Paediatric cardiology – not just small hearts in small bodies!

Juan Pablo Kaski[1,2]

[1] Centre for Paediatric Inherited and Rare Cardiovascular Disease, University College London Institute of Cardiovascular Science, London, UK
[2] Centre for Inherited Cardiovascular Diseases, Great Ormond Street Hospital, London, UK

The age-old adage commonly used by paediatricians across different subspecialties that "children are not just small adults" applies equally well to the specialty of paediatric cardiology. Long dismissed as a Cinderella specialty focussed almost exclusively on rare congenital heart defects and with a limited evidence base, strategies for clinical assessment and management of children with heart disease have often been extrapolated from adult data, without validation in paediatric populations. While there are many valid reasons for this, and in many cases paediatric cardiac care has benefitted from advances in adult cardiology, it is also the case that progress in paediatric cardiology has also in some cases been hampered by a lack of paediatric-specific data. The last decade, however, has seen an explosion in paediatric-specific research in the field of cardiovascular medicine (Figure 1) and, with that, a recognition of important differences between adult and paediatric heart disease.

Beyond congenital heart disease

A common misconception of paediatric cardiology is that it relates almost entirely to the diagnosis and management of congenital heart disease (CHD). While there is no doubt that CHD, the most common congenital anomaly with an estimated prevalence of 8 per 1000 births, represents a major aspect of paediatric cardiac care, the field is uniquely rich in its scope, encompassing, among others, electrophysiology, heart failure, pulmonary hypertension, inherited cardiac conditions and inflammatory heart disease, and catering for a vast range of ages from the fetus though childhood to adolescence, each with its unique set of physiological and psychological challenges. This is reflected in the range of paediatric cardiology work published in the *Journal* over the last 5 years[1-3] and in the development of subspecialty training programmes in the various subspecialties within paediatric cardiology. Perhaps the best recent example of the importance of paediatric-specific research in cardiovascular disease is the identification of the Paediatric Inflammatory Multisystem Syndrome Temporally related to SARS-CoV-2 (PIMS-TS) in the context of the recent (and ongoing) COVID-19 pandemic[4].

Pathophysiological differences between children and adults

Many international clinical practice guidelines in the field of cardiovascular medicine include small sections on recommendations for children, though usually without specific paediatric data available to guide these. In hypertrophic cardiomyopathy (HCM), for instance, recommendations for screening of paediatric first-degree relatives based on expert consensus opinion of predominantly adult cardiologists have suggested that young children should not routinely undergo screening[5], but with the advent of paediatric datasets[6], it has become clear that this approach is incorrect, a fact that has been recognised in the most

recent American Heart Association/American College of Cardiology guidelines[7]. Similarly, risk stratification for sudden cardiac death in childhood HCM has traditionally been extrapolated from adult data, but we have shown that this also is not appropriate and this has led to the development of new, paediatric-specific risk prediction models[8] with the potential to significantly improve outcomes for children. A similar situation arises in the management of heart failure in children, where for decades the approach was an extrapolation of adult data; improvements in survival are primarily driven by the availability of mechanical support and cardiac transplantation, rather than pharmacological advances[9], unlike in adult heart failure. This, however, is perhaps not surprising, given the different pathophysiological mechanisms in childhood heart failure, highlighting the importance of a paediatric-specific approach.

Rare disease clinical trials

A major challenge in paediatric heart disease is the difficulty in performing large-scale prospective clinical trials, for diseases and phenotypes that are several orders of magnitude rarer than common adult diseases such as atrial fibrillation and coronary artery disease. This of course is not restricted to paediatric cardiac disease, but here too, a paediatric-specific approach is required, and may even be of benefit to other rare diseases in adults. An example is the recent use of an emulated target trial approach in children with Duchenne muscular dystrophy, with the results arguing for early initiation of angiotensin-converting enzyme (ACE) inhibitors to improve survival and reduce heart failure hospitalisations, in a population in whom a clinical trial would have been impossible to conduct[10].

It is for these reasons that the new section for paediatric cardiology research in the *Journal* is both welcome and necessary. The aim is to publish high-quality original research articles, invited and unsolicited reviews and short communications in the field of paediatric cardiology. All aspects of cardiovascular medicine in infants, children and adolescents, including fetal cardiology, inherited cardiac conditions and acquired heart disease, will be covered within this section and we particularly encourage work on clinical paediatric cardiology subspecialties, including electrophysiology, interventional cardiology, cardiac imaging and cardiogenetics, as well as submissions on basic and fundamental science as they relate to paediatric heart disease, including cardiomyocyte biology, pharmacology and biochemistry. There are exciting times ahead for the field and we hope you will join us on this journey!

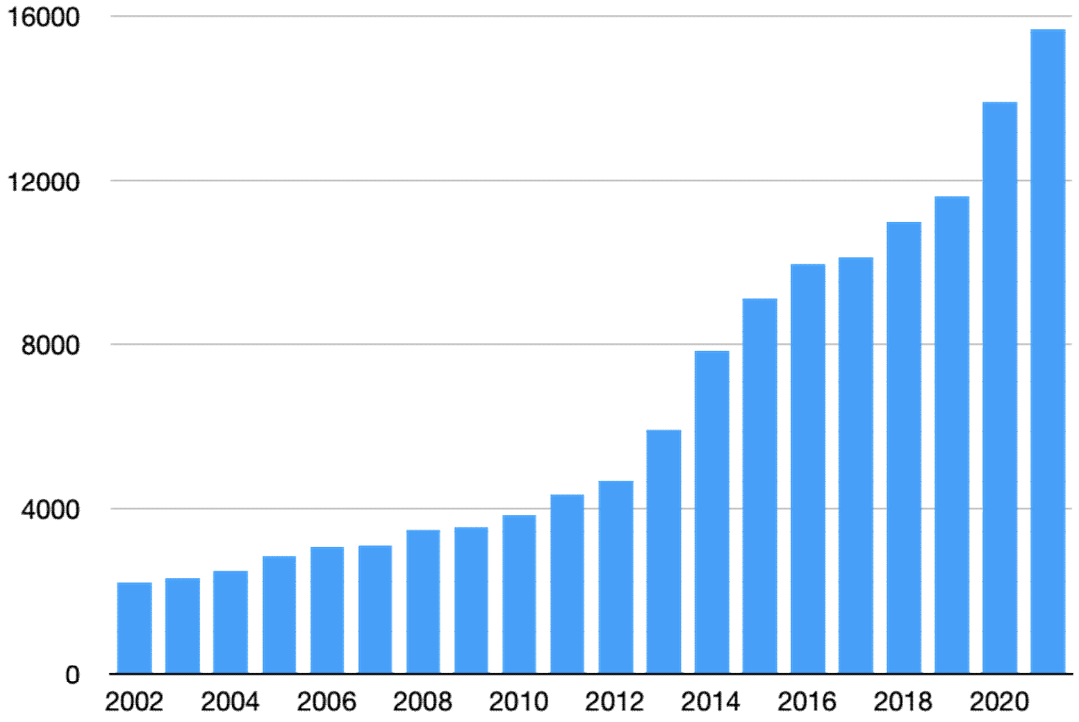
References

1. Beghetti M, Brand M, Berger RMF*, et al.* Meaningful and feasible composite clinical worsening definitions in paediatric pulmonary arterial hypertension: An analysis of the TOPP registry. *Int J Cardiol* 2019;**289**:110-115. doi: 10.1016/j.ijcard.2019.04.062
2. Seidel F, Opgen-Rhein B, Rentzsch A*, et al.* Clinical characteristics and outcome of biopsy-proven myocarditis in children - Results of the German prospective multicentre registry "MYKKE". *Int J Cardiol* 2022;**357**:95-104. doi: 10.1016/j.ijcard.2022.03.026
3. Stanner C, Horndasch M, Vitanova K*, et al.* Neonates and infants requiring life-long cardiac pacing: How reliable are epicardial leads through childhood? *Int J Cardiol* 2019;**297**:43-48. doi: 10.1016/j.ijcard.2019.10.008
4. Stasiak A, Kedziora P, Kierzkowska B*, et al.* Changes in the cardiovascular system in children with pediatric multisystem inflammatory syndrome temporally associated with COVID-19 - A single center experience. *Int J Cardiol* 2022;**361**:126-133. doi: 10.1016/j.ijcard.2022.05.030
5. Elliott PM, Anastasakis A, Borger MA*, et al.* 2014 ESC Guidelines on diagnosis and management of hypertrophic cardiomyopathy: the Task Force for the Diagnosis and Management of Hypertrophic Cardiomyopathy of the European Society of Cardiology (ESC). *Eur Heart J* 2014;**35**:2733-2779. doi: 10.1093/eurheartj/ehu284
6. Norrish G, Jager J, Field E*, et al.* Yield of Clinical Screening for Hypertrophic Cardiomyopathy in Child First-Degree Relatives: Evidence for a Change in Paradigm. *Circulation* 2019. doi: 10.1161/CIRCULATIONAHA.118.038846
7. Ommen SR, Mital S, Burke MA*, et al.* 2020 AHA/ACC Guideline for the Diagnosis and Treatment of Patients With Hypertrophic Cardiomyopathy: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. *J Am Coll Cardiol* 2020;**76**:e159-e240. doi: 10.1016/j.jacc.2020.08.045
8. Norrish G, Ding T, Field E*, et al.* Development of a Novel Risk Prediction Model for Sudden Cardiac Death in Childhood Hypertrophic Cardiomyopathy (HCM Risk-Kids). *JAMA Cardiol* 2019. doi: 10.1001/jamacardio.2019.2861
9. Blume ED, Rosenthal DN, Rossano JW*, et al.* Outcomes of children implanted with ventricular assist devices in the United States: First analysis of the Pediatric Interagency Registry for Mechanical Circulatory Support (PediMACS). *J Heart Lung Transplant* 2016;**35**:578-584. doi: 10.1016/j.healun.2016.01.1227
10. Porcher R, Desguerre I, Amthor H*, et al.* Association between prophylactic angiotensin-converting enzyme inhibitors and overall survival in Duchenne muscular dystrophy-analysis of registry data. *Eur Heart J* 2021;**42**:1976-1984. doi: 10.1093/eurheartj/ehab054

Figure legend

Figure 1: Number of paediatric cardiology publication on PubMed 2002-2021, demonstrating a significant rise in the last decade.

Figure 1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