

# Establishing Cardiac Surgery in Eastern Nepal: Early Results

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## ABSTRACT

**Background:** Only few dedicated cardiac centres provide cardiac surgery service in Nepal. We are the only government affiliated centre outside the capital providing this service. In this study, we aim to present our early results of cardiac surgery.

**Methods:** This retrospective study was conducted at B P Koirala Institute of Health Sciences with objective of analysing the early results of cardiac surgery in the patients operated from July 2016 to March 2017. The data were analysed for patient demographics, type of surgery and cardiac disease, mortality, hospital and intensive care unit stay, valve related complications.

**Results:** Total 51 major cardiac surgeries (42 on pump and nine off pump) were performed. There were 27 (53%) males and 24 (47%) females with median age of 36 years (range: 1 to 70 years). The cardiac diseases consisted of 28 rheumatic heart disease, 12 congenital heart diseases, five coronary artery disease, five chronic constrictive pericarditis and one left atrial myxoma. The mean cardiopulmonary bypass and cross clamp times were  $106 \pm 35$  and  $80 \pm 26$  minutes respectively. The mean intensive care unit and hospital stay was  $4 \pm 2$  and  $8 \pm 3$  days respectively. Two (4%) patients required re-exploration for mediastinal bleeding. There was no prosthetic valve thrombosis or infection. Two patients (4%) had superficial wound infections. There were four (7.8%) in hospital mortalities. Remaining 47 patients (91.8%) are in NYHA class I after mean follow up duration of five months.

**Conclusions:** Our early result of cardiac surgery is encouraging and has established the safety and feasibility of starting open heart surgery in other parts of Nepal.

**Keywords:** CABG; cardiac surgery; congenital heart disease; early results; RHD.

## INTRODUCTION

Cardiovascular disease is a major health burden and leading cause of mortality worldwide.<sup>1</sup> It accounts for significant proportion of non communicable disease (NCD) in Nepal.<sup>2,3</sup> With advancement in medical technology, many cardiac diseases are now surgically treatable. In Nepal, Rheumatic valvular heart disease (RHD), congenital heart defects (CHD) and coronary artery disease (CAD) are major cardiac diseases treatable with surgical intervention.<sup>4,6</sup> Due to inequitable distribution of health facilities, surgical treatments for these cardiac diseases are still not available to significant proportion of population in Nepal. Only few dedicated tertiary centres of the capital city provide cardiac surgery in Nepal.<sup>7,8</sup> We recently started our cardiac surgery program at B P Koirala Institute of Health Sciences (BPKIHS) in Eastern Nepal. BPKIHS is the only government affiliated centre providing this

service outside the capital city of Nepal. Here we aim to present our early results and share our experience in establishing this service as well as discuss the challenges that are needed to overcome in its further development.

## METHODS

The hospital records of all patients undergoing major cardiac surgery (both on pump and off pump) in department of surgery at BPKIHS from July 2016 to March 2017 were reviewed for preoperative, intraoperative and postoperative data. Telephonic interview and/or interview at the last outpatient visit was done to assess the postoperative functional class. The study protocol was duly approved by institutional review committee of BPKIHS hospital where the study was conducted (IRC/0986/017). The data collected included age, sex, type of cardiac disease, type of surgery, cardiopulmonary bypass details, postoperative complications, length of hospital and intensive care

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unit(ICU) stay, in hospital mortality/morbidity, and prosthetic valve related morbidities. Data were entered and analysed in SPSS for windows version 21.0 (SPSS Inc., Chicago, Ill). Descriptive analysis was performed and data are presented as mean ± standard deviation for continuous variables or median and ranges for skewed variables. Total count and percentages are reported for discrete variables.

**RESULTS**

Total 51 cardiac surgeries were performed in ten months period, out of which 42 (82.3%) were on pump cardiac surgeries requiring cardiopulmonary bypass (CPB) and nine (17.7%) were off pump cardiac surgeries not requiring CPB (five total pericardectomy and four patent ductus arteriosus ligation). There were 27 males and 24 females

(M:F- 1.13:1) with mean age of 36±19 years (range:1 to 70 years) (Table 1). Majority of heart surgeries were for rheumatic valvular heart disease (RHD) followed by congenital heart defects (CHD), coronary artery disease (CAD) and chronic constrictive pericarditis (CCP) (Figure 1). Two cases of rheumatic valvular heart diseases were having infective endocarditis. The meanCPB and cross clamp time were 106 ±35 and 80±26 minutes respectively for all on pump cardiac surgeries. The meanIntensive care unit (ICU) and hospital stay were4±2 days and 8±3 days respectively. There were overall four (7.8%) early (inhospital) mortality, three in valvular heart disease group and one in a CCP group. All surviving 47 (92.2%) patients are in regular follow upand are in NYHA class I. The preoperative characteristics and types of cardiac surgeries performed in each group of patients are presented in Table 1 and 2 respectively.

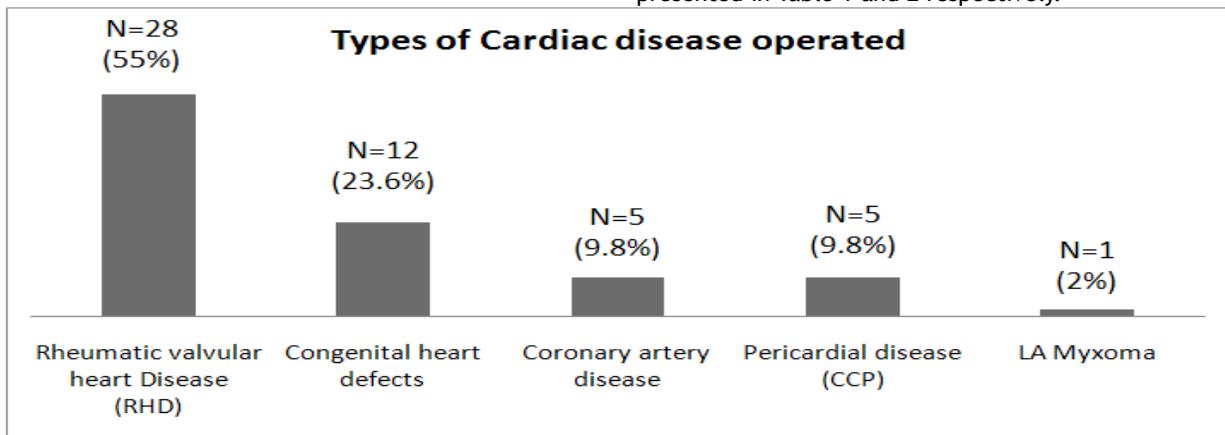


Figure 1. Types of Cardiac disease operated.

Table 1. Baseline characteristics of all patients.

Variable	All Groups (N=51)	RHD (N=28)	CHD (N=12)	CAD (N=5)	CCP +LA myxoma (N=5 +1)
Age (years ±SD)	36±19	39±16	19±15	60±6	39±16
Sex (M:F)	27:24	13:15	9:3	2:3	3:2
LV Dysfunction, N (%)					
Normal (≥55%)	16(31.3)	2(7.1)	12(100)	-	3(50)
Mild (EF 45-54%)	14(27.5)	8(28.6)	-	2(66.6)	3(50)
Moderate (EF 36-44%)	19(37.2)	16(57.1)	-	3(33.4)	-
Severe (EF≤35%)	2(4)	2(7.1)	-	-	-
Atrial fibrillationN (%)	22(43.1)	20(71.4)	2(16.6)	-	-
NYHA Class, N (%)					
Class 1	5(9.8)	1(3.6)	2(16.6)	1(33.3)	1(16.7)
Class 2	30(58.8)	15(53.6)	10(83.4)	3(33.4)	2(33.3)
Class 3	13(25.5)	10(35.7)	-	1(33.3)	2(33.3)
Class 4	3(5.9)	2(7.1)	-	-	1(16.7)

Co-morbidities					
COPD	4(7.8)	3(10.7)	-	1(33.3)	-
Hypertension	11(21.6)	4(14.3)	1(8.3)	5(100)	1(16.7)
Type 2 DM	4(7.8)	1(3.6)	-	2(66.6)	1(16.7)
Liver Dysfunction	3(5.9)	2(7.1)	-	-	1(16.7)
Hypothyroidism	1(2)	1(3.6)	-	-	1(16.7)
Tuberculosis	5(9.8)	-	-	-	5(83.3)
Surgery, N (%)					
Routine	46(90.2)	25(89.3)	12(100)	4(80)	5(83.3)
Urgent	4(7.8)	2(7.1)	-	1(20)	1(16.7)
Emergent	1(2)	1(3.6)	-	-	-
ICU stay(days)	4±2	4±2	2±0.5	5±1.5	4±1.6
Hospital stay(days)	8±3	9±2	6±2	12±1.4	8±2
Early Hospital deaths, N (%)	4(7.8)	3(10.7)	-	-	1(16.7)

Table 2. Types of Cardiac Surgery performed.

Type of disease	N(%)	Type of surgery performed	N (%)
Valvular Heart disease (All rheumatic etiology)	28 (55%)	Mitral valve replacement (MVR)	10(35.7)
		Mitral valve replacement (MVR)/ +TV repair	8(28.6)
		Double valve replacement(DVR) ± TV repair	5(17.8)
		AVR + Mitral Valve repair	2(7.1)
		MVR + TV Repair + ASD closure	1(3.6)
		Aortic valve replacement (AVR)	2(7.1)
Congenital heart disease	12 (23.6%)	Atrial septal defect(ASD) closure	5(41.7)
		ASD closure + Pulmonary valvotomy	2(16.7)
		Patent ductus arteriosus (PDA) ligation	4((33.3)
		Cortriatriatum repair	1(8.3)
Coronary artery disease	5 (9.8%)	Coronary artery bypass surgery 3 Grafts	3(60)
		4 Grafts	2(40)
		Chronic constrictive pericarditis	5 (9.8%)
Others	1(2%)	LA Myxoma excision	1(100)

A total of 28 (55%) patients underwent open heart surgery for valvular heart disease (Table 3). The etiology was RHD in all patients. The mean age was 39 ±16 years, ranging from 12 to 69 years. Out of 28 patients, 19 underwent isolated mitral valve replacement (MVR), two isolated aortic valve replacement (AVR) and seven double valve surgery [five double valve replacements (DVR) at aortic and mitral position and two AVR with Mitral Valve (MV) repair]. Twelve patients (nine in isolated MVR and three in DVR) had additional procedure of tricuspid valve (TV) repair ( Double De Vega's tricuspid annuloplasty) for

severe tricuspid regurgitation or tricuspid annulus >40 mm. All patients received mechanical heart valve at both aortic and mitral position. Rigid rings were used for MV repair. All patients had some form of mitral valve chordal preservation during MVR and left atrial appendage (LAA) was ligated routinely in all patients. A total of 10 patients had total chordal preservation, eight had posterior chordal, two had partial chordal and four had basal chordal preservation. Eight patients were having LA/LAA clot. Atrial fibrillation was present preoperatively in 20 (71.4%) patients, out of which

eight patients reverted to sinus rhythm and 12 patients remained in atrial fibrillation till last follow up.

The average CPB time and cross clamp time were  $109 \pm 28$  and  $83 \pm 28$  minutes respectively. Two (7%) out of 28 patients underwent successful re-exploration in postoperative period for mediastinal bleeding. Superficial wound infection was present in one patient. There were three (10.7%) in-hospital mortalities in this group of patients. Two deaths occurred due to sepsis

with multiorgan dysfunction syndrome in cases of active infective endocarditis. Third mortality was due to liver failure in a background of alcohol related chronic liver disease. He subsequently developed sepsis and low cardiac output syndrome. There was no early valve related events of valve dysfunction and mechanical failure, thromboembolic episodes, valve thrombosis or paravalvular leak. All surviving 25 (89%) patients are in NYHA class I on last follow up.

**Table 3. Preoperative characteristics of patients with valvular heart disease**

Variable	Entire Group (N=28)	Mitral valve surgery ( $\pm$ TV repair) (N=19)	Isolated Aortic valve surgery (N=2)	Double Valve surgery (N=7)
Age (years $\pm$ SD)	39 $\pm$ 16	38 $\pm$ 16	50 $\pm$ 14	35 $\pm$ 16
Sex, N (%)				
Male	13(46.4)	7(36.8)	2(100)	4(57.1)
Female	15(53.6)	12(63.2)	-	3(43.9)
Valve lesion, N (%)				
Severe MS	5(17.8)	5(26.3)	-	-
Severe MR	6(21.4)	6(31.5)	-	-
Mixed mitral disease	9(32.1)	8(42.1)	-	-
Severe AR	1(3.6)	-	1(50)	-
Severe AS	1(3.6)	-	1(50)	-
Severe MR+ Severe AR	2(7.1)	-	-	2(28.6)
Severe MR + Moderate AR	2(7.1)	-	-	2(28.6)
Severe MS + severe AR	1(3.6)	-	-	2(28.6)
Severe MS + Moderate AS	1(3.6)	-	-	1(14.3)
Severe TR	12(42.8)	9(47.3)	-	3(42.8)
LV systolic dysfunction, N(%)				
Normal (50-70%)	1(3.6)	2(10.5)	-	-
Mild (EF 40-49%)	9(32.1)	7(36.8)	-	1(14.3)
Moderate (EF 30-39%)	16(57.1)	8(42.1)	2(100)	6(85.7)
Severe (EF<30%)	2(7.1)	2(10.5)	-	-
Cause, N (%)				
Rheumatic	28(100)	19(100)	2(100)	7(100)
Degenerative	-	-	-	-
Congenital	-	-	-	-
Active Infective Endocarditis, N (%)	2(7.1)	-	-	2(28.6)
NYHA Class, N (%)				
Class 1	1(3.6)	1(5.3)	-	-
Class 2	15(53.6)	9(47.3)	2(100)	4(57.1)
Class 3	10(35.7)	9(47.3)	-	1(14.3)
Class 4	2(7.1)	-	-	2(28.6)
Atrial Fibrillation, N (%)	20(71.4)	15(78.9)	-	5(71.4)
LAA clot, N (%)	8(28.6)	6(31.6)	-	2(28.6)

Out of 51 patients, 12 (23.6%) patients were operated for congenital heart defects. A total of 40 patients with congenital heart defects were referred for surgical repair, however only 12 patients consented for surgical intervention. Those who lost to follow or refused for surgery were infants with poor economic status. There were three females and nine males with age ranging from 1 to 40 years. The types of congenital heart defects and surgeries performed are shown in Table 2. The average CPB and cross clamp time were  $58 \pm 4$  minutes and  $40 \pm 7$  minutes respectively. There was no morbidity or in hospital mortality in this group. All patients are in regular follow up and are in NYHA class I.

A total of 10 patients with CAD were referred for surgery, out of which 5 refused for surgery (2 opted for medical management and 3 lost to follow up). Five (9.8%) patients underwent coronary artery bypass graft (CABG) surgery. There were three females and two males with mean age of  $60 \pm 6$  years. All patients were hypertensive while two patients were having type 2 diabetes mellitus. All patients were having triple vessel disease with average Euroscore-II of 6.8. Two patients were having mild LV dysfunction and three were having moderate LV dysfunction with regional wall motion abnormalities (RWMA). The average LVEF was 40%. All patients had on pump CABG surgery of which three patients received 3 grafts and two patients received 4 grafts. All patients received left internal mammary artery (LIMA) graft to left anterior descending (LAD) artery and reversed saphenous vein graft were used for rest of the target coronary arteries. The average CPB and cross clamp time were  $150 \pm 22$  minutes and  $61 \pm 7$  minutes respectively. There was no re-exploration or in hospital mortality. One patient with diabetes mellitus had superficial surgical site infection of leg wound.

Five (9.8%) patients underwent total pericardectomy via median sternotomy for chronic constrictive pericarditis. There were 3 male and 2 female with mean age of  $39 \pm 16$  years. The etiology was tubercular in all patients out of which three patients were treated for pulmonary tuberculosis in past and two patients were on antitubercular treatment at the time of surgery. Two patients were having mild LV dysfunction. One patient was having features of chronic liver disease due to cardiac cirrhosis who subsequently succumbed due to progression of liver failure following ventricular arrhythmia and hypoxic brain damage. Four patients are in regular follow up and are in NYHA class I.

## DISCUSSION

Non communicable diseases (NCD) account for significant

health burden. Nearly half of all deaths and disability are caused by NCDs, with cardiovascular disease being a significant contributor.<sup>2,3</sup> Modern medical and surgical interventions for cardiac diseases have increased the overall longevity.<sup>9</sup> Although reach to medical facility with cardiac intervention has improved, surgical intervention for cardiac diseases is not easily available to considerable population of Nepal due to various constraints.<sup>7,8</sup> Major surgically treatable cardiac diseases in Nepal consists of rheumatic heart disease (RHD) and congenital heart disease with prevalence of 10.2 per 1000 children and 1.3 per thousand school children respectively.<sup>10,11</sup> With change in life style and increasing urbanisation coronary artery disease too is becoming an important health problem requiring coronary artery bypass surgery.<sup>12</sup> Recent analysis of NCDs in Nepal has shown younger age group (below 40 years) and poorest households in Nepal suffer disproportionately more from NCDs like ischemic and hypertensive heart disease, rheumatic heart disease and congenital heart disease.<sup>2</sup> Our initial experience of cardiac surgery in Eastern Nepal has also shown RHD (55%) and CHD (23.6%) to be a major cardiac diseases requiring surgical intervention.

Around 31% of all cardiac diseases and 43% of all valvular heart disease patients presented in NYHA class 3 and 4. Similarly 41.2% of all patients and 64.2% of valvular heart disease patients were having moderate to severe LV dysfunction. These are due to late presentation of patients in the advanced stage of cardiac disease. In our study the overall in hospital mortality was 7.8% (4/51) including all groups of patients undergoing cardiac surgery. The in-hospital mortality in RHD patient's group was 10.7% (3/28) with no early valve related complications. The overall in-hospital mortality in established national centre in Nepal is reported to around 4.1% varying from 3.4% for isolated MVR to 9.4% for MVR with TV Repair.<sup>13</sup> Our patients were having moderate to severe LV dysfunction which is predictor of poor outcomes leading to slightly higher in hospital mortality in our patients. Similar outcomes are reported from heart centres in south asia.<sup>14</sup> In an experience from Nigeria, with a set up similar to us had a comparable overall mortality of 9% and mortality in valvular heart disease group patients was 10.5%.<sup>15,16</sup> The higher rate of mortality (20%, 1/5) in CCP group could be biased due to small sample size and high risk subset of patients. However, comparatively there is good postoperative outcome in terms of improvement in symptoms in all four surviving patients.<sup>17</sup> There was no mortality in CAD and CHD group with significant improvement in LV function and functional class which is comparable to other tertiary centres of Nepal.<sup>18</sup> However, large sample

size is needed to make definite comparison.<sup>19</sup> The re-exploration for mediastinal bleeding is reported to be 5-9% with mortality varying from 10% to 19%.<sup>20</sup> In our study, only two (4%) patients out of 51 underwent re-exploration in the immediate postoperative period for mediastinal bleeding with no mortality. The reported re-exploration for mediastinal bleeding in other centre in Nepal is around 2%.

Although the Government of Nepal is successfully implementing the program for prevention of rheumatic fever and RHD burden, its load is still higher compared to developed nation due to poor socioeconomic condition.<sup>21,22</sup> Similarly, there is late screening and referral of congenital heart disease cases due to limited skilled and trained physician.<sup>8</sup> Early detection and referral for surgical correction can help in reducing infant mortality of cardiac causes. Among children who were detected to have CHD at our centre, only few consented for surgical correction due to poor financial support. Similarly, many RHD and CAD patients refused for surgery due to financial constraints.

Cardiac surgery is expensive due to its requirement of modern equipments, accessories and skilled manpower. There is limited resource allocation from government for cardiac diseases to few centres only. Nepal is going through demographic and socio-political transition and the health sector should also remain attuned to this transition. Tertiary health care centre with cardiac surgery service is needed in every state as per our new federal structure. The existing disparity in health sector can be extrapolated from the fact that most of public and private health workforce in Nepal is in the central region.<sup>2</sup> More resource allocation and investment from government is needed to prevent early deaths from surgically treatable cardiac diseases.

## CONCLUSIONS

Our early result shows safety and feasibility of cardiac surgery at tertiary care centre of Eastern Nepal (BPKIHS) with comparable early outcomes in terms of morbidity and mortality. Financial problem and skilled manpower are major challenges in its expansion. Government support and planned institutional effort is needed for further development of this essential service.

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