

Implementation of open-heart surgery in dong nai general hospital: Preliminary results

Le Trung Duc Tai¹, Nguyen Cong Tien¹, Nguyen Anh Dung², Nguyen Thai An³, Vo Tuan Anh¹

ABSTRACTS

Introduction: Implementation of open-heart surgery in local hospitals might be necessary to help economize the treatment, improve the quality of the local medical staff and unload central hospitals. Since 2018, Dong Nai General Hospital, such a program with the assistance from Cho Ray Hospital. After 4 years, a research was conducted to assess the efficacy of this program

Methods: We retrospectively evaluated the efficacy of the cardiac surgery program in Dong Nai general hospital. Demographic characteristics, the preoperative cardiac lesions, comorbidities, early postoperative results, mid-term outcome were collected and analyzed.

Results: From May 2018 to May 2022, a total of 62 patients underwent cardiac surgery at Dong Nai General Hospital. 33.9% were male, mean age was 45.6 ± 15.5 . 47 cases were operated in the first phase and 15 underwent surgery in the second phase. The overall short-term mortality was 1.6% (1 patient), early complications rate was 9.7%. These complications did not lead to prolonged sequelae.

Conclusion: Implementing cardiac surgery program in Dong Nai General Hospital under the assistance of Cho Ray hospital was proved safe and efficient in terms of short-term result. The success of this program should encourage other regional hospitals to start a new field and

ameliorate the capacity of local healthcare system.

Keywords: Cardiac surgery, open-heart surgery, implementation, regional hospital

INTRODUCTION

Cardiovascular disease (CVDs) remains one of the leading causes of death globally. In 2016, The World Health Organization (WHO) estimated that 17.9 million people died from CVDs, accounting for one-third of deaths worldwide [3].

Approximately one million cardiac surgeries are performed every year, in roughly 4000 centers. Most of the centers are located in big cities ^{(1), (2)}. The situation in Vietnam is not different, with most cardiac surgery centers are in big cities, distributed evenly in Ha Noi, Hue and Ho Chi Minh city. The reason for this distribution is due to cardiac surgery characteristics: This type of surgery demand high technologies, well-trained staff, including doctors and nurses in order to provide a good outcome. Moreover, surgical equipment, the need of a larger operating

1. Thoracic and Cardiovascular Surgery Department – Dong Nai General Hospital

2. Thoracic and Cardiovascular Surgery Department – Tam Anh General Hospital

3. Cardiac Surgery Department – Cho Ray Hospital

*Corresponding author: Vo Tuan Anh

Email: dranhuanvo@gmail.com - Telephone: +84908520016;

02 Dong Khoi, Tan Hiep Ward, Bien Hoa City, Dong Nai Province, VN

Received: 26/06/2022 - Accepted: 20/07/2022

theater and a proper postoperative cardiac Intensive care unit (ICU) have made the investment for such a program very expensive. As a result, this is not affordable for many regional hospitals in Viet Nam and it localizes cardiac surgery centers in big cities. The situation itself created difficulty in treatment accessibility for patients, particularly poor ones and overloaded central hospitals.

Therefore, the implementation of open-heart surgery in local hospitals might be necessary to help economize the treatment, improve the quality of the local medical staff and unload central hospitals. Since 2018, Dong Nai General Hospital, a provincial hospital in the Southeast region, has established an open-heart surgery program with the assistance from Cho Ray Hospital. After 4 years, we conducted a research to assess the efficacy of this program.

MATERIALS AND METHODS

1. Study population

Patients underwent cardiac surgery at Dong Nai General Hospital from May 2018 to May 2022.

2. Study method

We retrospectively evaluated the efficacy of the cardiac surgery program in Dong Nai general hospital.

Demographic characteristics, the preoperative cardiac lesions, presence of comorbidities, early postoperative results, mid-term outcome were collected and analyzed. Early mortality was defined as death occurring within the first postoperative 30 days. Data was analyzed using SPSS 18.0.

3. Operative techniques:

In full sternotomy patients, conventional cardiopulmonary bypass (CPB) was set up: Bicaval and ascending aorta cannulation was

performed in patients with mitral valve disease, tricuspid valve diseases and other diseases requiring an atriotomy; single double-staged atrial cannulation was indicated in aortic valve replacement and on-pump coronary artery bypass graft (CABG) surgery. However, off-pump CABG (OPCAB) was routinely used for our patients. Mitral valve replacement was performed with

In right thoracotomy cases, the patient was placed on the supine position with a cushion under the right shoulder. Cardiopulmonary bypass (CPB) was set up with cannulation of the right femoral vessels. A 5 cm skin incision was made parallel to the anterior axillary line and a video camera was inserted through a 5 mm port in the third right intercostal space. The Chitwood aortic cross-clamp was inserted and aortic clamping was performed. Custodiol HTK solution was delivered antegradely into the aortic root and was repeated every 120 minutes if necessary. A left atriotomy is performed and a left atrial retractor was used to expose the mitral valve. We then assessed the mitral valve for the feasibility of repairing. In this series, hence, mitral valve replacement was performed with a mechanical valve or a tissue valve. We preserved the posterior leaflet whenever possible, even in rheumatic patients. Pledgeted sutures were placed on the atrial side of the annulus and the valve was replaced in usual manners. Transesophageal Echocardiography (TEE) was used to control the result of the operation.

In ministernotomy cases, the patient is placed in the supine position with hands along the body as in conventional cardiac procedures. After induction with general anesthesia, transesophageal echocardiography (TEE) is routinely performed.

After positioning and draping the patients, the self-retaining retractor is set up before incision at the top of the table. This retractor consists of blades in different sizes to fit the patients. Before the ministernotomy, we expose the femoral vein, usually on the right side, using a small incision (2 cm) at the groin, and place a purse string on the vein. The femoral vein size is sufficient for inferior vena cava cannulation, and provides adequate venous return. We perform a 7 cm skin incision, starting at the lower border of the manubrium of the sternum and extended to nipple line. Subcutaneous tissue and the pectoralis major muscle are dissected using electrocautery. The sternum is divided in the midline and extended cephalad using an oscillating saw. The skin at the top of the incision is retracted using two Army/Navy retractors and the sternotomy is further extended using a Mayo scissors. By using an inverse J sternotomy with the extension to the right border of the sternum, one can reduce the bleeding from bone fracture when retracting the sternum during the operation. A subtotal or total thymectomy is routinely performed, and several pericardial traction sutures are used to enhance the exposure of the aorta, the superior vena cava, as well

as the pulmonary artery. Autologous pericardial patch is harvested and treated with glutaraldehyde. The ascending aorta is cannulated using a straight arterial cannula. The superior vena cava is cannulated directly, and the lower body venous return is drained by a long femoral cannula advanced from the groin. The femoral cannula is advanced just below the RA, and both vena cava are snared to restrict blood draining into the RA. Cannulation is facilitated by retracting the self-retaining retractor to further expose the aorta and the superior vena cava. In this case, the doubly committed ventricular septal defect (VSD) was approached via the pulmonary arteriotomy. The right sinus of Valsalva was prolapsed through the VSD but was intact on direct examination. We closed the VSD with autologous pericardial patch using continuous running sutures at the lower border and pledgeted sutured at the upper border, where the VSD directly fused with the pulmonary valve.

All of the surgeries were performed under general anesthesia using the standard protocol of Cho Ray hospital. 40 first cases were performed by Cho Ray hospital and the last 16 cases were performed by Dong Nai General Hospital’s team.

RESULTS

From May 2018 to May 2022, a total of 62 patients underwent cardiac surgery at Dong Nai General Hospital. Patient’s demographic data are presented in Table 1.

Table 1. Demographic variable of the patients.

Variables	Number	Percentage
Total procedure	62	100%
Sex (Male)	21	33.9%
Mean age	45.6 ± 15.5	
Hypertension	24	38.7
Diabetes	9	14.5
Dyslipidemia	22	35.4
Smoking	12	19.3

Surgical types are presented in Table 2 and table 3. There are 47 patients operated in phase 1 and 15 patients underwent surgery in phase 2 until May 2022.

Type of surgery	Number	Phase 1 (n=47)	Phase 2 (n=15)
ASD closure	13	11	2
VSD closure	6	5	1
Atrial myxoma	2	2	0
Aortic valve replacement	4	3	1
CABG	7	2	5
Mitral valve replacement	19	14	5
Mitral valve repair	8	7	1
Double valve replacement	1	1	0
Valvular surgery + CABG	2	2	0
Maze (additional procedure)	4	4	1
Tricuspid valve repair (additional procedure)	24	19	5

*ASD: Atrial septal defect; VSD: Ventricular septal defect; CABG: Coronary artery bypass graft; CPB: Cardiopulmonary bypass

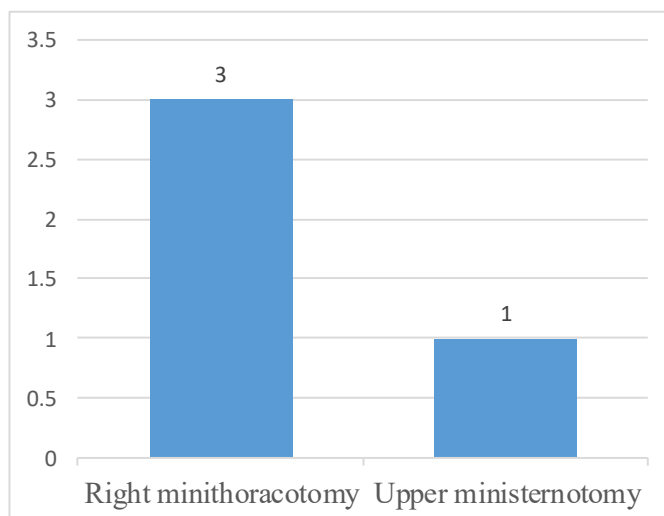
Early post operative data was shown in table 3

Table 2. Early postoperative data

Parameters	Value
Mean CPB time (minutes), with OPCAB excluded	126.5 ± 62.1
Mean cross-clamped time (minutes), OPCAB excluded	82.4 ± 26.2
Mean ventilation time (hours)	14.6 ± 6.3
Mean ICU time (days)	1.6
Mean postoperative time (days)	8.3

Of 62 cases underwent surgery, 4 cases were operated with minimally invasive approach. These consists of 1 ASD closure, 2 mitral valve replacements and 1 VSD closure. Chart 1 showed the approaches used in minimally invasive surgery.

Chart 1. Approaches in minimally invasive surgery



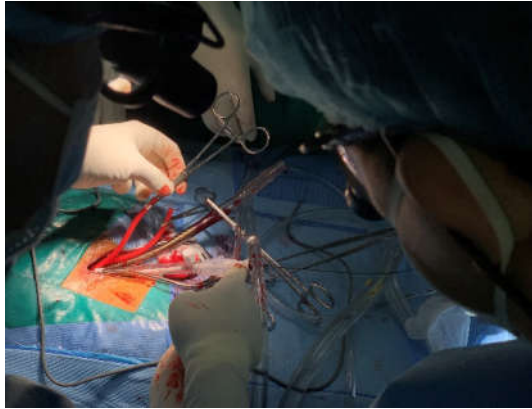


Figure 1. Femoral cannulation in minimally invasive mitral valve replacement

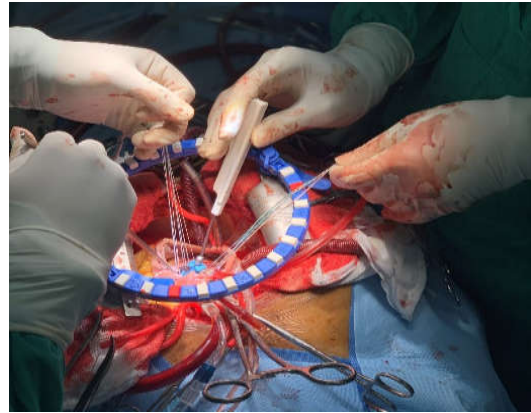


Figure 2. Full sternotomy mechanical mitral valve replacement



Figure 3. Ministernotomy incision



Figure 4. Surgeon from Cho Ray hospital helped Dong Nai's team performing minimally invasive mitral surgery

Early postoperative complications are displayed in Table 3.

Table 3. Early postoperative complications

Complications	Phase 1 (n = 47)	Phase 2 (n = 15)
Pneumothorax	1	0
Pericardial effusion requiring drainage	3	0
Reoperation due to bleeding	1	1
Early death	1	0

There was one reoperation due to bleeding in a CABG patient, the bleeding was caused by a small tear on the native coronary artery and was stopped with Biogluce and compression. This patient was discharged uneventfully after 14 days.

Three patients, including two ASD closure and one mitral valve replacement, developed postoperative tamponade requiring surgical drainage. One patient had pneumothorax (1.8%) after removal of the pleural drainage.

Early mortality was 1.6% (1 patient). This is a patient in phase 1 with mitral valve replacement and tricuspid valve repair, the surgery had gone uneventfully, the was extubated on postoperative day (POD) 1 and transferred to the ward on POD 3. On POD 7, he developed a respiratory failure with a massive hemothorax, the patient was transferred to Cho Ray Hospital, where he was reexplored for hemostasis, his condition worsened later and the patient passed away on POD 10.

Other patients were treated successfully and discharged uneventfully.

DISCUSSION

- With the developing of the economy, early detection of cardiac diseases requiring surgery has increased dramatically in the recent years. Hence, the burden on big cardiac surgeries centers in Ho Chi Minh city was becoming higher and higher. The situation creates a demand of new cardiac surgery team in Ho Chi Minh city as well as regional local hospital in order to unload central hospitals. To meet the demand, Dong Nai General Hospital established the cardiac surgery program, with the help of Cho Ray hospital. The project was outlined in 2013, after the contract negotiations the first pioneers were sent to Cho

Ray hospital in 2015 to start learning. After three years of training in Cho Ray hospital, the first case was performed in 2018, this marked the new milestone for the program, from training in a big center to operating a local team with the help of consultants.

- The first phase was completed in 2020 with 40 patients operated, a low mortality of 2.5% (1 patient) and complications rate as low as 12.5% was recorded. Based on this results, Cho Ray hospital had signed off the contract, giving Dong Nai General Hospital the right to perform simple cases independently.

- In 2021, to make a further step, Dong Nai General Hospital signed another contract with Cho Ray hospital in order to develop minimally invasive cardiac surgery and complex cardiac surgery. This contract consists of another 40 patients with more complex cardiac lesions, e.g: Double valve or triple valve disease, valvular disease in combination with coronary disease, aortic disease... This phase aimed at making simple surgery routine and develop further techniques for the local team. So far, we performed 16 cases since the beginning of the phase.

- The benefit in conducting a cardiac surgery program in a tertiary hospital like Dong Nai General hospital consists of:

- Unloading central hospitals in Ho Chi Minh city.
- Lowering the cost of cardiac surgery.
- Improve the professional capacity of our hospital, a regional hospital.
- Improve the cardiac surgery capacity of the whole country, and increase the numbers of patients operated per 1 million people

According to a thorough research of cardiac surgery situation in poor region, a large gap exists for access to cardiovascular services in developing countries ⁽³⁾. In developed countries such as North America, Australia, and Europe, the average number of cardiac surgical cases performed was 860 per 1 million people as of 2008. On the other spectrum, in developing countries such as South America, Asia, and Africa, the average number of cardiac surgical cases performed was 60 per 1 million people. Therefore, 93% of people who require cardiac surgery living in developing countries, an estimated 4.5 billion people total, do not have access to treatment ⁽⁴⁾. For example, as of 2010 data from South America, 138 cardiac centers exist, equating to one center for every 2.9 million people, performing an average of 42 operations per million people ⁽⁵⁾. The need for cardiac surgical centers in developing countries and underserved areas of the world is critical to help ease this gap in care. Successful cardiac programs will benefit local patients and economies, and support teams from central hospitals will provide long-term educational commitment and support until the centers reach their full independence ⁽⁶⁾. These numbers and opinion therefore support our cardiac surgery program in a regional hospital.

In our experience, conducting such a program have both advantages and disadvantages

The advantages include:

- The strong supports of the director board and functional departments in solving administrative issues
- The commitment and large contributions from Cho Ray hospital

- The motivation of a young cardiac surgery team

- The good initial results create an inspiration for the whole program

- The number of patients requiring cardiac surgery was increasing gradually as the program developed

- The hospital infrastructure is new and the equipment as well as medical machines are modern and ready to use.

However, despite of the advantages, we still encountered some obstacles during the implementation of the program, these disadvantages consist of:

- The income in public hospitals is still low compared to private ones. This lead to one of the biggest problems: Well-trained employees quit their job and move to private sectors where they get a better salary

- The geographical distance between Bien Hoa City (Dong Nai Province) and central hospitals in Ho Chi Minh Center is quite short, thus making it hard to persuade patient to stay and to be operated at Dong Nai General Hospital. As a result, the number of patient at the initial phase was quite low, the reputation of local cardiac surgery will increase gradually within years, in the condition that the program should develop well enough.

- Consumable supplies are more difficult to find

- Low coverage of insurance causing high price of procedure, this prevents poor patients from accessing cardiac surgery in an appropriate time. Therefore, these patients usually have poorer condition of the disease.

Our results showed a favorable short-term outcome, with low mortality and an acceptable rate of complications. The complications did not have prolonged sequelae, all the patients recovered uneventfully after solving the problems. These results are encouraging for our team to continue consolidating the program and bringing benefit to our patients.

CONCLUSION

In conclusion, implementing cardiac surgery program in Dong Nai General Hospital was proved safe and efficient in terms of short-term result. The process was difficult at the beginning with both advantages and disadvantages, but it grew gradually as time went by and was becoming more and more important. The success of this program should encourage other regional hospitals to start a new field and ameliorate the capacity of local healthcare system.

REFERENCES

1. Saxena A (2012). Strategies for the improvement of cardiac care services in developing countries: what does the future hold?, *Future Cardiol.* 8(1):29-38.
2. Hoffman J (2013). The global burden of congenital heart disease, *Cardiovasc J Afr.* 24(4):141-5.
3. Mocumbi A O (2012). The challenges of cardiac surgery for African children, *Cardiovasc J Afr.* 23(3):165-7.
4. Akomea-Agyin C, M Galukande, T Mwambu, S Ttendo, and I Clarke (2008). Pioneer human open heart surgery using cardiopulmonary by pass in Uganda, *Afr Health Sci.* 8(4):259-60.
5. Sandoval N, C Kreutzer, M Jatene, T D Sessa, W Novick, J P Jacobs, P L Bernier, and C I Tchervenkov (2010). Pediatric cardiovascular surgery in South america: current status and regional differences, *World J Pediatr Congenit Heart Surg.* 1(3):321-7.
6. Reichert H A and T E Rath (2017). Cardiac Surgery in Developing Countries, *J Extra Corpor Technol.* 49(2):98-106.