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PRE-OPERATIVE ECHOCARDIOGRAPHY FOR RISK STRATIFICATION OF CHILDREN WITH IDIOPATHIC PULMONARY ARTERIAL HYPERTENSION UNDERGOING GENERAL ANAESTHESIA FOR CARDIAC CATHETERIZATION

T. J. W. Dawes[1], _V. Woodham[1]_, _E. Sharkey[2]_, _A. McEwan[1]_, _V. Muthurangu[3]_, _S. Moledina[1]_, _L. Hepburn[1]_
[1]_Great Ormond Street Hospital for Children NHS Foundation Trust, UK_
[2]_Evelina London Children's Hospital, Guy's and St. Thomas' NHS Foundation Trust, UK_
[3]_Institute of Cardiovascular Science, University College London, UK_

INTRODUCTION AND AIMS

Idiopathic pulmonary arterial hypertension (PAH) in children increases the risks of peri-operative cardiorespiratory complications with general anaesthesia (GA). Quantifying these risks requires invasive haemodynamic data though performing cardiac catheterisation typically requires GA, so exposing the child to further risk (1-3). We investigated whether pre-operative echocardiography predicts peri-operative complications or unforeseen escalations of care (collectively: "adverse events") in children undergoing GA for cardiac catheterisation.

METHODS

We retrospectively collected demographic, echocardiographic, anaesthetic, haemodynamic and adverse event data from the records of children with PAH undergoing cardiac catheterisation at our institution between 2003 and 2022. The project was designed after two Patient and Participant Involvement and Engagement group consultations, registered with the hospital's Research & Development team and ethically approved by the Regional Ethics Committee (REF:17/LO/0008). Adverse events were defined as any cardiorespiratory complication or unanticipated escalation of care between induction of anaesthesia and 24 hours after emergence. All analysis was done using R version 4.0.2 (4) with code publicly available on Github. Echocardiographic variables predictive of adverse events by Bayesian logistic regression were added to a multivariable predictive model (see figure). To develop a multivariable scoring system which was straightforward to use clinically, each variable was divided into ranges representing "low", "medium" and "high" risk with optimised category boundaries. Categorised variables were used in a multivariable model to predict adverse events using Partial Least Squares regression and performance reported by area-under-the-curve for receiver operating characteristics (AUCroc) and precision/recall (AUCpr). A pre-operative scoring system was developed from the model with scores and predicted peri-operative risk of an adverse event derived from the regression coefficients.

RESULTS

In total, 1366 consecutive children referred for investigation to GOSH National Pulmonary Hypertension Service were evaluated for eligibility with a final cohort of 93 children undergoing 152 cardiac catheterisations under GA. Mean (+/-standard deviation) age was 8.9+/-4.6 years and

weight 31.5+/-17.9 kg. Seven patients (4.6%) had complications (stridor on extubation n=1, 0.7%; cardiopulmonary resuscitation n=5, 3.3%; electrocardiographic changes n=3, 2.0%; death n=2, 1.3%) and 14 patients (9.2%) required escalation of care (vasoactive intravenous n=8, 5.3% or inhaled n=6, 3.9% therapies; increased post-operative respiratory support n=7, 4.6% or care level n=8, 5.3%). Younger age, right ventricular dysfunction or dilatation, and pulmonary or tricuspid regurgitation severity and maximal velocity were significant univariable predictors. A multivariable model was highly predictive of adverse events (AUCroc 0.83, 95% CI: 0.74–0.91, p=0.03; AUCpr 0.68, 95% CI: 0.40–0.77, p=0.006; baseline AUCpr 0.11) and a clinical scoring system developed from this model.

DISCUSSION AND CONCLUSION

Our data demonstrate that pre-operative echocardiography is a significant predictor of unplanned escalations of care and complications which may inform the consent and planning processes for children with idiopathic, familial or hereditary PAH undergoing GA for cardiac catheterisation.

References

1. Taylor CJ, Derrick G, McEwan A, Haworth SG, Sury MR. Risk of cardiac catheterization under anaesthesia in children with pulmonary hypertension. Br J Anaesth. 2007;98(5):657-61.

2. Beghetti M, Schulze-Neick I, Berger RM, Ivy DD, Bonnet D, Weintraub RG, et al. Haemodynamic characterisation and heart catheterisation complications in children with pulmonary hypertension: Insights from the Global TOPP Registry (tracking outcomes and practice in paediatric pulmonary hypertension). Int J Cardiol. 2016;203:325-30.

3. O'Byrne ML, Kennedy KF, Kanter JP, Berger JT, Glatz AC. Risk Factors for Major Early Adverse Events Related to Cardiac Catheterization in Children and Young Adults With Pulmonary Hypertension: An Analysis of Data From the IMPACT (Improving Adult and Congenital Treatment) Registry. J Am Heart Assoc. 2018;7(5).

4. R Development Core Team. R: A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing; 2010.