Research in pediatric cardiac anesthesia and intensive care in low- and middle- income countries and low resource settings: Challenges and opportunities

Around 1.35 million infants are born with congenital heart disease each year across the world.[1] Of these approximately 960,000 are born in low- and middle- income countries (LMICs) where pediatric cardiac surgery is not a public health priority. Ironically therefore, the majority of the world's infants and children with heart disease reside in LMICs, where facilities and resources for pediatric and infant cardiac surgery range from non-existent to moderately well developed. The disparity in demand and supply of pediatric cardiac care in LMICs leads to long waiting lists and overworked health care personnel in the few cardiac centers that exist.

Compounding the situation of having to deal with large volumes of patients is the reality that many infants and children present late for intervention with secondary issues like pulmonary vascular disease, ventricular dysfunction or severe polycythemia. In addition, many neonates and small infants with ductus dependent lesions not infrequently present with cardiovascular collapse. These secondary complications further stress an already resource crunched surgical program. This profile of patients is in stark contrast to the high-income countries (HICs) where ante-natal diagnosis or diagnosis at birth is the norm and a sizeable proportion of patients presenting to cardiac centers comprise of newborns for biventricular repair or for palliation of complex single ventricle physiology.

Rheumatic heart disease with multivalvular disease continues to be a challenge in many LMICs with many children again presenting late in the natural history with varying degrees of pulmonary hypertension and ventricular dysfunction. Some children with severe mitral valve disease also frequently present in pulmonary edema with circulatory compromise.

Thus, the profile of patients presenting for cardiac surgery or cardiac interventions is vastly different in our part of the world and other LMICs, providing a wealth of opportunity for novel therapeutic approaches, original research and publications particularly in the area of cardiovascular anesthesia and intensive care.

WHAT IS THE STATUS OF RESEARCH AND PUBLICATIONS FROM INDIA AND OTHER LMICS?

A detailed survey of publications and original research from India and other LMICs revealed a significant paucity of original work both in pediatric cardiac anesthesia and in pediatric cardiac intensive care.[2] This is in keeping with the observations of a recent paper that showed that overall pediatric articles from LMICs were few and comprised less than 10% of all pediatric publications when three standard pediatric journals with the highest Eigen factor scores were studied.[3] This paper also showed that the topics published from LMICs did not coincide or parallel the profile of disease patterns in LMICs, despite the fact that the LMICs bear the majority of the global pediatric disease burden in the world. Eigen factor score alludes to the number of times a published article is cited and is a ratio of the number of citations to the total number of articles. The paucity of research and publications from LMICs in peer reviewed journals both in pediatric cardiac anesthesia and in pediatric cardiac intensive care, thus mirrors that of the parent specialty - pediatrics.

WHY ARE THERE SO FEW PUBLICATIONS IN PEDIATRIC CARDIAC ANESTHESIA AND CARDIAC INTENSIVE CARE FROM LMICS?

There are several possible reasons – many of which are quite sobering and need careful reflection by all of us. Many pediatric cardiac surgical programs in India are grossly understaffed and are manned by one or two senior surgeons supported by one intensivist or an intensivist who also doubles as an anesthetist. Likewise, many programs have only one pediatric anesthetist, sometimes supported by an adult anesthetist. Surgical volumes are quite large in these compact programs and are usually in the range of more than 500-700 open heart surgeries annually. By and large the anesthetists and intensivists who are generally supported only by inexperienced junior resident and nursing staff are significantly overworked with clinical work often

exceeding 12 hours a day, leaving little or no time or energy for research or publications.

Many busy and productive programs which have good outcomes with sustained markers of quality manage to generate voluminous data which are unfortunately inadequately analyzed, because they do not have access to a statistics department or even a statistician. Useful and potentially powerful data thus goes waste. So, considerable useful information on late presenting heart disease remains unavailable to the rest of the world.

The International Quality Improvement Collaborative (IQIC) in congenital heart disease has addressed some of these issues by collaborating with many centers in LMICs to provide detailed outcome data from LMICs.[4,5] However, these remain largely outcome data with identified risk factors. They do not address the utility and relevance of cost-effective home-grown innovations e.g., for topical and highly relevant issues like polycythemia or late presenting children with transposition of great arteries and intact ventricular septum.

Many surgical programs with excellent outcomes utilizing indigenous strategies are today based in non-governmental institutions, which are considered "private". The challenges in this scenario for any form of prospective study are countless. Clinical research protocols demand very detailed and lengthy consent forms which arouse suspicion and concern in the average Indian parents' minds. In addition, the ethical committees have stringent regulations and require that families do not pay for any clinical service e.g., echocardiograms which is part of a prospective study, even if it is part of a routine follow up. The Ethics committees also are concerned about possible deaths in any prospective study with stipulations on how families will be compensated in such an event. These valid and relevant issues raised by the Ethics committee can deter the most enthusiastic academicians from venturing into potentially litigious situations. Additional challenges include growing but incomplete awareness of our challenging specialty which leads to increasing conflict of interests and significant dichotomy of priorities between the management, the clinicians, families, and the Ethics committee. The issue of research funding remains a genuine and valid challenge with most funding bodies reluctant to fund projects in nongovernmental organizations – many of which are considered to be non-academic and unworthy of receiving research grants.

Finally, many pioneers in intensive care and anesthesia who were keen to document and share their experiences have had well written papers rejected on the basis that data and experience from LMICs were not relevant to the rest of the industrialized world where the profile of patients is vastly different! After a few such attempts, the feeling has unfortunately crept in that the efforts to generate and analyze vast amounts of data after a long day's clinical work is possibly not worthwhile if it was going to be rejected on this basis. This feeling whether justified or not has led to cynicism and the feeling – why bother? An unfortunate but avoidable state of affairs where invaluable data and educational information useful for posterity is lost for all times to come.

We from India and other LMICs need to remember that we are at an interesting and unique situation in our journey of pediatric cardiac care. Two decades ago, there was little or no interest in what happens in our part of the world. On the other hand, today, many from HICs are more than willing to lend their time, thought processes and their names to work from our part of the world. Something for all of us to ruminate on....

IS THERE ANY HOME-GROWN SOLUTION?

It is important going forward to be self-reliant and not rely on personnel and institutions from HICs to support our work financially, lend authorship or otherwise. We need to also remember that the bulk of pediatric cardiac surgery is performed in nongovernmental organizations in our country with little or no access to academic funding or research facilities. Academic institutions with strong statistical departments can assist other programs which have no access to, this highly important and relevant service. The entire work can be collaborative and then we will truly be home-grown or made in India!

Both medical litigation and our subspecialty are in its infancy in our country. It is a fragile subspecialty which involves potentially expensive and relatively high-risk surgeries. It is also a specialty, which is still growing in many parts of our country. There is stigma and fear in families of children with heart disease and many do not disclose their child's condition to other extended family members. In this atmosphere of fear, suspicion, and inordinate expense, prospective studies with appropriate consenting might be challenging. Thus, any plan to conduct prospective studies especially randomized studies must be taken judiciously to avoid jeopardizing the growth of this vulnerable subspecialty.

In the interim, we need to encourage case series, especially if they are large and involve economical alternative successful therapies. These therapies could then become applicable across our country and other LMICs. Our final goal should be to encourage publication of home grown, low-cost alternative treatment options which can be applicable across our part of the world, to ultimately facilitate the growth of our specialty.

In this context, the two papers.[6,7] related to pediatric cardiac anesthesia published in this issue of the journal,

which is dedicated to 'research made in India' are interesting. Pathak P *et al.* looked at optimal ventilatory setting for children with ventricular septal defect. The pilot study suggested that ventilation with lower tidal volume and higher respiratory rate may be preferable in children with ventricular septal defect (VSD). In the second paper, the authors report their own institutional anesthesia protocol for bed-side duct ligation in pre-term neonates.[7] This is encouraging as the report is from a nongovernmental center focusing on a problem relevant to low-resource settings.

SO, WHAT THEN IS THE WAY FORWARD?

The last two decades have witnessed significant growth in pediatric and infant cardiac care in our part of the world, but the specialty still remains in its infancy in many parts of our country. There has been a phenomenal learning curve in many institutes and cardiac anesthesia and intensive care has evolved to a remarkable degree, such that many infants presenting late with significant systemic ventricular dysfunction and pulmonary hypertension have a relatively smooth perioperative course. However, the growth in our subspecialty has been lopsided with some units still having worrying levels of morbidity and mortality.

Is there a way forward, then? There always is a way forward, but that would involve greater synergy and collaboration between multiple institutions and departments with the ultimate goal of achieving equivalence in clinical care by learning from each other and helping each other grow. A synchronized growth in our subspecialties is imminently feasible if we pull together and if programs in our part of the world who have struggled for decades share their challenges and strategies with younger fledgling programs. In this manner, we in our land can both help each other and our specialty grow to phenomenal heights and teach each other the all-important lessons of self-sufficiency and indigenous innovation.

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