

## Perspective

### Current Status of Paediatric Cardiac Surgery in Pakistan

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#### Abstract

This study is aimed to assess current status of paediatric cardiac surgery in Pakistan regarding the available procedures, hospitals and number of patients being treated. Data was collected through related published articles on PubMed, Google Scholar, ResearchGate and hospital websites. Pakistan has a prevalence of approximately 60,000 births with Congenital Heart Diseases (CHD) each year. With a population of 200 million and only 17 paediatric cardiac surgeons in Pakistan, the current ratio is 0.08 surgeons / million for Pakistan. 3000-4000 paediatric cardiac surgical procedures are performed each year in Punjab, 1400-1500 surgeries per year in Sindh, some surgeries being performed in Khyber Pakhtunkhwa (KPK) while there is no such facility in Baluchistan, Azad Jammu & Kashmir (AJK) and Gilgit Baltistan. Children's Hospital Lahore performs about 1100 surgeries per year, Ittefaq Hospital (IHL) about 950, Armed Forces Institute of Cardiology Rawalpindi (AFIC) conducts about 900, University of Lahore Teaching Hospital Lahore (UOLTH) about 200 cases, National Institute of Cardiovascular Disease (NICVD) about 1500 and Agha Khan University Hospital (AKUH) about 400 cases per year. There is a huge patient load but a lack of resources as well as trained staff and infrastructure.

**Methods:** Publications were systematically searched on PubMed, Google Scholar and ResearchGate using the key words 'paediatric cardiac surgery', 'quality measures for paediatric cardiac surgery', 'paediatric cardiac surgery current status in Pakistan'. 31 articles were found related to our topic and were included. More over data was also collected from official websites of NICVD, Children Hospital Lahore and Pakistan Children's Heart Foundation (PCHF).

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#### Introduction:

#### Burden of Disease

Paediatric cardiac surgeons treat the congenital and acquired heart problems in children. Congenital heart diseases are the most common birth defects<sup>1</sup>. They refer to the structural or functional heart diseases which are present at birth<sup>2</sup>. The mean prevalence of CHD is 9.4 per 1,000 live births with the highest prevalence on the continent of Asia<sup>3</sup>. Ventricular Septal Defect (VSD) is the most common condition<sup>4</sup> whereas the commonest cyanotic

heart disease in neonates is Tetralogy of Fallot (ToF)<sup>5</sup>. Unfortunately, 90 % of the estimated 1.3 million children born with CHD annually do not have access to cardiac care<sup>6</sup>. Routine neonatal screening is not common in developing countries including Pakistan, as most births take place at homes and not recorded reliably; therefore, true birth prevalence of CHD cannot be calculated accurately. In western countries however, the pattern of CHD is well documented<sup>7</sup>. An early diagnosis of CHD leads to a better prognosis. It also provides an additional time for families to explore all possible options available<sup>8</sup>.

Every year, 60,000 babies are born with CHD in Pakistan<sup>9</sup>. Pakistan is a country with high fertility rate, so it has a significantly high number of children born with CHD and this imposes an additional burden<sup>10</sup>.

According to some statistics 11% Pakistani children die due to cardiac anomalies during first month of life<sup>11</sup>. With time, mortality due to CHDs has decreased in developed countries like USA and Canada. However, data from Asian countries shows that mortality is increasing.<sup>12</sup>

Poor access to cardiothoracic surgery in low and middle-income countries results in premature mortality, particularly in patients of rheumatic heart disease and congenital heart disease<sup>13</sup>. Out of 1 million children born with CHD in these countries, 90% have no access to affordable specialist surgical treatment.<sup>14</sup>

### **History of Cardiac Surgery in Pakistan**

Closed heart surgical procedures were started in Pakistan sporadically by local surgeons during 1950s. Open-heart operations were started by a Canadian born missionary, Dr. Donald Edward Bowes in 1967-1968 at United Christian Hospital Lahore<sup>15</sup>. Regular cardiac surgical program in public sector began when NICVD was established in Karachi in the early 1970s. Cardiac surgery was started again in Punjab at the Mayo Hospital Lahore in 1978. During the 1990s the trend was towards palliation initially and complete repair at later age. No neonatal or early infant surgery facilities were available. Greater focus was on adult cardiac procedures. Many patients went to India for surgery<sup>16</sup>. But the situation has changed significantly. Paediatric surgical services are now more readily available in Pakistan.

### **Paediatric Cardiac surgery in Pakistan**

When we take a look into the status of paediatric cardiac surgery in the world, it shows that one cardiac centre is present for a population of approximately 120,000 in North America. However, in Asia, one cardiac centre is present for a population of 16 million people. In Africa, the situation is even worse with one centre per 33 million people<sup>17</sup>. According to cardiothoracic surgery network, there are 0.52 (0-25.97) paediatric cardiac surgeons per million population globally. Disparities exist between different

continents. This ranges from 0.08 paediatric cardiac surgeons per million in sub-Saharan Africa to 2.08 paediatric cardiac surgeons per million in North America<sup>18</sup>.

With a population of 200 million and only 17 paediatric cardiac surgeons in Pakistan, the current figure is 0.08 paediatric cardiac surgeons / million for Pakistan. In Pakistan, 5 million babies are born each year. Among these there are approximately 60,000 new cases of CHD. Approximately 40 to 50% need an intervention / surgery in the first year of life. This has resulted in an overwhelming patient burden with more than 5000 patients on waiting list with 25-30 new cases being added to this patient pool each week.

In Pakistan, there are 16 Paediatric intensive care units (PICU) with a total of 155 PICU beds. This means there is one PICU bed for 500,000 children under 14 years of age<sup>19</sup>. The healthcare associated infections (HAI) frequency in PICU is around 7.9%. The relatively low incidence is due to strict adherence to institutional infection control policy, strict hand hygiene and 1:1 nurse-to-patient ratio in intensive care and high dependency areas.<sup>20</sup>

Pakistan is a developing country with limited resources, poor health facilities and a low Gross Domestic Product (GDP) per capita of \$1,284<sup>21</sup>. A large proportion of CHD cases appear in the families who cannot afford expensive procedures. A child with CHD has serious socioeconomic consequences for a family which in turn influences the accessibility, affordability and actual utilization of health facilities which are available<sup>22</sup>. Paediatric cardiac services are also quite expensive<sup>23</sup>. Cost of an open-heart procedure is around \$3500. Cost of Atrial Septal Defect (ASD) device is around \$3000. A study by Manu Raj et al. shows that one in two families with a child with CHD in India reported an overwhelming to high financial stress during their child's surgery and borrowed money during the course of treatment<sup>24</sup>. Pakistan has similar low socioeconomic situation and the families are often supported by Non-Governmental Organizations (NGO). Parents go through high mental stress levels during a child's treatment<sup>25</sup>.

Currently the procedures which are not being done in Pakistan are Hypoplastic Left Heart Syndrome (HLHS) and heart Transplant.

## Punjab

Punjab is the largest province of Pakistan with a population of 110 million. Around 3000- 4000 paediatric cardiac surgical procedures are performed each year in this province

### Following Hospitals have Cardiac Facilities:

Children Hospital & Institute of Child Health Lahore (CHL/ICH)

Ittefaq Hospital Lahore (IHL)

Armed Forces Institute of Cardiology Rawalpindi (AFIC)

University of Lahore Teaching Hospital Lahore (UOLTH)

Rawalpindi Institute of Cardiology Rawalpindi (RIC)

Punjab Institute of Cardiology Lahore (PIC)

Faisalabad Institute of cardiology Faisalabad (FIC)

Multan Children Hospital (MCH)

Faisalabad Children Hospital (FCH)

Wazirabad Institute of Cardiology (WIC)

Among these hospitals, only 4 hospitals (CHL/ICH, AFIC, IHL, UOLTH) have the facilities for neonatal cardiac surgery. Other cardiac setups deal with adult cardiac surgery only. MCH and FCH are merely providing outpatient services.

CHL & ICH is the largest hospital for paediatric cardiac surgery in Pakistan and second largest Children's hospital in Asia and the world with 23 sub-specialities<sup>26</sup>. This hospital conducts over 1100 cases of paediatric cardiac surgery each year. The paediatric cardiac surgery department was established in 1997 and consisted initially of 5 beds and 1 operating theatre. Today it consists of a 40-bed ward, 15 bed ICU and 3 operating rooms.

IHL performs over 950 paediatric cardiac surgical procedures per year, AFIC over 900 per year and UOLTH over 200 per year.

## Sindh

Sindh is the second largest populated province with a population of 48 million people.

The Paediatric Cardiology Department at NICVD was the first of its kind to be established in Pakistan

in 1984 and to be recognized by the College of Physicians and Surgeons in Pakistan (CPSP). It is the largest cardiovascular centre in the country. NICVD is currently working towards developing a separate paediatric cardiology unit which will be a centre of excellence for the treatment of congenital and structural heart diseases in the entire country<sup>27</sup>. The hospital has 4 surgeons, 2 fellows, 15 bed ICU with trained staff and conducts 1400 - 1500 CHD related surgical procedures per year. NICVD has opened 9 satellite centres across the province.

Agha Khan University Hospital (AKUH) conducts 400 paediatric cardiac surgical procedures each year. It has 3 surgeons and 5 beds in cardiac surgery intensive care unit (CSICU) dedicated to paediatric cardiac surgery.

Liaquat National Hospital is a new centre which is just starting.

## KPK

KPK has a population of 35.5million. There is no infant and neonatal cardiac surgery facility in the province. Most of the patients are adults/adolescents and children of more than 1 year.

### The Cardiac Centres are:

Lady Reading Hospital (LRH) Peshawar

Rehman Medical Complex (RMI) Peshawar

Pak Medical Complex Peshawar

## Baluchistan/AJK/Gigit-Baltistan

Baluchistan, AJK & GB with populations of 12.3 million, 4million and 1.2million have no cardiac surgery facilities.

The Pakistan Child Heart Foundation (PCHF) is a non-profit organization that was established in 2011 under section 42 of the Companies Law. PCHF provides monetary assistance to children born in poor families with congenital heart defects. Surgical procedures are either fully funded or subsidized. PCHF has supported 2036 surgical procedures till April 2020 with a cost of \$4.4 million and 4.62% mortality rate. One of the main goals of PCHF is the establishment of a 150 bedded specialized Children's Heart Hospital and Research Institute<sup>28</sup>.

According to an article of Jeffrey Phillip Jacobs et al., regarding quality measures for congenital and paediatric cardiac surgery, 21 quality measures should be followed by a paediatric cardiac surgery setup. This includes following. The setup should participate in a national database to contribute in the data regarding paediatric heart surgery and congenital heart surgery. Rounds should be conducted with teams composed of doctors from different disciplines. An institutional paediatric extracorporeal life support program should be available. There should be a significant surgical volume of paediatric and congenital heart cases: total programmatic volume and programmatic volume stratified by Five Society of Thoracic Surgeons-European Association for Cardio-Thoracic Surgery (STS-EACTS) Mortality Categories. The setup could hold a volume of eight paediatric and CHD operations. There should be preoperative planning with doctors of multiple disciplines. Quality Assurance and Quality Improvement Cardiac Care Conference should be held after every two months. Intra-operative trans-oesophageal echocardiography and epicardial echocardiography should be available. A schedule for administration for prophylactic antibiotics should be established. Use of an expanded pre-procedural and post-procedural “time-out”. Record of the occurrence of postoperative renal failure, neurological defect, arrhythmia or paralysis of diaphragm, need for postoperative mechanical circulatory support, unplanned re-operation and operative mortality stratified by the five STS-EACTS mortality categories for 8 benchmark procedures. Record of operations without any death or major complications.<sup>29</sup>

CHL/ICH is the first neonatal cardiac surgery setup in Pakistan which meets 17/21 of these requirements.

International Quality Improvement Collaborative (IQIC) was formed in low and middle-income countries in order to reduce morbidities and mortalities from CHD surgical procedures. Participating countries have shown a decrease in morbidity and mortality<sup>30</sup>. Amina Khan et al. compared the post-IQIC versus pre-IQIC period and stated that the number of cases with infections at the site of surgery and sepsis decreased. A slight decrease of mortality rate was also reported<sup>31</sup>. Henceforth, there is a need to improve the training of intensive care staff and the surgery facilities to lower post-operative mortality<sup>32</sup>. Health

related quality of life is low in post-operative CHD patients and even lower in patients with complex defects, re-operations and those who use medications<sup>33</sup>. Capacity building as well as use of more innovative and low-cost procedures is the key to success in dealing with the rising patient load of CHDs<sup>34</sup>.

### Conclusion:

Paediatric cardiac surgery in Pakistan suffers from lack of resources and government attention. On one hand patient load is increasing but on the other hand some provinces do not even have a paediatric cardiac surgery setup. Emphasis should be placed on the training of new doctors and para medical staff along with the establishment of infrastructure for paediatric cardiac surgery.

### Salient Points

- Pakistan has a very high burden of CHD in children partly due to a large population and high birth rate.
- Paediatric cardiac surgical facilities are exceedingly inadequate to meet this rising demand.
- CHL/ICH in Punjab and NICVD in Sind are becoming centre of excellence for paediatric cardiac surgery.
- Pakistan Child Heart Foundation and International Quality Improvement Collaborative have made tangible improvement in this area
- There is a dire need for significantly more investment in human resources and infrastructure of paediatric cardiac surgery to meet the needs of population.

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