachycardia overlaps arrhythmia rates
    - Detection algorithm not assessed in children
    - Lead breakage



# Appropriate vs Inappropriate D/C

| Investigator | Population   | Appropriate D/C | Inappropriate D/C | Lead Failure | Risk factors                       |
|--------------|--------------|-----------------|-------------------|--------------|------------------------------------|
| Alexander    | Children CHD | 28%             | 25%               | 21%          | Growth                             |
| Fortescue    | Children CHD |                 |                   | 23%          | Age<12<br>CHD<br>Epicardial        |
| Berul        | Children CHD | 26%             | 21%               | 14%          | Lead failure<br>Atrial arrhythmias |
| Korte        | Children     | 75%             | 49%               |              | Atrial arrhythmias                 |
| Poole        | Adult        | 22%             | 17%               |              |                                    |



# Inappropriate D/C

- SCD-HFT database – long term outcome following ICD implantation
  - Appropriate d/c associated with markedly increase risk of death
  - BUT inappropriate d/c also associated with increased risk of death



# Ideal device characteristics

- Stronger smaller leads which can be easily removed and aren't thrombogenic
- -or no leads?
- Smaller devices with longer battery life
- Less invasive epicardial delivery systems
- Better SVT/VT algorithms on ICD's



Panel


Daily Living

- Pacemaker Patients
- FAQs
- Patient Stories
- Implantable Cardioverter Defibrillator (ICD) Patients
- FAQs
- Patient Stories
- Heart Failure Device Patients
- FAQs
- Patient Stories
- LATTITUDE Patient Management
- FAQs
- Patient Stories
- LATTITUDE Heart Failure

**LATTITUDE Patient Stories**

The Harvey Family

- Family with Long QT Syndrome
- ICD devices with LATTITUDE® Patient M
- Active 4-wheelers



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