

INCIDENCE OF COMPLICATIONS AFTER CARDIAC SURGERY, SINGLE UNIT EXPERIENCE

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ABSTRACT

Objective: The objective of this study was to determine the incidence of complications after cardiac surgery in a single unit.

Study Design: This was an observational study.

Place and Duration: This study was conducted in the department of Cardiac surgery of Civil Hospital Karachi, Dow University of Health Sciences Karachi, over the period of 1 year.

Patients and Methods: This being a prospective, observational study, therefore all patients undergoing cardiac surgery were included in this study, only exclusions being those patients who had redo or reopen procedures. Any complications that took place were noted in the proforma. This study was based on proforma that included patients profile, pre operative investigations, operative data, included date of surgery, type of surgery (whether coronary, valvular or others). Both intra and post operative complications, like cardio vascular complications, respiratory complications, neurological complications, renal complications, infective complications and miscellaneous complications were noted and entered in the proforma.

Results: Over the period of one year, 312 patients have their cardiac surgeries in the department of cardiac surgery, Civil Hospital, Karachi. Over all rate of complications were 118 (37.8%), cardiovascular complications were in 65 patients, neurological in 8 patients, respiratory in 27 patients, renal in 5, infective in 10, and miscellaneous complications in 3 patients. There were two (.6%) mortalities in our study group.

Conclusion: This study concludes that cardiac surgery is not free of complications. Therefore it must be done with care and with all the possible supportive measures. The incidence of complications in our unit is about the same as in other renowned centers of the world, but central nervous system complications were less as compared to others, probably related with younger age group of patients in our study.

Keywords: Complications after cardiac surgery, CABG, Valve surgery.

INTRODUCTION

Advances in medical care and the introduction of broader indications for surgery have meant that patients previously inoperable are now considered suitable candidate for surgery. Over the past twenty

years: there has been a steady increase in the age of patients undergoing cardiac surgery. This increase has been accompanied by a rise in both the severity of cardiac disease at the time of surgery and the re-operation rate for recurrent disease. Nevertheless, the likelihood of dying or sustaining a major complications after Cardiac surgeries (CS) in the year 2007 is significantly lower than that in the 1950's. Not unreasonably, most patients expect to survive CS intact, make a good functional recovery and live longer.

A significant numbers of patients however suffer an intra operative and post-operative complications

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involving the neurological, cardiovascular, respiratory, renal, infective complications, though some patients do have some uncommon complications but their incidence is very low.

Cardiovascular complications after CS can range from trivial, benign Atrial Fibrillation (AF) to the death of the patient. Arrhythmias are frequent after CS. The most common arrhythmias are Supraventricular^(1,2,3,4,5). Proposed hypothesis to explain the high incidence of A.F includes, the increased adrenergic drive in the post operative period, atrial ischaemia/necrosis associated with atriotomy, incomplete or prolonged atrial cardioplegia, and electrolyte abnormalities during and after cardiopulmonary bypass (CPB) or pericarditis.

The ventricular arrhythmias (VA) following cardiac surgery is an uncommon but serious complications.^(6,7,8,9,10,11) Some patients are clearly at risk for ventricular arrhythmias. In Patch trial⁽¹²⁾ for example, the patients operated for coronary artery bypass grafting (CABG) showed no association with an ischemic dilated cardiomyopathy and ventricular arrhythmias after CS but had an abnormal signal-averaged electrocardiograph (ECG). However, most of the patients who developed ventricular tachyarrhythmias after cardiac surgery had no definite risks factors for this complication. The respective role of myocardial ischemia, the use of inotropic agents, or electrolyte abnormalities is discussed, but frequently these factors are not present. Therefore the mechanism of post operative ventricular arrhythmias remains debatable and the treatment is controversial.

Neurological complications after cardiac surgery is the result of damage to the brain, spinal cord, and/or peripheral nerves. Neurological complications range in severity from subtle changes in personality, cognitive functions to fatal brain injury. A major neurological complication after otherwise successful surgery represents a devastating outcome for the patient and their family. The social and economic impact is enormous.⁽¹³⁾

Respiratory complications although not always fatal but are fairly common after cardiac surgery, all kind

of respiratory complications like upper respiratory tract (RT) complications and lower RT complications can take place. Some are related to prolong anesthesia and the period of Endotracheal Intubation and mechanical ventilation, some are related to CPB pump and some directly related to surgery. Respiratory complications that have been reported to occur are hoarseness of voice, lung collapse, pneumothorax, hemothorax, pleural effusion, broncho-pleural fistula, Adult Respiratory Distress Syndrome.

Renal complications are not uncommon after CS, as most of the patients undergoing coronary revascularization are old aged, and some of them already have borderline renal function, when these kidneys are exposed to CPB their renal functions are more prone to deteriorate.

Gastrointestinal complications after CS is rare but a study conducted by Welling et al⁽¹⁴⁾, concluded that age > 69.8 years, valve replacement, or combined cardiac procedures, emergency procedures, increased aortic cross clamp time and increased bypass times are risk factors for the development of gastrointestinal complications.

Infective complications (IC) are very common after cardiac surgery, in USA alone its incidence is about 1% of all median sternotomies. IC can range from wound infection leading to mediastinitis, serious infection leading to pneumonia, septicemia and septic shock.

Miscellaneous complications I can arise after cardiac surgery some of them are a) leg oedema, b) Surgical emphysema c) Jaundice, d) Nausea and vomiting e) Unstable sternum, f) ICU psychosis etc.

PATIENT AND METHODS

This was a prospective, observational study, therefore, all those patients who had cardiac surgery in CHK, from Nov 2006 to Oct 2007 were included in this study, the only exclusion being redo surgery and reopen procedures. In total we had 312 numbers of cardiac surgeries in CHK during the above mentioned period. This study was based on a proforma, indicating patient's profile, date of surgery, intra and

post operative complications like cardiovascular, neurological, respiratory, renal, infective and miscellaneous complications.

In cardiovascular complications any incidence of Arrhythmia (AF or VT/ VF), number of patients requiring inotropes for more than 24 hours. Pace maker requirement, Defibrilated after surgery, use of Intra Aortic Balloon Pump (IABP), Pericardial effusion requiring aspiration was noted.

In neurological complications: patients mental status whether confuse / drowsy, stroke and unexplained failure to awaken was noted.

In respiratory complications, presence of hoarseness of voice, mechanical ventilation for > 24 hours, re intubation, pneumothorax, pleural effusion, pulmonary oedema, broncho pleural fistula were noted.

In renal complications, serum creatinine > 2 mg / dl and acute renal failure (ARF) requiring dialysis were noted.

In infective complications, wound infection, mediastinitis, pneumonia and septicaemia were noted.

Miscellaneous complications noted were gastrointestinal complications and surgical emphysema. Single clamp technique was used for proximal and distal coronary anastomosis. Warm intermittent blood (1:4) antegrade and retrograde cardioplegia was used in CABG cases and cold crystalloid cardioplegia in valvular cases. Anaesthetic and cardiopulmonary bypass techniques were standardized. The bypass circuit used a hollow fibre membrane oxygenator non pulsatile flow was generated by a roller pump, and 40 µm arterial line filter. Flow was 2.4 L.min, m² at 37°C falling to 1.8 L.min, m² at 32°C, arterial pressure was maintained between 50-70 mm Hg, hematocrit between 0.20 to 0.25, and alpha stat blood gas management was used.

Data was defined as the mean with standard deviation where as a discrete variables were presented as frequencies.

RESULTS: As can be seen from the Table I that the

Table I. Post cardiac surgery complications (118) in 312 patients

Complications	No of patients
Cardiovascular	65(55%)
a. Arrhythmias	25
b. Low cardiac output syndrome	38
c. Pericardial effusion	1
d. Myocardial infraction	1
Neurological	8(6.7%)
a. Confusion	4
b. Stroke	2
c. Unexplained failure to wake up in 1 st 24 hours	2
Respiratory	27 (22.9%)
a. Hoarseness of voice	2
b. Ventilation for >24 hours	10
c. Re-intubation	4
d. Pneumothorax	6
e. Plural effusion	2
f. Pulmonary oedema	2
g. Brocho-pleural fistula	1
Renal	5 (4.2%)
a. Creatinine >2mg/dl	4
b. ARF required dialysis	1
Infective	10 (8.5%)
a. Wound infection	4
b. Mediastinitis	2
c. Pneumonia	2
d. Septicemia	1
Miscellaneous	3 (2.5%)
a. Gastrointestinal	1
b. Surgical emphysema	2

Data is shown as number followed by percentage in parentheses, ARF, Acute Renal Failure.

Table II. Preoperative, Intra-operative and postoperative variables.

Variables	Values
Age (years)	41.7±18
Male	76 (79%)
Diabetes mellitus	22 (22.9%)
Hypertension	26 (27%)
CPB (min)	95.5±30.5
X-clamp (min)	66.5±23.6
ICU Stay (days)	2.3±.7
Ward Stay (days)	6±3
Extubation time (hours)	8.4±6.2
Mortality	2 (0.6%)

Data is shown as number followed by percentage in parentheses or mean with standard deviations. CPB, Cardiopulmonary bypass, X-clamp, aortic cross clamp, ICU, intensive card unit.

total number of reported complication in our study - was 118, but the no of patients having these complication was lesser than that, as some patients had more than one complication.

As can be seen from the table that in cardiovascular complications, 25 patients had arrhythmias, 20 of them had AF and 5 had VT/VF. 38 patients went in to low cardiac output syndrome, requiring Inotropes support for > 24 hours and 2 patients needed IABP, 1 patient had pericardial effusion that was aspirated and 1 patient had post operative MI.

Regarding neurological complication, 4-patients were found to be confused for first 24 hours, 2 had stroke and 2 patients didn't wake up even after 24 hrs after operation.

From respiratory complications point of view, 2 patients had hoarseness, 10 patients needed mechanical-ventilation for > 24 hrs, 6 patients developed pneumothorax, 4 patients were re-intubated as they didn't maintain their ABGs, 2 patients developed pleural effusion, 2 patients developed pulmonary oedema, and one patient developed broncho-pleural fistula.

Regarding renal complication, 4 patients showed serum creatinine level of > 2 mg/ dl and one patient developed ARF requiring dialysis.

As far as infective complications are concerned, 4 patients developed wound infection, 2 patients had mediastinitis, 2 had pneumonia and 2 patients had septicemia.

In miscellaneous complications, 1 patient had gastrointestinal complications manifesting as severe malena and acute tense abdomen on 8th post op day and died before emergency laparotomy could be done. Two patients developed surgical emphysema over their face and neck on the 3rd post-op day.

DISCUSSION

The overall incidence of complications after CS varies from 5-50 % (1). different systems-are affected in different frequency. In our study we noted 118 complications out of 312 no of cases, who underwent any kind of cardiac surgery over the period of one

year.

Cardiovascular complications were more common in our study. AF is the most common complication to occur after cardiac surgery. An exaggerated inflammatory response has been proposed to be one etiological factor. AF occurs in up to 50% of patients after open heart surgery. Incidence of arrhythmia has not changed, despite improvement in anesthetic and surgical techniques, and evidence suggests its incidence may be increasing⁽¹⁵⁾. It usually tends to occur with in 3 to 4 days postoperatively and in a minority of cases, it may results in hypotension, heart failure, and a possible risk of cerebro vascular accidents (CVA)⁽¹⁶⁾. Age has been identified as one of the most powerful contributing risk factors for AF after open heart surgery^(17,18,19,20,21,22). Although the etiology of AF after open heart surgery is incompletely understood, stimuli and triggers such as preexisting structural changes of the atria related to hypertension, mechanical damage, volume overload, age, intraoperative atrial ischemia, electrolyte imbalance, and pericardial lesions are thought to play a role in the pathogenesis of postoperative AF⁽²³⁾. Additionally there seems to be a significant increase in sympathetic tone in the postoperative period, in those patients who subsequently developed AF⁽²⁴⁾. The preexisting abnormal atrial tissue and electrophysiological abnormality that may be amplified during surgery and, when subjected to an adverse postoperative triggers, could result in AF⁽²⁵⁾. Out of 38 patients who developed low output cardiac syndrome, all of them were needed Inotropic support for > 24 hours, 6 patients out of them were paced and 2 received IABP. One patient had pericardial effusion that was diagnosed on echocardiography and was aspirated. Pericardial effusion though rare but every now and then we hear case report on this complication, one such case was reported by Augustine T.M. Tang et al⁽²⁶⁾. One patient developed postoperative MI in the ICU and he was managed by a cardiologist.

There were 8 reported cases of neurological complications, 4 patients had confusion, 2 had stroke and 2 patients had unexplained failure to wake up even after 24 hours, the interesting point to be noted regarding neurological complications was that all 8 patients had their surgery on CPB pump.

The great reduction in overall cardiac morbidity and mortality associated with cardiac surgery has focused attention on CNS complications, such stroke, that can arise as studies suggest that elderly patients with comorbid and advanced cardiovascular disease benefit more from cardiac surgery than from medical therapy alone, yet these patients have greater morbidity and mortality especially neurological dysfunction after cardiac surgery⁽²⁷⁾. CNS complications caused 7.2% of all death after cardiopulmonary bypass surgery in the 1970s, but rose to almost 20% by the mid 1980s and it continues to increase⁽²⁸⁾. Postoperative neurological dysfunction is also a concern because it affects quality of life and has implications for health economics^(29,30,31). Neurological injury describes a range of disorder, from incapacitating or lethal stroke or coma to encephalopathy, delirium, and neurocognitive decline⁽³¹⁻⁴¹⁾. Although stroke after cardiac surgery is an important concern for both short term and long term disability, more subtle neurological effects, such as encephalopathy and neurocognitive dysfunction, are associated with increased medical cost and decreased cognitive function and quality of life⁽³¹⁾. Patients, their family members, and the medical team find upsetting the situation of an operation being successful in its cardiac outcome, but resulting in substantial neurological or neurological deficits that subsequently restricts the patients ability to function independently.

Causes of neurological complications include, aortic atherosclerosis and cerebral embolization, hypoperfusion of brain, arrhythmias, Systemic inflammatory response (SIR) as a result of surgery or CPB. Certain genetic factors are also said to play some role in stroke, general anesthetic agents, especially inhaled agents could effect either short term or long term cognitive functions as reported by Mark F .Newman et al⁽⁴¹⁾.

Regarding respiratory complications, 2 patients had hoarseness of voice, that probably was due to the trauma to the vocal cords caused by the transesophageal echocardiography(TEE) probe, as both of these patients had preoperative TEE insertion, 10 patients had mechanical ventilation for > 24 hours, these patients also had low cardiac output failure, requiring heavy dose of inotropic support and 2 of them had IABP. 4 patients were reintubated with in

24 hours as they couldn't maintain their ABGs and got exhausted, 6 patients had pneumothorax that was discovered on x-rays chest, therefore, chest tube was inserted. Two patients had pleural effusion that was also discovered on chest x-rays and were aspirated. Two patients developed pulmonary oedema, probably because of volume overload, but as they were still on the ventilator so they were managed by diuretics and mechanical ventilation, one patient developed bronchopleural fistula and his chest tube was kept under water seal for 7 days and patient was settled without any further surgery.

Regarding renal complications, 4 patients had serum creatinine > 2 mg/dl, all 4 of them already had their preoperative creatinine more than 1.5mg/dl, and all 4 of them had their cardiac surgery on CPB pump which might have worsen their renal status. One patient went in to ARF needed dialysis and died on 8th postoperative day in ICU, this patient also had mild impairment of renal function preoperatively and was operated on CPB. A study was conducted by Haase M et-al in Berlin, Germany, they have found that acute kidney injury (AKI) is a common and serious postoperative complication following exposure to CPB. Several mechanisms have been proposed by which the kidney can be damaged and interventional studied addressing known targets of renal injury have been undertaken in an attempt to prevent or attenuate CPB associated acute kidney injury. However, no definite strategy appears to protect a broad heterogenous population of cardiac surgery patients from CPB associated AKI. Although the association between hemoglobinuria and the development of AKI was recognized many years ago. Accordingly, we now describe in detail the mechanism by which hemoglobinuria may induce injury and raise the question as to whether CPB associated AKI may be, in a significant part, a form of pigment nephropathy where hemoglobin is the pigment responsible for renal injury .It is postulated that if CPB associated AKI is a pigment nephropathy, alkalinization of urine with sodium bicarbonate might protect the kidneys.

Regarding infective complications, 4 patients had wound infection, 2 patients developed mediastinitis, 2 had septicemia. Median sternotomy has been established as the standard approach for open heart surgery, ever since it was first introduced by Julien et

al, in 1957⁽⁴²⁾. Mediastinitis continues to be a major complication of CS and is associated with tremendous morbidity and cost. The incidence of postop mediastinitis varied between 0.5 and 5% in several studies. Mediastinitis is associated with significant incidence of mortality. Ridderstolpe et-al, showed a 30 days mortality of 1%, and a mortality of 7.2 % after one year of follow up. Regarding the cause of infectious complications some authors favor the intraoperative contamination, whereas other studies demonstrate that endogenous bacteria might be involved because preoperative intranasal antibiotic treatment significantly reduced the incidence of wound infection.

One patient in our study developed gastrointestinal complication on the 8th postop day, he suddenly developed massive malena and acute abdominal distention, before having emergency laparotomy he died, the cause probably was ischemic colon or mesenteric ischemia, that may be caused by CPB, in some studies hypoperfusion has been implicated as the primary etiology of gastrointestinal complication⁽⁴³⁾. Hypoperfusion can be caused by prolonged pump time, perioperative hypotension, and the perioperative use of vasopressor.

Two of our patients developed surgical emphysema of face and neck on the 3rd postoperative day, definite cause couldn't be ascertained but as they were known case of chronic obstructive airway disease.

CONCLUSION

This study concludes that the incidence of complication after CS in our hospital is about the same as in other renowned centers of the world, but we have lesser incidence of neurological complication as compared to others, probably because quiet significant number of surgeries in our hospital are performed on beating heart and most of patient were of younger age group then the other studies which may be associated with lesser number of neurological complications.

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