



Top Stories

Top stories: Pediatric CIEDs

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Introduction

Cardiac implantable electronic device (CIED) use in children and adolescents comes with unique challenges related to patient size and growth. As we learn more about these risks, pediatric electrophysiologists continue to mitigate these risks through the introduction of novel devices.

Growth charts and pediatric CIEDs

To build upon the known risk of CIED lead failure in pediatric patients, Hong et al¹ performed a retrospective single-center review of epicardial and transvenous lead survival over a 30-year period. A cohort of 396 subjects with 952 leads were followed for a median lead dwell time of 7.2 years, with 33% leads followed for at least 10 years. Lead failure occurred in 12% of leads (21% of subjects), with 87% lead survival at 10 years and 78% at 15 years. A novel predictor of lead failure was height growth velocity of ≥ 5 cm/y, which raised the risk of both transvenous and epicardial lead failure. Epicardial leads did not have a higher risk of failure than transvenous leads when accounting for patient height growth velocity. The authors suggest that the optimal age for initial transvenous lead implantation may be later in adolescence, after most of height growth has taken place.

An evolving pediatric implantable cardioverter-defibrillator option

With the Food and Drug Administration approval of the Medtronic extravascular implantable cardioverter-defibrillator (EV-ICD) in adults in October 2023, case reports described off-label adoption of this device in children. Rabin et al² described the placement of a secondary prevention EV-ICD in a 2-year-old with a pathologic SCN5A mutation who had an out-of-hospital ventricular fibrillation arrest. The EV-ICD was chosen as an alternative to epicardial ICD. They described the surgical technique, with the generator posi-

tioned in a pocket below the latissimus dorsi and the lead tunneled along the left inferior costal margin and secured medially to the rectus fascia. Although sensing was not reported, the authors reported appropriate ventricular tachycardia detection and therapies 1 week postoperatively.

Nash et al³ reported the implantation of a primary prevention EV-ICD in an 18-year-old competitive runner with long QT syndrome type 2. The EV-ICD was chosen owing to the patient's thin frame and desire to avoid a potential prolonged recovery with arm restrictions. Preprocedural computed tomography scan helped evaluate device candidacy, and the implant was reported to be successful without P wave oversensing and with successful defibrillation thresholds. After 4 weeks, the patient underwent an exercise stress test with appropriate sensing and was cleared for return to sports. These case reports described the EV-ICD as a new option as an alternative to transvenous, subcutaneous, or epicardial ICDs in children and adolescents.

Less is more

Despite decades of pacemaker therapy in infants and children, the optimal pacemaker programming strategy for infants with isolated congenital complete atrioventricular block (CCAVB) remains unresolved. Tan et al⁴ reported the outcomes of dual- vs single-chamber pacing in a multi-center comparative study of dual- (DDD) vs single-chamber (VVI) pacing in infants younger than 1 year with CCAVB (DAVINCHI). The study found that DDD pacing increased the risk of left ventricular dysfunction compared with VVI. Single-chamber left ventricular apical pacing should be considered in infants with isolated CCAVB who require chronic ventricular pacing. Not unexpectedly, the study showed a high risk of pacing-related complications, particularly with an increased risk of ventricular lead complications in low-weight neonates.

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Bridge over troubled waters

In smaller patients, such as preterm babies, neonates and infants, an epicardial system is typically the standard of care for permanent pacing. Complications in epicardial systems have been seen in as many as 25% of pediatric patients, with the most common complications being infection, erosion, and migration of pacemaker generators. Berul et al⁵ report midterm follow-up data on a modified implantable pulse generator developed containing a Medtronic Micra subassembly. With a median implant age of 15 days (29% premature neonates), weight of 2.3 kg, and implant duration of 329 days, the study showed that this novel device could be safely used with stable electrical parameters in neonates and infants as a bridge to growth in patient size that can accommodate commercially available conventional pacemakers.

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