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APPROACH TO ANAESTHETIC AND SURGICAL MANAGEMENT OF REDO CARDIAC SURGERIES - A SINGLE CENTRE EXPERIENCE

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Abstract

Redo cardiac surgeries are often considered a different genre because of the technical challenges they pose for the surgeons and the intraoperative hemodynamic and bleeding challenges they impose on the anaesthesiologists. Time has seen an increase in redo cardiac surgery candidates presenting to centres due to various reasons including increase in lifespan, increase in comorbidities, more primary patients with bioprosthetic valves in situ etc. Better results have also been visible throughout the years owing to high volume in these centres and inturn, greater experience in handling these cases. In addition, the risk associated with resternotomy is a seperate challenge which can be tackled by preoperative imaging and proper surgical planning accordingly. The focus of this study was to observe the occurrence of intraoperative complications and to formulate steps to tackle and prevent these challenges in a systematic manner.20 consecutive redo cardiac surgeries done in two years duration by the same surgical team were opted for this purpose. The reason for reoperation, grade of cardiac injuries, intraoperative adverse events and perioperative morbidity and mortality were studied in these cases and the challenges were tackled as per institutional protocols in place. To conclude, this study helped in reaffirming the statistical trend showing that redo cardiac surgeries are becoming safer with more experience. This is also helped by the fact that a stepwise strategy can help in advanced anticipation of life threatening events and preventing or tackling them without ado.

Keywords: redo cardiac surgery, bleeding control, cardiac injury, CABG, resternotomy

Introduction

Redo cardiac surgeries are associated with an increased risk of morbidity and mortality. Over the years, there has been a rise in the number of patients undergoing redo surgeries due to

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increase in lifespan, more patients opting for bioprosthetic valves, a slowly rising incidence of prosthesis endocarditis and an increased incidence of morbidities. Although it is assumed that redo surgeries are associated with higher morbidity and mortality, studies have shown that it is becoming increasingly safer due to advanced assessment techniques, better risk stratification protocols, improved surgical techniques and better preparedness for intraoperative catastrophic haemorrhage. Patients undergoing redo cardiac surgeries are a diverse group, belonging to different age groups, with different morbidities and undergoing different procedures ranging from heart valve replacements to coronary artery bypass graft (CABG)

Redo cardiac surgeries pose a challenge for both the surgeon and the anaesthetist in cardiac OR. There are high chances of catastrophic injury and bleeding due to adhesions from previous surgery, difficulty in cannulation and perioperative mortality in these cases. Redo surgeries also have a high incidence of injury to right ventricle, great vessels, lungs and bypass grafts.As a result, it's a common practice to do groin dissection and prepare femoral vessels prior to sternal incision so as to establish an alternate route for cardiopulmonary bypass (CPB).[1]

Intraoperative adverse events (IAE) most commonly included injury to bypass grafts, the chambers of the heart, or the great vessels. Other IAEs include the development of life-threatening arrhythmias, lung injury or torrential bleeding that was severe enough to alter the course of the operation. Intraoperative adverse events can occur during every phase of operation but is said to be most common during pre-pump dissection. This finding constitutes a change from previous reports that highlight the risk of injury during repeat sternotomy.[2]

In redo valve surgeries, extensive surgical dissection of mediastinal and pleuro-pericardial adherences to mobilise the entire heart and facilitate exposure causes diffuse capillary injuries and tissue damage that increase bleeding. CPB adds a major insult to injury and creates excessive activation of the fibrinolytic system that leads to bleeding tendency. Hence pharmacological strategies play a major role in bleeding control.[3] The general assumption is that the incidence of intraoperative life threatening events and mortality is higher in redo surgeries when compared to primary surgeries.

We present a series of 20 redo cardiac surgery cases we performed in our centre from the years 2021 to 2023, where we monitored for the occurrence of intraoperative life threatening adverse events including torrential haemorrhage and arrhythmias with an aim to formulate steps to tackle challenges like hemodynamic instability occurring during adhesiolysis around ventricles and prolonged cannulation time. No catastrophic bleeding or injury to major structures were observed in these cases, instilling more confidence in the already established fact that redo cardiac surgeries are becoming safer by the day due to better preparedness and in the hands of a meticulous surgeon.

Case Description

Redo MVRs

Out of the 20 redo cardiac surgeries that happened in our institution, 17 were redo mitral valve replacements. Of these, one procedure was dual valve replacement (Atrial+mitral). This majority of mitral valve replacements (MVRs) can be attributed to the increased incidence of rheumatic heart disease in our country, higher incidence of mitral valve affection in rheumatic

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heart disease (RHD) and more young patients opting for bioprosthetic valves. Patients were evaluated clinically and all routine blood investigations were done along with 2d echo. Chest x ray was obtained in PA and lateral view to see the extent of adhesions. The patients that presented due to defective mechanical valves, choked valves or valve dehiscence were critical because the valve affection is sudden in such cases. This means that the heart doesn't get adequate time to develop compensatory mechanisms. These patients were hence a challenge to manage perioperatively and the decision to operate has to be quick. Meanwhile, the patients with bioprosthetic valves usually present with a more chronic progression and hence there are compensatory mechanisms in place. Hence there is ample time for optimisation so it is safe to say that operative risk in these patients is similar to a first time surgery.

Age group	No. of patients
15-35y	8
36-55y	6
55-75y	3
NYHA classification	
I	0
II	4
III	8
IV	5
Urgency of operation	
Elective	0
Urgent	15
Emergent	2
Reason for resternotomy	
Biological valve failure	7
Mechanical valve failure	5
Perivalvular leak/ valve dehiscence	2
Endocarditis	3
No. of prior sternotomies	

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1	14
2	3

Table 1. Demographics and characteristics of the patients that underwent redo MVR

Redo AVR

We had 2 cases requiring redo aortic valve replacement (AVR) of which one was a dual valve replacement where MVR was also done. One patient, a 43yr old lady who was an operated case of MVR with dyspnoea on exertion of New York Heart Association (NYHA) grade II for 2 months. Physical examination revealed a pansystolic murmur in the mitral area. Blood investigations were within normal limits. 2d echo revealed left ventricular ejection fraction (LVEF) of 60%, bioprosthetic valve in situ at mv position, severe intravalvular leak, severe mitral regurgitation (MR), moderate aortic regurgitation (AR), severe tricuspid regurgitation (TR), severe affection of aortic valve, pulmonary artery systolic pressure (PASP) of 65mm of Hg.

Second patient was a 43 yr old lady, a known case of bronchial asthma on MDI who was operated for AVR 20 yrs back, now posted for redo AVR. She presented with breathlessness of NYHA grade III of 1.5 yrs duration and intermittent chest pain. Examination revealed an ejection systolic murmur best heard in the aortic area. Investigations revealed mild anaemia with Hb 10.5 and platelet count of 69,000/cmm. ECG showed left ventricular hypertrophy (LVH) with a strain pattern. 2d echo showed ejection fraction of 60%,severe AS,with PASP 35mm hg.

Redo CABG

A 65y old lady,known case of insulin dependent type 2 Diabetes mellitus and hypertension on medication, operated case of CABG in 2008, presented with complaints of chest pain of 6 months duration and dyspnoea on exertion NYHA grade III which progressed to grade IV. Patient had bilateral basal creps on auscultation of lung fields. Blood investigations showed all parameters within normal limits except a slightly raised serum creatinine level of 1.6mg/dl. With eGFR of 36. 2d echo showed LVEF of 45% with anteroseptal and anterior wall hypokinesia. Coronary angiography showed LMCA 30% distal plaque, LAD 80% tubular stenosis, LCX near total occlusion and RCA 70% tubular stenosis followed by total occlusion.

A 74 year old male, known case of type 2 diabetes mellitus and hypertension on oral medication, presented with left sided chest pain of 2 years duration. He was an operated case of CABG one year earlier, on tablet aspirin 150 mg and clopidogrel 75 mg since then. Blood investigations were within normal limits. A LIMA→ LAD and LIMA→OM2 →OM3 were done in previous CABG. Current angiography showed total occlusion of LMCA with collaterals from right system, LIMA- RIMA sequential graft with 90% tubular stenosis in mid followed by total occlusion in graft leading to LAD and 70 % long segment stenosis

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in graft leading to OM2. 2d echo revealed anterior wall, anterior septum and anterolateral ventricular wall hypokinesia with akinesia at apex and thinning out of anterior wall, LVEF 35%, type I diastolic dysfunction, grade II MR, mild TR, PASP by TR jet 35 mm of Hg.

Perioperative Management

Patients were admitted and preoperative evaluation was done. On the day of surgery, starvation was ensured and informed written consent was obtained after explaining all possible complications. It was also ensured that adequate blood and blood products were reserved. Patients were taken in the operating room and peripheral iv cannulation was done with 16-18 G cannula under local infiltration. All standard monitors including ECG, pulse oximetry, temperature, NMT, entropy, urine output, capnography, IBP and CVP were used. Activated clotting time (ACT), serial arterial blood gas, ionogram, haemoglobin, hematocrit and blood glucose levels were measured at regular intervals. Sedation was administered with inj.midazolam at 0.02-0.03 mg/kg and inj. Fentanyl at 1-2mcg/kg. After proper local infiltration, USG guided central venous cannulation of the right internal jugular vein and right femoral arterial cannulation was done. Patients were induced with inj. Fentanyl 5-8 mcg/kg and inj. Etomidate 0.3-0.5 mg/kg and muscle relaxation achieved with inj. Rocuronium 1-1.5mg/kg. Maintenance was done with mixture of O2 and air at 60:40 and isoflurane or sevoflurane as inhalational agent.Blood was called for and reserved in hand and Inj tranexamic acid was administered 15 - 30 mg/kg before and after CPB. Right femoral vessels were exposed and prepared in anticipation of need for peripheral cannulation. Anticoagulation was achieved with heparin 300 iu/kg with a targeted ACT > 400s. Blood was called for and made available before incision in anticipation of torrential bleeding.

CPB lines were primed while skin incision is made and groin area prepared and vessels exposed in anticipation of peripheral cannulation. Following midline skin incision, sternal wires are cut and removed.Midline sternotomy with an oscillating saw was the approach taken in all patients as it gave a clear view of adhesions and mediastinum. For this, first, blunt dissection is done superiorly around the sternal notch. This helps to separate the innominate vein from the back of the sternum. Inferiorly, linea alba is separated and xiphisternum is cut in the midline, The sternum is now elevated from each side with hook retractors to visualise retrosternal adhesions.Once the retrosternal view is achieved in this manner, soft tissue is cut and separated from midline with long curved scissors, starting from lower sternum with initial cut to right as if entering right pleura with the help of intermittent lung deflation by the anaesthesiologist. This surgical manoeuvre is done to minimise risk of entering epicardial right ventricular tissue as the correct plane is visualised initially. Care was taken not to damage the pleura and heart during adhesiolysis. Aorta and SVC, once visualised properly, are cannulated. Rest of the adhesiolysis around the right ventricle is carried out on CPB before cooling as the aim is to avoid ventricular fibrillation at this point. Once satisfactory adhesiolysis is achieved, cooling is started.Right femoral vessels were exposed and prepared in anticipation of need for peripheral cannulation. Anticoagulation was achieved with heparin 300 iu/kg with a targeted ACT > 400s. Blood was called for and made available before incision in anticipation of torrential bleeding.

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Fig 1

Fig 2

Fig 3

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Fig 1-3 showing different stages of sternotomy after blunt dissection is done superiorly around the sternal notch inferiorly, linea alba is separated and xiphisternum is cut in the midline which is then followed by elevating the sternum from each side with hook retractors to visualise retrosternal adhesions. Once these steps are completed, sternum is cut in layers with an oscillating saw.

Redo valve surgeries

Out of the 13 redo MVRs that happened in our institution, we had two patients who were undergoing sternotomy for the third time. Although bleeding and need for pre - bypass transfusion was anticipated in both cases, it was actually seen in only one of them. 3 patients in total required pre-bypass blood transfusion. We did not see any injury to major structures during release of adhesions. The problems we faced were : 1) Bleeding and need for blood transfusion due to extensive adhesions.

2) prolonged time for cannulation (ranging from 65 minutes to even 145 minutes in one case with extensive adhesions) and going into cardiopulmonary bypass and management of hemodynamic instability associated with it.

As a precautionary step, we had called for blood in hand before incision was taken. The source of bleeding in all our cases requiring transfusion were adhesions and not injury to major cardiac structure or vessels. Hence, with timely interference , we could avoid hemodynamic instability from blood loss. Control of hemodynamics and rhythm during adhesiolysis around the heart and inferior vena cava was a clear hurdle to overcome in most of our cases. Extensive dissection was not carried out in the left side of heart to minimise chances of tamponade postoperatively. This has also contributed to shorter aortic cross clamp time and CPB time. Of all the redo MVRs done in our centre, we had one case of right atrial tear before CPB could be instituted. To buy time till cannulation and CPB institution, a soft sucker was placed in RA to drain blood into the venous reservoir, which was then collected in bags and auto transfused to the patient. Remaining blood was then given through CPB once the patient went on pump.

Good communication between anaesthetist and surgeon was vital in these situations. Avoiding tachycardia by use of esmolol 0.5mg/kg or diltiazem 0.25mg/kg over 2 min followed by another dose bolus of 0.35mg/kg after 15 minutes if required, to reduce myocardial O2 consumption, maintaining serum potassium levels less than 4.5 mmol/L were some precautionary steps taken. In the event of displacement of heart during dissection, significant hemodynamic changes were seen which was managed by maintaining a high perfusion pressure (MAP > 70 mm hg) using trendelenburg position, administration of fluids and infusion of a vasopressor, usually noradrenaline 0.05 - 0.2 mcg/kg/min , dopamine 2-20 mcg/kg/min or a combination of both or aliquots of phenylephrine 1-2mcg/kg or ephedrine at 6mg boluses. In the event of bradycardia while weaning off CPB, epicardial pacing wires were inserted into the right ventricle. While weaning off CPB, one patient developed atrial fibrillation which was brought under control with diltiazem. Another patient developed bradycardia requiring pacing. 9 patients required inotropic support ie; infusions of dopamine or norepinephrine to maintain perfusion pressures. Postoperative period was satisfactory in 15 patients. One patient died due to ventricular arrhythmias on postoperative day 3. One patient developed hemorrhagic stroke on pod 2 which was managed conservatively.

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Redo CABG

Preoperatively, bilateral great saphenous veins (GSV) were evaluated to make sure that there was adequate length to form new conduits. Bilateral GSVs were harvested. Providing myocardial protection in redo CABG is a challenge due to stenosis of grafts and it is often helpful to use retrograde cardioplegia. In our cases, antegrade cardioplegia was successfully used. Sternotomy and adhesiolysis went smoothly and anastomosis was done with venous grafts. One case had occlusion in the LIMA-Y segment. This was clipped which resulted in restoration of patency in the rest of the circuit. The 2nd case had occlusion in LIMA - RIMA Y, so the pedicle was looped and venous anastomosis was done to reestablish supply. Both patients were weaned off CPB without inotropic support and the postoperative period went uneventful.

Discussion

Redo cardiac surgeries are technically more challenging because of various reasons. Mediastinal and pericardial adhesions are extensive and worsens with lesser time to reoperation and more number of sternotomies. Additionally, these patients also present with more complex heart pathologies, more comorbidities and worse physiological conditions.

In the Redo Cardiac Surgery in Adults Third International Symposium (April 1999, San Diego) it was stated that “Cardiac reoperations are associated with increased death and major morbidity compared to primary operations …the resternotomy itself has a certain morbidity because of adherence of the structures….and…sternal reentry is the primary cause of massive bleeding during redo cardiac surgery.” [4] However, there is ample evidence from subsequent studies to to believe that the risks of cardiac injury and catastrophic haemorrhage at the time of resternotomy and the resultant morbidity and mortality are preventable.There is ample evidence to believe that resternotomy as such is no longer an independent predictor of perioperative mortality. In this review, we analysed the frequency of intraoperative life threatening events and postoperative morbidity and mortality in redo cardiac surgeries that happened in our institution over a span of 1 year.

Patient Screening & Assessment

To begin with, risk stratification of patients undergoing redo surgery helps in proper preparedness. We used EUROSCORE II for predicting perioperative outcomes of our patients. Choosing the right method for this is still a grey area and there are different schools of thoughts regarding which score is superior to which between EUROSCORE II, Society of Thoracic Surgeons score etc.[5] However, deterioration of functional capacity as shown by increased mortality linked to worsening of New York Heart Association (NYHA) grade shows that decision to operate should be made before clinical condition worsens. Risk factors for redo cardiac surgery includes elderly age, heart failure, urgent/ emergent surgeries, previously patent coronary grafts, hepatic dysfunction, chronic renal failure, prosthetic valve endocarditis, peripheral vascular disease. Last but not least, the skill and experience of a surgeon plays an important role in the outcome of redo cardiac surgeries.

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Inorder to stratify patients hence, we do all routine blood investigations along with eGFR, 2d echo, Xray chest AP & lateral views and preferably a chest CT scan to assess the extent of adhesions and other structural anomalies that may complicate the surgical approach. TEE is also a valuable tool in assessing anatomy of valves, jet flow in regurgitant lesions and to fully understand the disease mechanism. In endocarditis, a PET CT scan can identify other sources of infection or septic emboli in peripheral structures.

Perioperative Management

In our institute, an alternate cannulation site is always prepared , preferably groin for femoral vessels, in all redo cardiac surgeries.

Indications for groin cannulation and sites are mentioned in table below

Groin cannulation Indications
Prophylactic
Emergency indications
Aortic dissection/ aneurysm
Excessively adherent cardiac structures
Pre surgery cardiac arrest
Innominate vein injury during high aortic cannulation required for ascending aorta cannulation
Sites
External iliac artery
Femoral artery

Table 2. Indications and sites for groin cannulation

External defibrillator paddles are kept ready as internal defibrillation is difficult if there are extensive adhesions. Early institution of CPB before sternotomy can be considered if there is high risk anatomy like pseudoaneurysm of aorta or graft adherent to chest wall in case of a previously operated CABG. The drawback of this is, adhesiolysis can bleed profusely as the patient is already heparinized at this point. Mobilisation of heart during adhesiolysis can result in rampant fluctuation of hemodynamics which should be managed by clear communication between surgeon and anaesthetist, administration of appropriate inotropes and timely management of arrhythmias. Hemostasis is a major concern in redo cardiac surgeries as these patients are highly prone to bleeding. Careful surgical dissection, administration of antifibrinolytics, substitution of coagulation factors and keeping blood ready are some measures taken to tackle this.

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Technical Considerations

The standard approach that we follow is a midline sternotomy with an oscillating saw while making sure that only adhesions that are visualised from below are divided and only sternal bone that is freed of adhesions is sawn.(10), keeping in mind that the lesser the adhesions divided, the lesser it will bleed.
Grades of injury during resternotomy are described in following table.[4]

Grade 1	uncomplicated resternotomy: This can be a reasonably fast reentry because the adhesions are easily divided. The cardiac structures are generally not densely adherent to the back of the sternum.
Grade 2	Adhesions behind the sternum are dense and the reentry is slow: Although the adhesions may be dense, there is no injury to the heart and they must be divided under vision carefully. Note, sometimes prophylactically groin cannulation is carried out because it is detected that the adhesions are dense. In some situations groin cannulation is done prophylactically because the aorta may be aneurysmal and it is known that the aorta will need to be replaced as well, high up to where aortic cannulation and/or the clamp would normally be. Hence this cannulation is avoided by putting it in down the groin (generally iliac vessels).
Grade 3	Minor cardiac injury: Minor cardiac injury occurs during resternotomy, requiring suturing, with nil or minimal blood loss (i.e., epicardial and subendocardial RV tissues)
Grade 4	Moderate cardiac injury: There is significant blood loss that necessitates the quick institution of cardiopulmonary bypass or with significant blood loss the

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	suturing of a larger laceration. There is opening into a cardiac chamber, i.e.. into the bloodstream.
Grade 5	Severe cardiac injury This requires the urgent institution of cardiopulmonary bypass via the femoral or iliac vessels. There is major blood loss, hypotension and the likelihood of cardiac arrest before bypass can be established.

Table 3. Grades of injury during resternotomy

Among the 20 cases that we did, we encountered grade 1 injury in 8 cases, grade 2 injury in 6 cases, grade 3 injury in 2 cases and grade 4 injury in 3 cases. Fortunately and due to meticulous dissection and proper planning, we did not encounter any grade 5 injuries which would've required urgent instillation of peripheral CPB. 8 of the total cases required transfusion of blood and blood products prior to instillation of CPB of which one patient required transfusion of platelets due to preoperative thrombocytopenia. 5 cases of these 8 were grade 3 or 4 injuries. Autotransfusion in these cases is a viable option as a safer approach to massive blood transfusion.

Key technical considerations for reoperative valve surgery

Discuss alternative options within the heart team.

Preoperative CT scan for assessment of proximity between the sternum and mediastinal structures

Consider alternate approaches to sternotomy:

- Right minithoracotomy (mitral/tricuspid valves)
- Upper partial sternotomy (aortic valve)
- Right anterolateral thoracotomy (aortic valve)

Consider alternate cannulation sites:

- Femoral (if percutaneous, then under ultrasound guidance)
- Axillary
- Carotid

In our institute, femoral route was exposed but carotid and axillary can be considered

Placing external defibrillator pads is an option (internal direct defibrillation might be challenging due to adhesions)

Consider initiation of CPB and cooling of patient before entering the chest in patients at high risk of mediastinal injury

Minimise excessive bleeding with meticulous tissue dissection and liberal application of antifibrinolytics and coagulation factors. In addition, avoid excessive cooling during CPB.

Careful consideration of myocardial protection strategies:

- Systemic cooling

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- Regular dosing of cardioplegia
- anterograde cardioplegia was given to all our patients. The decision between anterograde and retrograde can be taken as per institutional preference.
- Direct coronary ostia antegrade delivery or retrograde cardioplegia in patients with aortic insufficiency can be considered

If present, identify previous coronary bypass grafts and avoid injury. “No-touch” technique of patent venous bypass grafts.

Consider “in-graft” implantation of valves in previously implanted conduits (i.e., prosthetic valve in Dacron graft after previous aortic valve-sparing root operation) instead of redo Bentall operation.

Consider open implantation of transcatheter valves in patients with severe mitral annular calcification or small valve orifice areas to reduce myocardial ischemic times and risk of paravalvular leaks.

Consider using rapid deployment valves and automated knotting devices to reduce myocardial ischaemia time

Anaesthesia Considerations

Anaesthesia management in redo cardiac surgeries is generally aimed at tackling haemorrhage and its consequences, managing hemodynamic instability associated with increased time to go on bypass and cardiac manipulation. Preparedness is key in these surgeries as there is minimal time to act. Obtaining a chest X ray in lateral view and/or CT scan to evaluate extent of adhesions to the heart, great vessels and sternum will help in preparing for any intraoperative catastrophe. During sternotomy, maintain ventilation at low tidal volumes. Reverse Trendelenberg position to reduce myocardial chamber size will also help prevent cardiac injury during sternotomy to some extent. It is also important to look out for large volumes of blood collecting in the surgical field, sudden hypotension, tachycardia which may indicate injury to a critical vessel, adherent graft, cardiac structure etc. If a blood salvage device is planned to be used, it should be set up prior to sternotomy. Always ensure that at least two units of PRBCs are called for and available in the OR prior to sternotomy. Rapid fluid infusers should be kept ready to be used in the event of torrential bleeding.

In the event of a catastrophic haemorrhage, switch off volatile anaesthetics and administer 100% oxygen. If any vasodilators are ongoing, stop the infusion, aspirate and clear the line out so that no inadvertent flushing of these drugs happens through these lines. Circulating volume is maintained with crystalloids and colloids using rapid iv infusers. Perfusion pressures are maintained using vasopressors like epinephrine, phenylephrine, norepinephrine etc. If the injury happens before cannulation, along with resuscitative measures heparin is administered as well at 300-400 units/kg IV through the central line and ACT is checked as soon as feasible. Target ACT is tried to be maintained more than 400 seconds by administering more heparin as and when required. Once CPB is initiated, anticipation and planning for problems associated with prolonged CPB time and myocardial injury.

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Bleeding Control

In redo cardiac surgery bleeding occurs either due to the procedure or due to hemostasis changes by exposing blood to CPB or more often than not, a combination of both. This is because CPB adds more insult to injury by overactivation of the fibrinolytic system. This is why different pharmacological strategies have been recommended to reduce bleeding tendencies. This includes administration of drugs like tranexamic acid, epsilon amino caproic acid (EACA),both lysine analogues, aprotinin (a natural serine protease inhibitor) etc, or spraying topical agents like fibrin sealant over pericardial surface in cases of prosthetic endocarditis.[3] IV pharmacotherapy is a more popular strategy in preventing blood loss. In our institution, we use tranexamic acid before going on CPB and after protamine administration at a dose of 15mg/kg. Some institutions use EACA, aprotinin or a combination of tranexamic acid and low dose aprotinin. Lysine analogues being significantly cheaper than aprotinin, makes it a more popular drug but which is better than which, is still a controversial topic. Both have been proven to be effective in reducing intraoperative and postoperative bleeding and reducing the need for perioperative blood transfusion. Fibrin sealant is another safe and effective agent which is topically applied to control localised bleeding in redo cardiac surgeries. It reduces the incidence of postoperative bleeding and reduces the need for re-exploration. Hence it is a valuable hemostatic agent.[6] In the event of a torrential bleed due to injury to major vascular or cardiac structures, it is essential to immediately establish CPB with or without hypothermic arrest by peripheral cannulation before irreversible cardiac instability sets in so that the injury can be repaired.

Perioperative morbidity & mortality

In our series, we observed the morbidity and mortality associated with redo cardiac surgery during the period of hospital stay. Common causes of perioperative mortality as per Jones et al[7] are listed in table below.

Causes of death & morbidity
Cardiac failure
Haemorrhage
Myocardial infarction
Endocarditis
Bronchopneumonia
Multi-organ failure
Cerebrovascular accident
Renal failure

Table 4. Causes of perioperative mortality

The median hospital stay in our patients was 5 days. This early discharge can be attributed to factors like lesser intraoperative complications, meticulous technique, aggressive management

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of blood loss and hemodynamic instability with measures like autotransfusion, inotropes and intra aortic balloon pump (IABP) wherever necessary, early extubation and early mobilisation. We had 2 mortalities and the root cause of both was septicemia. As for morbidity, one patient developed a hemorrhagic cerebral infarct on postoperative day 2 which could be managed conservatively and the patient was discharged on postoperative day 10.

The overall risk of perioperative mortality is said to be higher in redo cardiac surgeries than primary surgeries, more so if it's a redo surgery for prosthetic valves due to inadequate time for compensatory mechanisms to come into play to save the heart. In our series, we have observed that the mortality is acceptable and was not necessarily due to cardiac injuries. The perioperative mortality and morbidity is more likely dependent on patient demographics, comorbidities and reason for redo surgery. Over the years, mortality associated with redo cardiac surgeries has decreased and is comparable to primary surgeries due to factors like better preparedness and newer techniques.

Conclusion

Redo cardiac surgeries are generally a risky affair due to both patient and procedure related reasons. It can't be stressed enough that an integrated institution derived perioperative protocol should be in place while approaching these cases. With adequate preoperative screening, assessment, perioperative management, good surgical technique and cardiac intensive care, redo cardiac surgeries are not necessarily as associated with mortality and morbidity as one may think. Proper optimisation of patients prior to surgery remains a key factor in determining perioperative mortality and morbidity.

Conflict of interest

Nil

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