

Permanent Cardiac Pacing in Children - Choosing the Optimal Pacing Site: A Multi-Center Study

Janousek J. (1), van Geldorp I.E.(2), Krupickova S.(1), Rosenthal E.(3), Tomaske M.(4), Früh M.(5), Elders J.(6), Hiippala A.(7), Gebauer R.A.(8), Kubus P.(1), Gabbarini F.(9), Clur S.-A.(10), Nagel B.(11), Ganame J.(12), Papagiannis J.(13), Marek J. (14), Nürnberg J.-H.(15), Wren C. (16), Friedberg M. (17), de Guillebon M.(18), Tisma-Dupanovic S.(19), Prinzen F.(20), Delhaas T.(21)

Kardiocentrum and Cardiovascular Research Center, Prague, Czech Republic(1); Pediatric Cardiology Cardiovascular Research Institute, Maastricht University Medical Center, Maastricht, Netherlands (2); Evelina Children's Hospital, London, United Kingdom (3); University Children's Hospital, Zurich, Switzerland (4); Oslo University Hospital, Oslo, Norway (5); Dept of Cardiology, UMC St. Radboud, Nijmegen, Netherlands (6); Hospital for Children and Adolescents, Helsinki, Finland (7); Department of Pediatric Cardiology, University of Leipzig, Heart Centre, Leipzig, Germany (8); Pediatric Cardiology Division Infant Hospital Regina Margherita, Turin, Italy (9); Emma Kinderziekenhuis - AMC, Amsterdam, Netherlands (10); Paediatric Cardiology, Children's Hospital, Graz, Austria (11); Pediatric Cardiology, University Hospital Leuven, Leuven, Belgium (12); Division of Pediatric Cardiology, Mitera Children's Hospital, Maroussi, Greece (13); Paediatric Cardiology, Great Ormond Street Hospital, London, United Kingdom (14); Klinikum Links der Weser, Abt. Kinderkardiologie, Bremen, Germany (15); Pediatric Cardiology, The Newcastle upon Tyne Hospitals, NHS Foundation Trust, Newcastle upon Tyne, United Kingdom (16); Division of Cardiology, The Hospital for Sick Children, Toronto, ON, Canada (17); Department of Cardiology, Hopital Haut Léveque, Bordeaux-Pessac, France (18); Cardiology Section, Children's Mercy Hospitals and Clinics, Kansas City, USA (19); Department of Physiology, Cardiovascular Research Institute, Maastricht University Medical Center, Maastricht, Netherlands (20); Department of Biomedical Engineering, Cardiovascular Research Institute, Maastricht University Medical Center, Maastricht, Netherlands (21)

Objectives: We sought to evaluate the effects of ventricular pacing site on LV synchrony and function in children requiring permanent pacing.

Methods: 152 children and adolescents (17 centers) with complete AV block and a structurally normal heart undergoing permanent pacing were prospectively studied. Median age was 11.2 yrs (interquartile range (IQR) 6.6-15.3). Median pacing duration was 5.3 yrs (IQR 3.0-8.6). Data were analyzed in a core lab. Pacing sites were the free wall of the RV outflow tract (RVOT, N=11), lateral RV (RVLat, N=31), RV apex (RVA, N=58), RV septum (RVS, N=18), LV apex (LVA, N=11), LV mid-lateral wall (LVLat, N=16) and LV base (LVB, N=7).

Results: Pacing sites differed in inter-ventricular mechanical delay (IVMD), septal to posterior wall motion delay (SPWMD), LV dyssynchrony index (sum of absolute mechanical delays from LV radial strain, LVDI) and LV ejection fraction (EF) with LVA/LVLat being superior (Table, median and IQR). LVDI correlated negatively with LVEF ($R=0.85$, $P=0.016$). Pacing from RVOT/RVLat (OR 7.9, CI 2.1-29.6, $P=0.002$) was a significant multivariable predictor of $LVEF < 45\%$. LVA/LVLat pacing (OR 8.7, CI 2.5-30.5, $P < 0.001$) predicted preserved LV function ($LVEF \geq 55\%$). Presence of maternal anti Ro/La antibodies, age at implantation, pre-implantation LV size and function, duration of pacing, DDD mode and QRS duration had no significant impact.

Conclusions: LV mechanical synchrony and function may significantly deteriorate with RVOT/RVLat and is best preserved by LVA/LVLat pacing. Although inferior to LVA/LVLat, RVA pacing is well tolerated in the majority. RVS did not show any advantage over RVA pacing. (JJ supported by the research project of Univ. Hosp. Motol MZOFNM2005).

| | RVOT | RVLat | RVA | RVS | LVA | LVLat | LVB | P< |
|----------|------------|------------|------------|------------|------------|--------------|--------------|-------|
| IVMD ms | 35 (17/59) | 55 (34/63) | 41 (23/59) | 42 (32/48) | 9 (-2/17) | -12 (-27/-3) | -16 (-31/-4) | 0.001 |
| SPWMD ms | 83 (70/90) | 70 (50/80) | 40 (0/70) | 90 (78/90) | 0 (-30/0) | -30 (-75/0) | -90 (-90/60) | 0.001 |
| LVDI ms | 189 | 163 | 87 | 134 | 44 | 73 | 136 | NA |
| LVEF % | 47 (46/53) | 52 (43/56) | 54 (51/59) | 52 (46/57) | 58 (55/61) | 62 (57/66) | 55 (51/64) | 0.001 |