Outcome of patients undergoing open heart surgery at the Uganda heart institute, Mulago hospital complex

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Abstract

Background: Heart disease is a disabling condition and necessary surgical intervention is often lacking in many developing countries. Training of the superspecialties abroad is largely limited to observation with little or no opportunity for hands on experience. An approach in which open heart surgeries are conducted locally by visiting teams enabling skills transfer to the local team and helps build to build capacity has been adopted at the Uganda Heart Institute (UHI).

Objectives: We reviewed the progress of open heart surgery at the UHI and evaluated the postoperative outcomes and challenges faced in conducting open heart surgery in a developing country.

Method: Medical records of patients undergoing open heart surgery at the UHI from October 2007 to June 2012 were reviewed.

Results: A total of 124 patients underwent open heart surgery during the study period. The commonest conditions were: ventricular septal defects (VSDs) 34.7% (43/124), Atrial septal defects (ASDs) 34.7% (43/124) and tetralogy of Fallot (TOF) in 10.5% (13/124). Non governmental organizations (NGOs) funded 96.8% (120/124) of the operations, and in only 4 patients (3.2%) families paid for the surgeries. There was increasing complexity in cases operated upon from predominantly ASDs and VSDs at the beginning to more complex cases like TOFs and TAPVR. The local team independently operated 19 patients (15.3%). Postoperative morbidity was low with arrhythmias, left ventricular dysfunction and re-operations being the commonest seen. Post operative sepsis occurred in only 2 cases (1.6%). The overall mortality rate was 3.2%.

Conclusion: Open heart surgery though expensive is feasible in a developing country. With increased direct funding from governments and local charities to support open heart surgeries, more cardiac patients access surgical treatment locally.

Keywords: Open heart surgery, Uganda Heart Institute.

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Background: Heart disease is a disabling condition. Performing open heart surgery for congenital heart disease in resource limited countries is a major developmental challenge and in several sub Saharan countries this is often un-available. As a result children in developing countries continue to have a significantly higher incidence and prevalence of serious congenital heart disease, partly due to lack of early corrective surgery. Lack of facilities for pediatric cardiac surgery results in a large number of potentially preventable death and suffering. The main options available to children with potentially correctable congenital heart defects include either referral abroad or having foreign surgeons come for short visits to operate on them. Only few families can afford the referral expenses abroad, yet most charities that sponsor referrals abroad commonly take on those with good prognosis.

Increasingly, a few nongovernmental organizations (NGOs) prefer to sponsor operations of children in their countries of origin where facilities allow. This is not only cheaper but it also helps develop local skills to carry on the surgeries on their own. Eventually developing a specialized cardiac treatment centre in a resource limited setting through such skills transfer programs would be ideal. An approach in which open heart surgeries are conducted locally by visiting teams alongside skills transfer to build local capacity has been adopted at the Uganda Heart Institute (UHI) since 2007.

The UHI is the national referral centre for treatment of cardiovascular diseases based at the Mulago Hospital complex. Closed heart surgeries like patient ductus arteriosus (PDA) ligation and pericardiectomy have been routinely performed at the UHI since 1997. Open heart surgery at the UHI began in 2007 with support from visiting teams comprising cardiologists, a cardiac surgeon, perfusionists, cardiac intensive care unit (ICU) nurses, cardiac anesthesiologists, fellows, biomedical personnel, and other staff from sponsoring NGOs. During these open heart surgery camps, the visiting teams carry a number of sundries for use in the operations. Preoperative surgical conferences were held, and the different cadres of visiting health personnel would work with their Ugandan counterparts enabling appropriate skills transfer.

Methods

The objective of the study was to evaluate the progress of open heart surgery at the UHI, to describe the postoperative outcomes and challenges faced in conducting these surgeries. This was a retrospective chart review where medical records of all patients undergoing open heart surgery for either congenital or acquired heart disease at the UHI from October 2007 to June 2012 were included. Those undergoing closed heart surgeries were excluded. Data including age, sex, cardiac diagnosis, type of operation, postoperative complications and ICU and hospital stay and funding source for the surgeries was collected on a structured questionnaire and analysed using SPSS. Data on other challenges faced in conducting the open heart surgeries was obtained from interviews with members of the UHI heart team. Categorical data is presented as frequencies and percentages and quantitative variables are expressed as means with standard deviation. The UHI research ethics committee gave approval to conduct this study.

Results

A total of 124 patients underwent open heart surgery during the study period. Of these, 66 (53.2%) were male. Indications for surgery varied depending on the specific pathologies. Patients with congestive heart failure, large atrial septal defects (ASDs) or VSD (ventricular septal defects), those with severe valvular lesions, or those where surgery is the definitive therapy were operated.

The mean age of the patients was 9.39 years (SD9.76), with age range from 3 months to 52 years. The vast majority of patients were children (age less than 18 years), making up 93.5% (116/124) of the patients (see table 1).

Table 1: Distribution of different cardiac pathologies operated on by age groups

<table>
<thead>
<tr>
<th>Age group</th>
<th>Numbers of patients with Congenital Heart disease</th>
<th>Numbers of patients with Acquired Heart Disease</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ASD</td>
<td>VSD</td>
<td>TOF</td>
</tr>
<tr>
<td>Less than 1 year</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1-4 years</td>
<td>10</td>
<td>27</td>
<td>8</td>
</tr>
<tr>
<td>5-11 years</td>
<td>13</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>12-18 years</td>
<td>9</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Above 18 years</td>
<td>11</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Totals</td>
<td>43</td>
<td>43</td>
<td>13</td>
</tr>
</tbody>
</table>

*##p<0.05, **p<0.01, ***p<0.001

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Acquired heart diseases operated included 3 patients with rheumatic heart disease, 2 patients with endomyocardial fibrosis (EMF) and an adolescent with atrial myxoma. The youngest patient with acquired heart disease was a 12 year old with rheumatic severe aortic regurgitation who underwent a Ross procedure. There was increasing complexity in cases operated from predominantly ASDs and VSDs at the beginning to more complex cases like TOFs and Total anomalous pulmonary venous drainage from 2010. Foreign charities funded 82.3% (102/124) of the operations, and only 4 patients (3.2%) paid for their surgeries. A local NGO funded the rest.

The local team independently operated 19 patients (15.3%). The local team started independently operating ASDs in 2009 and then moved on to the VSDs. The vast majority of patients independently operated by the local team were secundum ASDs (13/19), followed by perimembranous VSDs (4/19) and severe valvular pulmonary stenosis.

The challenges faced by the UHI occurred mainly in areas of staffing and procurement. The UHI at the time of the study had three resident consultant cardiothoracic surgeons with two in training abroad, two consultant pediatric cardiologists and two cardiac anesthesiologists. There was no cardiac intensivist. Staffing levels across all levels of health professionals is still low. Procurement of surgical supplies and sundries was a major challenge that hindered the number of cases performed locally. The mechanical ventilators at the UHI can only be used in older children weighing more than 10kg.

Postoperative morbidity was low with arrhythmias in 13(10.6%) patients being the commonest complication, followed by left ventricular dysfunction and re-interventions occurring in 6 (4.8%) patients each (see table 2).

Table 2 Showing postoperative complications.

<table>
<thead>
<tr>
<th>Post operative complications</th>
<th>Number/124 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need for re-intervention</td>
<td>6(4.9)</td>
</tr>
<tr>
<td>Postoperative arrhythmias*</td>
<td>13(10.6)</td>
</tr>
<tr>
<td>Left Ventricular Dysfunction</td>
<td>6(4.9)</td>
</tr>
<tr>
<td>Pericardial Effusion</td>
<td>6(4.9)</td>
</tr>
<tr>
<td>Postoperative Bleeding</td>
<td>4(3.3)</td>
</tr>
<tr>
<td>Sternal wound for pulmonary hypertension</td>
<td>3(2.4)</td>
</tr>
<tr>
<td>30-Day mortality</td>
<td>4(3.3)</td>
</tr>
</tbody>
</table>

Note *These excluded sinus tachycardia. Arrhythmias seen included atrial fibrillation, Junctional tachycardia, complete AV block. One patient went on to have a permanent pacemaker inserted. 3 patients needed a temporary pacemaker; two had amiodarone to control their arrhythmias. Most patients with pericardial effusions had small effusions except a patient with EMF who had a moderate pericardial effusion that was drained.

Re-interventions included re-exploration due to excessive hemorrhage from chest drains in 4 patients (a ten year old patient having Noonan’s syndrome with severe valvular pulmonary stenosis, a 17 year old with EMF; a three year old patient with Large VSD and Large PDA, and a 15 year old with subaortic stenosis), retrosternal abscess evacuation in a 12 year old girl with subpulmonary VSD and a 4 year old with malaligned VSD with complete heart block who underwent permanent pacemaker (VVI) implantation.

Post operative sepsis (defined as wound sepsis or intrathoracic abscess or pyrexia persisting for more than 48 hours postoperatively with leukocytosis or pyrexia with continuation of antibiotics after chest tube drain removal) occurred in only 2 cases (1.6%). These includ-
The overall mortality was 3.2% (4/124). The earliest post operative death was six hours after the initial surgery, with the latest being 40 days after the surgery (see figure 2).

Figure 2: Kaplan – Meier survival analysis showing the time to death among study patients.

Those who died included two adolescent patients with EMF having multigorgan failure, a 2 year old child with a VSD and a large PDA, and a 15 year old patient with a large inlet VSD with severe pulmonary hypertension who developed severe left ventricular dysfunction.

All were operated with the help of visiting teams. Three of the four who died were above 14 years. All of those who died had at least one post operative complication. One of the EMF patients was a 17 year old girl with biventricular EMF having severe tricuspid regurgitation and uncontrolled right heart failure who underwent excision of fibrotic RV endocardium, tricuspid annuloplasty and bidirectional Glenn procedure. She developed low cardiac output with hypotension immediately after surgery that required inotropic support. She underwent resection of fibrotic RV endocardium, tricuspid annuloplasty and bidirectional Glenn. She required isotropic support for three days after surgery, and was weaned off the ventilator in 3 days. She spent 5 days in the ICU and was subsequently discharged from hospital after two weeks. Four weeks after initial surgery he was readmitted with symptoms of worsening congestive heart failure. His repeat echo showed severe left ventricular dysfunction and he died from ventricular tachycardia.

Discussion

The experience at the Uganda heart institute shows that open heart surgery is feasible in the setting of a developing country. Most of our patients are operated beyond the age of one year. Currently our pediatric open heart surgery service is severely constrained in meeting the needs of neonates and infants. This situation is common in sub-Saharan countries7. In a study of 51 patients undergoing open heart surgery at Lagos State University Teaching hospital, the mean age was 29±15.6 years5.

With appropriate care, up to 85% of children diagnosed with congenital heart disease can reach adulthood6. A great obstacle to the provision of appropriate pediatric cardiac services remains a lack of appropriately trained medical personnel7 and funding for the surgeries. Major public health issues such as the HIV/AIDS pandemic, coupled with a myriad of tropical diseases like TB and malaria ravage resource limited countries. This makes congenital or acquired cardiovascular diseases less of a priority in government resource allocation7.

As such direct government spending towards corrective heart surgery is often lacking or severely limited. To compound the problem further, the prohibitive cost of open heart surgery is virtually out of reach of the vast majority of families in developing countries who have children with heart disease. This was clearly demonstrated in the present study where only 4 patients were able to afford surgery out of pocket. As a result, many patients with surgically correctable heart disease are left with no option but to continue medial therapy and suffer recurrent complications needing outpatient care and hospital admissions. This is the main reason for the low number of patients operated independently by the local team.

The mortality rates of 3.3% observed here in the present study are comparable to those seen elsewhere with cardiac centres and other databases that are reported to range from 1.8-6.1%10-13. Edwin et al reported mortality rates of 3% among patients with congenital heart disease undergoing open heart surgery, with a reduction in the ICU and required mechanical respiratory. He subsequently developed hepatic dysfunction, recurrent pleural effusions, coma, remained on pressor support to maintain cardiac output and developed renal dysfunction. He died on day postoperative day 42 from multiple organ failure.

The two year old with a large perimembranous VSD and large PDA underwent VSD closure and PDA ligation due to poor weight gain and congestive heart failure despite optimal medical therapy. Two hours postoperative the patient developed increased bleeding from chest drainage and bleeding from the sternotomy wounds that necessitated re-operation.

It was found that accidentally the descending aorta was ligated instead of the large PDA that was of identical size. End to end anastomosis of the descending aorta was done. The child died from acute kidney failure 6 hours from initial operation. The 15 year old with a large inlet VSD with lefl mitral valve (with moderate regurgitation) had surgery due to severe pulmonary hypertension that was deemed reversible clinically. Postoperatively he developed moderate LV systolic dysfunction that improved on isotropic support for 48 hours, and was given sildenafil for severe pulmonary hypertension. He spent 5 days in the ICU and was subsequently discharged from hospital after two weeks. Four weeks after initial surgery he was readmitted with symptoms of worsening congestive heart failure. His repeat echo showed severe left ventricular dysfunction and he died from ventricular tachycardia.

Increasing patient volumes in cardiac surgery is essential in boosting confidence of operating teams and refining critical skills that would enhance the development of centers for cardiac surgery and help to improve outcomes8. Access to needed cardiac surgery can be increased if locally based private foundations directly contribute to costs of open heart surgery programs9 together with greater direct government funding. This would help minimize the increased morbidity and mortality associated with older age at operation as was seen in this study. Another possible source for direct funding cardiac surgery programs directly engaging locally based corporate entities and civil society in charity funding10.

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mortality with increase in the volumes of patients operated on. The low postoperative morbidity encountered in this study could be attributable to rigorous patient selection. Late presentation to hospital and less than optimal preoperative evaluation may be a major contributor to postoperative mortality in resource poor settings. Currently we do not have a pediatric intensivist. Pediatric intensive care services that specialize in the care of cardiac patients needing postoperative management is an essential part of paediatric cardiac services and contributes significantly to outcomes. However the patients operated at the UHI were significantly older, there were no neonatal surgeries, and involved significantly less complex congenital heart disease which could have contributed to lower rates of complications. Neonatal surgeries or surgeries for very complex congenital heart disease are associated with higher rates of postoperative morbidity and mortality.

The visiting teams also had cardiac intensivists that could have helped reduce the mortality in the present study. Starting with relatively less complex, low risk congenital heart disease surgery with rigorous preoperative assessment is essential to prevent high morbidity and mortality in starting open heart surgery programs in a developing country. The low rate for sepsis seen here compared to other centers in sub Saharan Africa could be attributable to rigorous sepsis control measures and the local practice of keeping on antibiotics longer till all chest drains are removed (typically day 2 postoperative), absence of non emergent open heart surgery (OHS) cases as many patients are prepared electively.

Sample size was attained by enrolling all patients who underwent OHS during the period. We recognize that this study may not be powered enough to draw specific conclusions, but serves to describe experiences at the UHI during the study period.

Conclusion
The experience at the UHI has shown that conducting open heart surgery operations at local sites positively impacts on the ability of local cardiac teams to have hands on training, exposes most local health cadres to quality skills and builds their confidence. This approach has enabled the cardiac team at the UHI to start performing more open heart surgeries of increasing complexity independently. Lack of direct funding for open heart surgery programs is a major obstacle limiting the number of children that can be operated by local teams as only very few families can pay for the costs of the surgeries. Governments and local charities should direct funding to support treatment of more children with heart disease locally as opposed to referral abroad to increase access to the service.

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