

# Journal of Humanitarian Cardiovascular Medicine

Vol 1, No 1 (2022)

1st Issue



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doi: [10.12681/jhcv.30447](https://doi.org/10.12681/jhcv.30447)

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### To cite this article:

Kolwalkar, J., Agarwal, R., Borkar, S., Sunil, V. S., & Vijay, M. (2022). Review of sustainable Paediatric Cardiac Surgery Program based on Humanitarian Principles at Govt. Medical College, Goa. *Journal of Humanitarian Cardiovascular Medicine*, 1(1). <https://doi.org/10.12681/jhcv.30447>

## Review of sustainable Paediatric Cardiac Surgery Program based on Humanitarian Principles at Govt. Medical College, Goa

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### Keywords

Congenital heart disease, India, Goa medical college (GMC), Paediatric cardiac surgical care.

### Acknowledgments

We wish to thank Dr. Ravi Agarwal for agreeing to be an honorary consultant to conduct the paediatric cardiac surgical workshops at GMC and also for critically reviewing the manuscript

### Funding statement

The author has no relevant affiliations or financial involvement with any organization or entity with a financial interest in or conflict with the subject matter or materials discussed in the manuscript.

**Conflict of interest:** None.

## Abstract

**Introduction:** Paediatric cardiac surgery and paediatric cardiology Setup is an arduous task, in developing countries, like India. Access to advanced cardiac care is unavailable in the majority of developing countries. Due to high fertility rates in India, the annual estimate of CHD is approximately 150,000- 200,000 children per year. Of these, approximately a third to a quarter (~50,000) would need early intervention to survive the first year of life. Goa is a small state of India situated along the western coast of Indian peninsula. Goa medical college (GMC) is the only tertiary level institute, providing medical facilities in the state. There were no cardiology or cardiac surgical facilities available at GMC, prior to 2014. The cardiac surgical unit at Goa Medical College was started in April 2014. It provides cardiac surgical services free of cost to all the state's citizens. Initially, only adult cardiac surgical cases were being performed, but from September 2014, we initiated the paediatric cardiac surgical program, for which we availed the facility of a paediatric cardiac surgeon.

**Materials and Methods:** From 26<sup>th</sup> Sep 2014 to 11<sup>th</sup> Jan 2020, we operated on a total of 90 cases, - during 18 visits of the visiting paediatric cardiac surgeon, who operated an average of 5 cases per visit. Mean age of operated children was 3.2 years. We operated 34 cases of VSD's, 26 cases of TOF, 8 cases of Tricuspid atresia, 9 cases of ASD, 3 cases of MV repair, 1 case of ASD+PS, 5 cases of TAPVC, 3 PA banding & PDA ligation and one permanent pacemaker implantation. Patients were managed initially in a 5 bedded ICU and after extubation were shifted to a step-down ICU for further recovery.

**Results:** The average duration of ventilation was 36hrs and the average length of ICU stay was 5 days. Mean CPB time was 92.46 mins and mean aortic cross-clamp time was 59.5 mins. Overall mortality was 5.55%. One patient underwent a redo MV repair, as there was moderate residual MR in the post-operative period.

**Conclusion:** This model of cardiac surgical program has worked well for the state of Goa and has benefitted lot of people from within the state as well as neighbouring states, where easy and affordable access to cardiac surgical facilities are missing. It has produced excellent outcomes for adult cardiac surgery and has encouraged us to extend the facility to paediatric population. Gradually as our team has become self sufficient, we are able to achieve sustainable paediatric cardiac surgical model.

## Introduction

Goa is a small state of India situated along the western coast of the Indian peninsula. The “Escola Medico Cirurgica da Goa” was established in 1842 during the Portuguese rule and was re-named Goa Medical College in<sup>1</sup>.

Paediatric cardiac surgery and paediatric cardiology set-up is demanding, in India<sup>4</sup>. Access to advanced cardiac care is unavailable in majority of developing countries<sup>5</sup>. Due to high fertility rates in India, the annual estimate approximately 150,000- 200,000 children are born with CHD in India every year<sup>6, 10</sup>. Of these, approximately a third to a quarter (~50,000) would need early intervention to survive the first year of life<sup>7, 10</sup>.

Goa medical college (GMC) is the only tertiary-level institute, providing medical facilities in the state. There were no facilities for cardiology or cardiac surgery available at GMC, prior to 2014. The department of cardiac sciences was created by the government of Goa in February 2014. All the services here are provided, absolutely free of cost for the people of the state. The

govt. of Goa, appointed cardiologists and cardiac surgeons not on regular govt. employee’s terms, but as professional consultants, on contract with the govt, at a higher remuneration.

The cardiac surgical unit was started by a team of 2 cardiac surgeons, one anaesthesiologist and 2 clinical perfusionists. Initially only adult cardiac surgical cases were being performed, but from September 2014, we initiated the paediatric cardiac surgical program, for which we availed the facility of a visiting paediatric cardiac surgeon.

Department of cardiology was 18<sup>th</sup> Feb 2014. The cardiac surgery unit initially started performing adult cardiac surgeries like CABG, valve replacements, adult congenital heart surgeries, thoracic and vascular cases. Our annual case-load is about 500 pump cases (350 CABG’s, 120 Valve replacements and repairs and 30 congenital heart surgery cases) along with 200 vascular and 50 thoracic cases.

Paediatric cardiac surgery program was started in September 2014. We started calling a visiting paediatric cardiac surgery consultant, - who used



**Figure 1.** Picture of Escola Medico Cirurgica Da Goa, established under Portuguese in 1842, at Marquinez palace, Panaji<sup>2</sup>

to visit GMC, - once every 3 months, mainly over the weekends, for a total duration of 3 to 5 days.

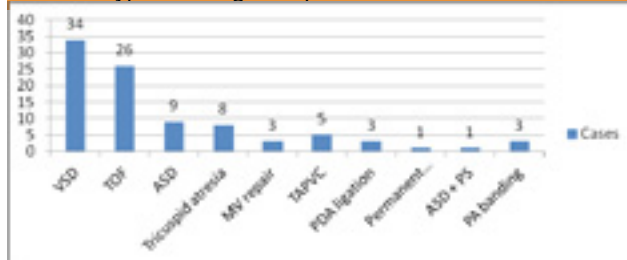
All the children with congenital heart disease were carefully screened, - pre-operatively by our in-house paediatric cardiologist and the prospective cases to be selected for the surgery were discussed in detail, - with the visiting surgeon prior to finalizing the operation list. In some cases where the 2D-echo data was inadequate, catheterisation studies and angiogram were done and shared with the visiting surgeon. He performed 4 to 6 open-heart surgeries during each of his visits. All the post-operative care was provided by the home team, with telephonic consultation with the visiting consultant in case of any doubts or difficulties.

### Materials and Methods

From 26<sup>th</sup> Sep 2014 to 20<sup>th</sup> Jan 2020, we operated 90 cases. During this time the consultant paediatric cardiac surgeon, - visited us 18 times. We operated an average of 5 cases per visit. The mean age of operated children was 3.2 years.

### Results

**Table 1.** Types of surgeries performed



All operated patients were initially managed in a 5 bedded ICU. Postoperative 2D echocardiograms were performed on all the children by our in-house paediatric cardiologist. After extubation, the children were shifted to a step-down ICU for further recovery.

**Table 2.** Operative details summary

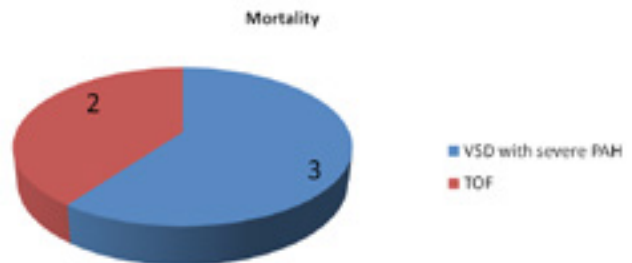
| Parameter                       | Outcome    |
|---------------------------------|------------|
| Average duration of ventilation | 36 hrs     |
| Average ICU stay                | 5 days     |
| Mean CPB time                   | 92.46 mins |
| Mean ACC time                   | 59.5 mins  |
| Overall mortality               | 5.55%      |

### Mortality

We had a total of 5 deaths. Two patients with TOF, developed severe RV dysfunction and low cardiac output in the postoperative period. One patient of VSD, - developed tension pneumothorax, - with mediastinal shift and hemodynamic compromise. Two patients of VSD with severe PAH developed pulmonary hypertensive crisis; with a low cardiac output state.

These children were low birth weight; with severe malnourishment. These mortalities occurred during the budding stages of our paediatric cardiac surgical program. Our institute does not have inhaled nitric oxide facilities. Our post-operative cardiac ICU is being managed by the anaesthesiologists, who are more used to routinely see adult cardiac surgical patients.

**Figure 2.** Pie-chart showing mortality data



### Morbidity

Neurological deficits were seen in 3 patients. One patient post TAPVC repair had seizures in the post-operative period and two patients following VSD repair have neurological deficits, which are gradually improving with physiotherapy. All of these patients are following up with physiotherapy at the paediatric neuro-rehabilitation centre at GMC.

One patient of mitral valve repair had to undergo a redo MV repair, as there was significant (moderate) residual MR in the post-operative trans-thoracic 2D-echocardiogram. We do not have paediatric TEE facilities.

### Discussion

The sustainability of a cardiac surgical program depends on 3 factors:

1. Adequate number of patients,
2. Uninterrupted funding and
3. A capable surgical team.

### **An adequate number of patients**

At Goa medical college, we do not have a dearth of patients.

We not only provide services to the entire state of Goa, but also cater to the adjacent states of southern Maharashtra and northern Karnataka, from where numerous people who come to the institute are below the poverty line and do not have access to avail cardiac surgical facilities in view of prohibitive costs of the procedures. We have a waiting list for our elective cases, running for over 2 weeks.

### **Uninterrupted funding**

Regarding the availability of funds, the govt. of Goa has been kind enough to support the cardiac department right from its inception. It has been sponsoring the program wholeheartedly with no limitation of funding.

### **Local cardiac surgical team**

We have a regular adult cardiac surgical program, running successfully at GMC for the last 7 years. A cost-effective method for skill acquisition is to engage a cardiac team from a good cardiac centre to work with the local team continuously until skill transfer is achieved<sup>3</sup>. We require the assistance of a visiting paediatric cardiac surgeon only for performing surgeries for complex congenital heart defects. Initially we used to call a visiting perfusionist as well, for a period of up to one year. Gradually our in-house perfusionist has become well trained to handle all types of congenital heart surgeries, including babies less than 5 kgs of weight.

Our team has also grown during this period. We have appointed one more junior consultant cardiac surgeon, two consultant cardiac anaesthesiologists, six new cardiologists, three more clinical perfusionists and more nursing staff in the operation theatre and ICU. All the team members with the support staffs work round the clock to provide comprehensive care and support in the peri-operative period.



**Figure 3.** Map of India showing the location of the western state of Goa and its relationship with the adjacent states<sup>3</sup>

The pediatric cardiac surgical emergencies which were duct-dependant cyanotic congenital heart lesions were managed by duct stenting by our cardiologists. Other complex congenital defects like obstructed TAPVCs, TGA, Defects requiring a conduit or homograft for reconstruction were referred to higher centres outside the state. From February 2014 to January 2022, we have referred 37 cases to a higher cardiac centre, outside the state. This paediatric cardiac surgical program has enabled the post graduate resident doctors from the departments of General surgery, Paediatrics and Anaesthesiology to get exposed to various surgical options available for congenital heart diseases and to get trained in the peri-operative management of babies which are operated for congenital heart problems.

As there were no cardiac surgical facilities before 2014, the department of paediatrics used to refer all such patients to metropolitan cities of other states like Bangalore or Mumbai. One-third of the children suffering from congenital heart disease within the state used to go to other states to get operated. However a large majority, - belonging to a poor socio-economic status never travelled, due to financial and logistic constraints. This model of cardiac surgical program has worked well for the state of Goa and has benefitted a lot of people from within the state as well as neighbouring states.

Our cardiac surgical team is capable of taking ICU care and handling post-operative complications. Our surgical team has been doing adult surgeries and only needed some assistance in handling small babies. There are different specialities & super-specialty services available at GMC, - for cross consultation and providing backup. Our cardiac anesthesia team was comfortable in handling small babies' right from the beginning and have been competently taking care of these cases during the intra-operative and post-operative period.

## Conclusion

Gradually, our local surgical team has become trained in performing various types of paediatric cardiac surgical procedures and we have been performing them regularly.

Sustainability cannot be achieved if a team is not locally self-sufficient and remains completely dependent on visiting (cardiac surgical, anaesthesia and perfusion) teams at all times. Gradually as our team has become self-sufficient, we are able to achieve a sustainable paediatric cardiac surgical model.

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