Experience with cardiac surgery in a private tertiary hospital in Chennai, India

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Background
Major perioperative complications are not uncommon during cardiac surgery, which has been attributed to an increase in patients scheduled for complex and urgent cardiac surgeries on account of a surge of patients at the extremes of age.
Patients and methods
This was a cohort study of patients anesthetized for open heart surgery from March 2012 to May 2012 at the Frontier Lifeline Hospital, Chennai, India. Primary outcome measures were the pattern of presentation and complications following cardiac surgery. Secondary outcome measure was the 30-day perioperative mortality associated with cardiac surgery.
Results
A total of 291 patients underwent cardiac surgery. Their mean age was 34.71 ± 26.25 years (range 8.4 months to 81 years). Of them, 63.57% were adults and 66.32% were male. The most common indication for cardiac surgery was coronary artery disease [135 (46.39%) patients], followed by septal defect [60 (20.62%)] and valvular defect [40 (13.75%)]. In patients with coronary artery disease, triple-vessel disease occurred in 39.26% and double-vessel disease in 32.59%. Three patients underwent coronary artery bypass grafting plus mitral or aortic valve replacement, whereas off-pump coronary artery bypass grafting was performed in three (2.22%) patients. Sixty-three complications were observed in 291 patients (21.64%); the most common complication was significant pleural effusion in 13 patients (4.47%), followed by deep sternal wound infection in 10 (3.44%) and respiratory failure in seven patients (2.41%). Thirty days' perioperative mortality was seen in 17 patients (5.84%).
Conclusion
We have demonstrated that major complications are not uncommon after cardiac surgery. However; prompt and appropriate intervention reduces mortality.

Keywords:
cardiac surgery, complications, mortality, patterns

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Introduction

There is an increase in the number of patients with cardiac pathology requiring surgical intervention in the last decade, which is due to increase in awareness and improved diagnostic and surgical techniques [1,2]. Despite the improvement in surgical techniques and management, major perioperative complications are still encountered during cardiac surgery [1,2]. These have been attributed to a change in the profile of patients scheduled for cardiac surgery to include extremes of age and more complex surgical procedures such as Kawasaki, and a combination of coronary artery bypass grafting (CABG) with valvular repair. The older population presents with multiple coexisting medical conditions such as diabetes mellitus, renal dysfunction and peripheral or cerebral vascular disease, whereas the younger population presents with complex congenital abnormalities [2]. The surge in interventional treatment modalities has resulted in presentation at a later stage of cardiac disease, requiring urgent or emergency or complex procedures [2].

The reported incidence of major cumulative perioperative complications following cardiac surgery is 12.4% [3]. The incidence of respiratory failure is 9.5%, that of sepsis is 3% [3], dialysis-dependent renal failure, 2.2–5.9% [2,3], stroke, 2–2.5% [2,3], mediastinitis, 1.7%, and gastrointestinal (GIT) complications, 1.5% [3]. The reported perioperative mortality ranges from 17.6% to 20% [2,3]. This study investigated the

pattern and complications following cardiac surgery in a private tertiary hospital in Chennai, India, over a 3-month period.

Patients and methods

Study population

A cohort study was conducted on the pattern and complications of cardiac surgery in 291 patients from March 2012 to May 2012.

Outcome analysis

The primary outcome measures were the pattern and complications following cardiac surgery.

The secondary outcome measure was 30 days' perioperative mortality.

For the purpose of this study, the following definitions were used

Respiratory failure was described as pulmonary insufficiency requiring reintubation or ventilation for a cumulative period of at least 72 hours at any time during the postoperative course [2].

Dialysis-dependent renal failure was described as the need for acute haemodialysis regardless of frequency and duration [2].

Deep sternal wound infection was described as 'when a patient had a deep sternal infection involving muscle, bone, and, or mediastinum requiring operative intervention, and have any of the following conditions:

(a). Wound opened with excision of tissue (incision and drainage) or re-exploration of mediastinum.
(b). Positive culture.
(c). Treatment with antibiotics within 30 days postoperatively' [4].

GIT complications were described as any postoperative episode of vomiting blood, presence of gross blood in the stool, or perforation or necrosis of the stomach or intestine that required an invasive diagnostic or therapeutic intervention, such as gastroscopy, colonoscopy, or laparotomy [5].

Sepsis was described as clinical evidence of infection with positive blood cultures [2].

Perioperative mortality was described as death during initial hospitalization or within 30 days after surgery when discharged [2].

Stroke (confirmed by computed tomography) was described as a sudden focal or generalized brain dysfunction from vascular causes and persisting for more than 24 h or leading to death [6].

Significant pleural effusion was described as effusion requiring therapeutic pleural drainage according to clinical assessment within the first 30 days of the operation [7].

Surgical and anaesthetic management

All procedures were performed using standard anaesthetic and surgical techniques adapted to the specific surgical procedures, and at the discretion of the attending cardiac surgeon. The majority of procedures were performed through a median (full or partial) sternotomy. Patients referred for minimally invasive mitral valve procedures underwent a right anterior-lateral thoracotomy. Cardiopulmonary bypass (CPB) was established between the ascending aorta and either the right atrium using a two-stage cannula or both venae cavae. During CPB a minimum flow of 2.2 l/min/m^2 and a perfusion pressure of 70 mmHg were aspired in all patients. Myocardial protection was achieved using either high potassium cold blood cardioplegia (Buckberg) in an antegrade and/or retrograde manner or by means of warm blood cardioplegia (Calafiore). Following surgery, all patients were transferred to the ICU.

Statistical analysis

Data were collated from standardized case report cards of patients, from the operating theatre and from ICU records. If the patient had undergone more than one type of surgery, only the first surgery was included.

Our analysis included the following: age, sex, comorbidities, diagnosis, type of surgery, duration of CPB, duration of aortic cross-clamping, duration of hospital admission and complications and mortality associated with cardiac surgery. Numerical data were presented as median, interquartile range and mean ± SD, whereas categorical data were expressed as frequencies and percentile. Statistical analysis was performed with the Statistical Package for the Social Sciences (SPSS) for windows, version 21, computer programme (SPSS, Chicago, IL, USA).

Results

Cardiac surgery was conducted in 291 patients from March 2012 to May 2012. The mean age of the patients was 34.71 ± 26.25 (range 8.4 months to 81 years). Among them, 63.57% were adults and 66.32% were male. The most common indication for cardiac surgery was coronary artery disease (CAD) in 46.39% patients, followed by septal defect in 17.18% and valvular defect in 13.75% (Fig. 1).

The mean age of individuals with CAD was 55.89 ± 15.01 years. The pattern of patients with CAD in our study included single-vessel disease was observed in 28.15% of patients, double-vessel disease in 32.59% and triple-vessel disease in 39.26%. A majority of individuals with CAD had coexisting medical disease (88%) (Fig. 1).

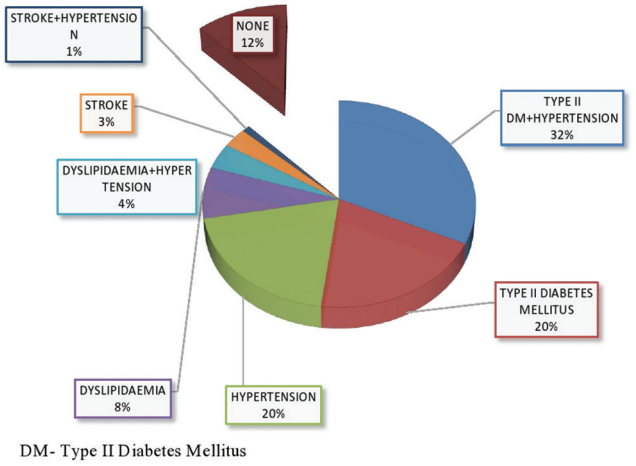
A greater proportion of the CABG procedures (96%) were performed via conventional CABG, whereas only four percent were carried out without the use of CPB (off-pump coronary artery bypass).

Three patients underwent CABG with valvular repair (CABG+aortic valve replacement in two and CABG = mitral valve repair in one).

There were three redo CABG cases (2.22%), and the CABG-associated mortality was 7.19%. In patients on CPB, the mean CPB time was 142 ± 48.76 (range 62–197) min, and the mean aortic cross-clamping time was 71.71 ± 25.14 (range 47–124) min. The median length of stay in hospital was 14 (interquartile range 10–26) days.

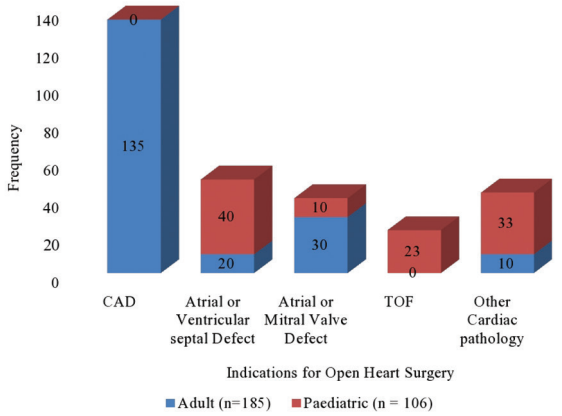
The most common septal abnormality was ventricular septal defect in 56.67%, followed by atrial septal defect in 25% and a combination of ventricular and atrial defect in 18.33% (Fig. 2). The most common valvular defect was mitral regurgitation in 65% followed by mitral stenosis and aortic regurgitation (12.5%) respectively. The surgical management of valvular defect included repair, replacement, open and balloon valvotomy (Fig. 3). Other cardiac pathologies encountered included atrioventricular septal defect in 2.06%, single ventricle in 2.06% and partial anomalous pulmonary venous connection in 1.38% (Table 1).

Figure 1



The distribution of coexisting medical disorder in patients with coronary artery disease.

Figure 2



Key Notes: CAD (coronary artery disease), TOF(Tetralogy of Fallout), Other cardiac pathology include but not limited to Transposition of great vessels, Truncus Arteriosus, Atrioventricular septal defect, Partial anomalous pulmonary venous connection, Double outlet right ventricle, Single Ventricle and Pulmonary stenosis.

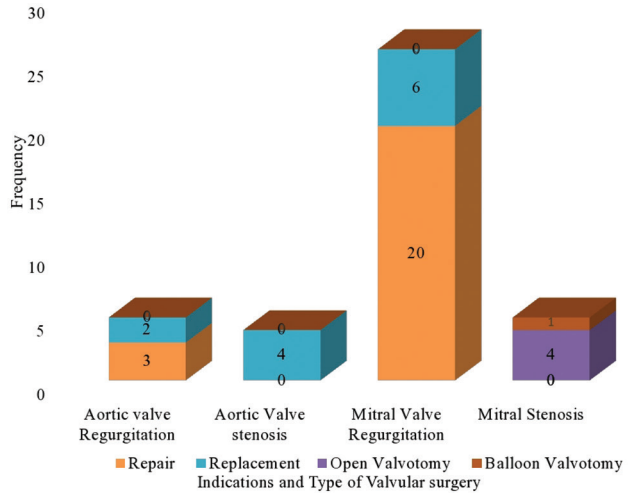
The indications for cardiac surgery.

Table 1 The pattern of distribution of patients scheduled for other types of cardiac surgery

Diagnosis	Surgery	Frequency [*n* (%)]
Transposition of great vessels	Arterial switch procedure	3 (1.03)
	Pulmonary artery banding	1 (0.34)
Truncus arteriosus	Total repair of TA	2 (0.69)
Atrioventricular septal defect (AV canal)	Repair of AV canal	6 (2.06)
Partial anomalous pulmonary venous connection	PAPVC repair	4 (1.38)
Double outlet right ventricle	Fontan procedure	1 (0.34)
Pulmonary stenosis	RVPA conduit	2 (0.69)
Pulmonary atresia	Blalock–Thomas–Taussig shunt (RMBT shunt)	2 (0.69)
Single ventricle	Bidirectional Glenn procedure	6 (2.06)
Pulmonary stenosis	Pulmonary valve replacement	1 (0.34)
Refractory malignant ventricular arrhythmias	Automated implantable cardioverter defibrillator	2 (0.69)
Myxoma	Excision of myxoma	2 (0.69)
Aortic aneurysm	Repair/graft of aorta	1 (0.34)
Total		33 (11.34)

AV, atrioventricular; PAPVC, partial anomalous pulmonary venous connection; RVPA, right ventricle to pulmonary artery; TA, truncus arteriosus.

Figure 3



Distribution of patients with valvular defect and types of surgical repair.

There were 63 complications in 291 patients (21.64%); the most common complication was pleural effusion in 4.47%, followed by sternal wound dehiscence in 3.44% and respiratory failure in 2.41% (Table 2). The 30-day perioperative mortality was 5.84%; adults constituted 6.49% and children 4.72%.

Table 2 The Major Complications following Cardiac Surgery

Major complications	Adults (*n* = 185)	Paediatrics (*n* = 106)	Total (*n* = 291)
Respiratory			
Pleural effusion	10 (5.46%)	3 (2.83%)	13 (4.47%)
Respiratory Failure	4 (2.16%)	3 (2.28%)	7 (2.41%)
Pneumothorax	–	1 (0.94%)	1 (0.34%)
Infection			
Deep sternal wound infection	9 (4.86%)	1 (0.94%)	10 (3.43%)
Thromboembolic			
Embolus	4 (2.16%)	2 (1.88%)	6 (2.06%)
Renal			
Dialysis dependent Renal Failure	2 (1.08%)	4 (3.77%)	6 (2.06%)
Cardiovascular			
Pericardial effusion	2 (1.08%)	1 (0.34%)	3 (1.03%)
Ventricular fibrillation	2 (1.08%)	2 (1.89%)	4 (1.38%)
Hypoxia	–	2 (1.89%)	2 (0.69%)
Central Nervous System			
Gastrointestinal tract			
Intestinal Ischaemia	–	1 (0.94%)	1 (0.34%)
Neurological deficit	2 (1.08%)	2 (1.88%)	4 (1.38%)
Reoperation			
CABG	3 (1.62%)		3 (1.03%)
Other surgeries	-	4 (3.77%)	4 (1.38%)
Total	36 (19.46%)	27 (27.47%)	63 (21.65%)

Discussion

Our finding of significant pleural effusion as the most common complication is not surprising as pleural effusion has been described as a common complication following heart surgery, which is associated with other postoperative complications [8]. Pleural effusion has been reported to be more frequent in women and in patients with associated cardiac or vascular comorbidities [8]. Our finding may be related to the presence of comorbid diseases in a great proportion of our patients. Trauma from the surgery and postoperative bleeding into the pleural space have been implicated in the aetiology of significant pleural effusion occurring within 30 days of surgery after CABG [9]. The incidence of significant pleural effusion (4.47%) in our review was lower than the 6.6–38.6% reported in previous studies [8,9]. The incidence is slightly higher in children, and is common after repair of Tetralogy of Fallot and univentricular repair [8,9]. Pleural effusion has been shown to cause significant morbidity following cardiac surgery and to contribute to prolonged ICU and hospital admission [4,10].

Respiratory failure was another common complication reported by us, with an incidence of 2.4%. This is slightly lower than the reported incidence of 5–20% in previous studies [2,11,12]. The difference in incidence has been attributed to a wide variation in the study design, difference in inclusion criteria, and case-mix, along with varying definitions for respiratory failure [11]. In our review, we used the New York State Department of Health definition for respiratory failure, which was described as pulmonary insufficiency requiring reintubation or ventilation for a cumulative period more than or equal to 72 hours at any time during the postoperative course. Some researchers, however, used a cut-off value of ventilation lasting 48 hours to define respiratory failure and focus on patients undergoing CABG surgery, with the majority reporting an incidence of respiratory failure from 5 to 9% [13,14]. Higher values were reported following non-CABG procedures [12,15]. The independent preoperative risk factors for respiratory failure included female sex, age 70 years, diabetes, renal failure, hypertension and a history of peripheral vascular diseases [16]. However, we did not investigate the risk factors associated with respiratory failure. In our centre, in an attempt to reduce the incidence of respiratory failure, modalities such as frequent and effective pulmonary toileting, ultrasonic chest physiotherapy, reduced sedation requirements and earlier mobilization of patient-facilitated weaning from mechanical ventilation were adopted. These factors have been reported to reduce the risk for ventilator-associated pneumonia and sepsis [17].

Deep sternal wound infection occurred in 3.34% of patients in our study, which is within the range of 0.8

and 5.0% reported in the literature [5,18]. This has been associated with great mortality and prolonged hospital admission.

Our findings showed that the incidence of acute renal failure (2.06%) is in the lower limit of the reported range of 1–40% [20–23]. The wide variation in the incidence of acute renal failure may be because the definition of acute renal failure in previous studies was not standardized [18,20–21], whereas we defined renal failure as the need for acute haemodialysis regardless of frequency and duration. Others described acute renal failure as creatinine more than 2.5 mg/dl for more than 7 postoperative days or the need for dialysis [20–23]. When renal failure is associated with haemodialysis, the morbidity and mortality increases. This is illustrated in this review when two of the six patients (33.33%) with dialysis-dependent acute renal failure died. Ischaemic injury secondary to hypoperfusion has been incriminated in the aetiology of acute renal failure during cardiac surgery [22].

Stroke occurred in four patients: two adults and two children. The incidence of stroke of 1.08% in adults was lower than the 4.6–19.5% reported during cardiac surgery in a similar population [7,24]. The independent risk factors of stroke in the first 30 days after cardiac surgery included prolonged duration of mechanical ventilation, a previous history of stroke with paresis, atrial fibrillation, haemodilution manifested by haematocrit less than 28% and a long duration of aortic cross-clamping [7,24].

The incidence of GIT complications was 0%, which was lower than in previous reports (0.3–3%) [3,5]. This may be because patients undergoing cardiac surgery at our institution routinely received proton pump inhibitors as ulcer prophylaxis. In addition we maintained a higher perfusion pressure (>70 mmHg) in all patients, particularly in those with atherosclerotic risk factors, and an adequate haematocrit in patients on CPB. This may have played a role in preventing abdominal organ hypoperfusion. However, the CPB and aortic cross-clamping time was higher in our findings compared with the protective level suggested in the literature [6]. Our observation is in agreement with previous reports, which suggested that variables such as CPB and aortic cross-clamping time, along with intra-aortic balloon pump, were marginal factors in the development of GIT complications [25]. However, the incidence of GIT complications after cardiac surgery varies between 0.3 and 3% [5]. In a case–control report of risk factors associated with GIT complications from 1991 to 1997, a decline in the incidence of GIT complications from 1.3 to 0.7% was documented during the study period [5]. This decline was attributed by the authors to better patient selection preoperatively, as patients with a previous history of GIT haemorrhage and peptic ulcer were routinely worked up, whereas others received perioperative ulcer prophylaxis such as systemic H2-blockers or proton pump inhibitors. Other factors implicated in the reduction of GIT complications include the implementation of new intraoperative measurements, such as routine epiaortic ultrasonography to detect any atherosclerotic lesions before aortic manipulation and cannulation; the preservation of a high perfusion pressure during CPB has also reduced the incidence of GIT complication [6].

The reported risk factors associated with GIT complications include age more than 65 years, severe impaired left ventricular function, history of myocardial infarction, congestive cardiac failure, haemodynamic instability on admission, need for intra-aortic balloon pump, previous cardiac procedure, CPB time more than 120 min, previous cardiovascular accident, peripheral vascular disease, hepatic failure, preoperative renal failure and endocarditis [6]. Other factors include prolonged mechanical ventilation, proctrated hypotension, sepsis and the use of anticoagulants during valvular surgery [25].

The 30-day perioperative mortality (5.84%) reported by us was lower than the value of 17–20% reported in previous studies [2]. This we attributed to the prompt and timely intervention in patients with major complications. Another contributing factor may be because the other studies were retrospective, which may distort the information [2].

In our paediatric cohort, the most common cardiac pathology was atrial or ventricular septal defect, followed by Tetralogy of Fallot. The incidence of septal defect was, however, lower than the rates reported in Trinidad & Tobago [26]. The trend of pattern and complication following cardiac surgery in our review followed that general trend in previous studies. Prompt and appropriate intervention, however, reduced the mortality in our study.

Strengths and limitations

The limitations of our study included the study design: this was a prospective study that was analysed retrospectively. Hence, we were unable to exploit confounding risk factors implicated in perioperative complications and mortality after cardiac surgery. The relatively small sample size in a single institution should also be taken into consideration. Despite this, the study included a large and heterogeneous group of cardiac pathologies, and therefore the findings are applicable to a broad spectrum of cardiac surgical procedures.

Conclusion

The occurrence of major complications following cardiac surgery in not uncommon at our institution. Nevertheless, the mortality was reduced by prompt intervention.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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