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Our Experience of Type A Acute Aortic Dissection and Their Outcomes in 27 Cases

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Abstract

Background: An acute type A aortic dissection is considered a surgical emergency. Surgical mortality for acute type a aortic dissection reported in different experiences from single centers or surgeons varies from 7% to 30%. Early intervention and judicious management in type A dissection improve outcome in terms of mortality. This study was performed to analyse the surgical experience of acute type A aortic dissection from single centre. *Methods:* 17 patients who were diagnosed with acute type A dissection were included in this study. These patients were admitted in GB Pant hospital from January 2016 to October 2018. Patients were evaluated with pulsed-wave Doppler echocardiography and cardiac CT angiography with 3D reconstruction and underwent surgery. Parameters under study were recorded and statistical analysis performed. *Results:* The overall in-hospital mortality was 5.9%. Independent predictors of mortality were older age, previous history of hypertension, presence of previous aortic valve disease, presence of acute onset migrating chest pain and features of CHF, extent of dissection flap and type of surgery. Follow-up revealed significant improvement in NYHA status of patients postoperatively. *Conclusion:* Timely intervention and prior comorbidities play an important role in determining surgical outcomes in patients with type A acute aortic dissection. Knowledge of significant risk-factors for operative mortality can contribute to better management. Shorter operative time and strict control of anticoagulation can lead to decreased mortality.

Keywords: Type A Acute Aortic Dissection; Bentall Procedure; Ascending Aorta.

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Introduction

Acute proximal aortic dissection is one of the most serious cardiovascular conditions and is associated with considerably high morbidity and mortality. Emergency surgical treatment is aimed to avoid lethal complications from complete rupture, pericardial tamponade, coronary obstruction and end-organ ischemia. Despite improved surgical techniques and perioperative care, operative mortality remains high, between 18.8% and 30%.[1-3] Advances in understanding the pathophysiology of dissection and its variants and the proliferation of improved diagnostic and therapeutic procedures have raised expectations for better outcomes. The relationship between preoperative risk-factors and mortality has been studied in recent years. The

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aim of this analysis was to analyse the surgical experience of acute type A aortic dissection patients operated by single surgeon and identify important factors that can help in improving medical and surgical treatment.

Materials and Methods

This study was conducted at Department of Cardiothoracic and Vascular Surgery, Govind Ballabh Pant Hospital, New Delhi, from January 2016 to October 2018. All patients diagnosed with acute type A aortic dissection were included in the study. The total number of patients included was 27. The patients underwent detailed history taking and clinical examination. Presence of comorbidities and complications was noted. All patients underwent blood investigations, CXR and ECG. They were evaluated with cardiac CT angiography with 3D reconstruction and pulsed-wave Doppler echocardiography. According to institutional protocol, all patients more than 40 years old underwent a conventional angiography to rule out CAD and those having critical CAD were planned for CABG in the same sitting.

All 27 patients admitted were stabilized in the intensive care unit preoperatively and invasive cardiac monitoring was started. In patients, having severe left ventricular systolic dysfunction, levosimendan infusion was started preoperatively with loading dose of 12.5 mcg/kg and maintenance dose of 0.1 mcg/kg/min.

Operation was done through midline sternotomy. For arterial cannulation, axillary artery was cannulated using 8 mm PTFE side graft in 26 patients and femoral artery was cannulated in 1 patient. After sternotomy, venous cannulation was done through right atrium using dual stage venous cannula and CPB was initiated. Topical and systemic cooling was done up to 28°C and aortic cross-clamp was applied once the heart fibrillated. Aortotomy was performed and antegrade ostial cardioplegia with Del Nido cardioplegia solution was given for myocardial protection. All patients were implanted with St. Judes Medical Masters Series composite mechanical valved aortic graft. In patients having distal extent of dissection upto origin of brachiocephalik trunk, selective antegrade cerebral perfusion through (ACP) right axillary artery with moderate hypothermia (26°C) was given. In these patients, distal anastomosis was performed with open clamp technique. In one patient, where total arch replacement was performed due to involvement of arch of aorta, right femoral artery cannulation was done and patient was taken on total circulatory arrest after cooling up to 20°C. Prior to distal anstomosis, false aortic lumen was closed using polypropylene sutures. Cross-clamp time and CPB time were noted. Patient was weaned off bypass and shifted to ICU after wound closure.

Postoperatively patients were followed up through the hospital stay and the amount of pleural drainage, time period to extubation, ICU stay and total hospital stay was recorded. The need for reintubation and reexploration was also noted. One patient had inhospital death. After discharge, patients were followed up at 15 days interval up to 3 months and then on monthly basis. Clinical examination was done on every visit with echocardiography and CT angiography after 3 months, 6 months and 1 year from surgery. At follow-up, NYHA status of the patient and presence of residual dissection on CT angiography was noted. Follow-up was done for 23 patients till now while 3 patients were lost in follow-up.

All study parameters were recorded and tabulated in Microsoft Excel worksheet. They were presented as observational data.

Results

Table 1: Patient Characteristics

Variable	Overall (n = 27)	Survived (n = 25)	Died (n = 2)
Demographics			
Mean age (Years)	49	47.94	61.2
Gender (M : F)	21:6	19:6	2:0
Etiology and Comorbidities			
Marfan's syndrome	10	10	00
Hypertension	11	10	01
Iatrogenic	00	00	00
History of atherosclerosis	06	06	00
Prior dissection	00	00	00
Diabetes	07	07	00
History of cardiac surgery	00	00	00
Complications			
Shock	03	03	00
Congestive heart failure	04	03	01
Acute renal failure	02	01	01
Clinical Presentation			
Chest pain	27	25	02
Abrupt onset of pain	13	11	02
Migrating Pain	02	01	01
Syncope	02	02	00
Hypotension	03	03	00
Pulse deficit	04	03	01
Echocardiography			

Variable	Overall (*n* = 27)	Survived (*n* = 25)	Died (*n* = 2)
Presence of aortic regurgitation	09	08	01
Presence of bicuspid aortic valve	10	10	00
CT Angiography			
Aorta diameter (mm)	58.1	56.85	68.0
False lumen extent	DTA -01 AA- 26	DTA-00 AA-25	DTA-01 AA-01

Table 2: Study Parameters

Study Variable	Value
Preoperative	
Number of patients needing preoperative Levosimendan support	08
Mean time delay between onset of symptoms and operative intervention	27.3 hours
Intraoperative	
Type of Surgery	
Bentall procedure	23
Bentall procedure with CABG	03
Bentall procedure with total aortic arch replacement	01
Mean CPB time (Minutes)	178
Mean cross-clamp time (Minutes)	121
Number of patients needing TCA	01
Number of patients needing SACP	05
Type of arterial cannulation	
Axillary	26
Femoral	01
Postoperative	
Mean duration of ventilatory support (Hours)	16.2 (Range 13–29 hours)
Mean duration of inotropic support (Hours)	57.1 (Range 49–165 hours)
Number of patients requiring IABP support	07
Number of patients needing reintubation	02
Number of patients needing reexploration	01
Number of deaths	02
Mean mediastinal drainage (ml)	210.4 (Range 180–900 ml)
Mean ICU stay (Days)	6.27 (Range 4–9 days)
Mean hospital stay (Days)	9.8 (Range 8–15 days)
Follow-up	
Postoperative NYHA Grade	
Grade I	13
Grade II	10
Grade III	02
Grade IV	00
Number of patients needing rehospitalization	01 (Admitted for dyspnea, treated conservatively)
Number of patients having CVA	00
Number of patients with residual dissection on postoperative CT	00

Discussion

Acute aortic dissection is a life threatening condition that remains challenging to diagnose and treat. Diagnosis of acute aortic dissection can be made on initial examination in up to 38% of patients and diagnosis is first established at postmortem examination in 28% of patients (Table 1).[1] The mean presenting age in our patient group was 49.0 years. The mean age of patients of type A acute aortic dissection in IRAD was 61.2 years who presented at a younger age as compared to type B aortic dissection. The gender distribution in our patient group was 77.78% males and 22.22% females. The gender distribution in IRAD was consisting of 62.97% males and 37.03% females.

Patients presents in acute condition with variety of signs and symptoms, many of which can mimic more common conditions such as myocardial infarction and pulmonary embolism. 1 Most common presenting symptom in our study was excruciating chest pain present in all patients with sudden onset reported in 48.15%. In IRAD data, chest and back pain radiating to shoulder and neck was most common presentation described as sudden onset pain in 84.8% of patients. The quality of pain was described as sharp in 64.4% patients more often than tearing or ripping pain to chest in 50.6%.[1] 2 patients presented with complaints of syncope in our study. Syncope is a well-recognized symptom of AAD, often indicating the development of dangerous complications such as cardiac tamponade, involvement of cerebral vessels or activation of cerebral baroreceptors. Syncope was reported in 12.7% of type A AAD patients in the IRAD registry.[1]

In our study, pulse deficit was reported in 14.90% patients. Pulse deficits occurred in 18.7% of the type A AAD patients in IRAD and are similar to the 30–50% of patients reported previously in other studies.[4–6] Like other reports, there is an incremental additive risk of in-hospital death with the number of pulse deficits noted on physical exam. This often serves as a surrogate finding indicating the extent of vascular compromise.[5]

After presentation to the hospital, one of the most ominous findings on physical exam is the presence of hypotension (systolic blood pressure < 90 mm Hg). In study by, Hypotension occurred in > 25% of patients and was associated with neurologic deficits, altered mental status, myocardial and mesenteric ischemia, limb ischemia and death in 55% of patients.5 In our study, 11.11% patients presented with hypotension on initial examination.

Congestive heart failure on presentation was detected in 6.4% of IRAD patients based on the impressions of the managing physicians. In our study, this proportion of patients was 14.81%.

With respect to prior comorbidities and possible etiology in patients, we had Marfan's syndrome in 37.04%. This is contrasting with IRAD data which showed only 6.7% Marfan's syndrome patients in type A AAD patients. The mean age of presentation in IRAD among these patients was significantly younger being 36 years. This can explain the comparatively younger mean age of presentation in our patient group where proportion of Marfan's syndrome patients was considerably higher.

Regarding other comorbidities, in our patient group, 40.74% patients had hypertension compared 35.7% in IRAD. Similarly history of atherosclerosis was present in our study in 22.22% compared to 24.2% in IRAD. No cases of iatrogenic dissection were reported in our study group. In our study, no patients had history of prior dissection, known aneurysm or prior cardiac surgery. The proportion of diabetic patients in our studies was 25.93% compared to 4.3% in IRAD.

Regarding imaging techniques used for diagnosis, 2D transthoracic echocardiography and CT angiography were used in our patients. On echo, associated aortic regurgitation was detected in 9 patients (33.33%). In IRAD, the murmur of aortic regurgitation was present in 44% of type A dissections and half of the patients of type A AAD had aortic insufficiency on echo.[1] Furthermore, bicuspid aortic valve was found on echo in 10 patients (37.04%) in our patient group. A morphologically bicuspid valve was present in 7–15% of unselected cases of fatal aortic dissection in published necropsy studies.[7–10] Compared with an estimated incidence of BAV of 1–2% in the general population, the presence of BAV was associated with a 9-fold increased risk of aortic dissection.[8,10] Moreover, a bicuspid morphology was found 10-fold more commonly in persons with a type A aortic dissection than in those without aortic dissection, based on the data of a 21-year necropsy population.[10] Patients with BAV and fatal aortic dissection were approximately one decade younger than dissection patients with a tricuspid aortic valve.[7,10] CT angiography confirmed the diagnosis in all patients in our study group. Average diameter of ascending aorta in our patient group was 58.1 mm. A false lumen with intimal flap was detected in all cases. The extent of false lumen was limited to ascending aorta in 26 cases but in one case, the false lumen extended involving aortic arch and descending thoracic aorta.

Surgery provides definitive treatment for patients with type A AAD. The time delay between onset of symptoms and surgical intervention is strong predictor of outcome as surgical treatment aims to treat and prevent the common and lethal complications including aortic rupture, stroke, visceral ischemia, cardiac tamponade and circulatory failure. In our study group, the mean time delay between onset and surgical intervention was found to be 27.3 hours. In study, conducted by Trimarchi et al., the mean interval between onset of symptoms and surgical intervention was 79.3 hours, with 37.9 hours in nonsurvivors and 93.0 hours in in-hospital survivors. In their study, surgical intervention was noted to be delayed for a number of reasons, including the need to obtain confirmatory imaging studies, the need to perform coronary angiography, a delay until the surgeon or operating room became available, or resolution of a comorbid medical condition. The overall in-hospital mortality was 25.1% in their study compared to our in-hospital mortality of 7.41%.[11] All 9 patients in our study group having aortic regurgitation on echo received levosimendan infusion preoperatively for 24 hours in a dose of 0.1 mcg/kg/min. Patients receiving levosimendan had a shorter duration of intensive care stay than peers who received a preoperative IABP.[12] levosimendan might reduce renal injury in adult patients undergoing cardiac surgery (Table 2).[13] With regard to the type of surgery performed, 23 patients underwent Bentall procedure, 3 patients underwent Bentall procedure with CABG for CAD and 1 patient underwent Bentall procedure with total arch replacement due to dissection involving complete aortic arch.

Our preferred method of arterial cannulation was right axillary artery which was used in 26 patients. One patient in which brachiocephalic artery was also involved underwent right femoral artery cannulation.

When repairing an AAD, brain preservation is still one of the major challenges during surgery, and failure to do so is the best predictor of hospital mortality 14.[5] Patients in our group had to be taken on selective Antegrade Cerebral Perfusion through (ACP) right axillary artery with moderate hypothermia (26°C). In these patients, distal anastomosis was performed with open clamp technique due to close proximity of distal extent of aneurysm to origin of brachiocephalic artery. One patient underwent total arch replacement with right femoral artery cannulation. During TCA, the minimum temperature achieved was 18°C and the mean duration of TCA in these patients was 41.2 minutes. Cook et al.[15] showed that a systemic temperature of below 22 degree C may not be necessary and may be associated with a higher incidence of neurological injury when SACP is used during deep hypothermic arrest. Salazar et al.[16] supported the conclusion that systemic circulatory arrest with SACP at moderate hypothermia can be safely performed.

The mean CPB time in our patient group was 178 minutes and mean aortic cross-clamp time was 121 minutes. In a similar study by Sakalauskas et al., the mean CPB time was 214.6 (± 102.9) minutes and mean aortic cross-clamp time was 114.5 (± 62.7) minutes.[17] The mean duration of ventilatory support was 16.2 hours and mean duration of inotropic support was 57.1 hours. The mean mediastinal drainage after surgery was 210 ml. The mean ICU stay was 6.27 days and mean total hospital stay was 9.8 days.

There were 2 deaths in our patient group in immediate postoperative period. One of these patient underwent Bentall procedure with total arch replacement. This patient underwent re-intubation next day after surgery as reexploration was needed due to postoperative hemorrhage. On reexploration, there was bleeding from distal anastomotic line. It was controlled with hard felt reinforcement. On 7th postoperative day, the patient died due to sepsis and pulmonary complications. The other patient developed postoperative renal dysfunction from 1st postoperative day which worsened over next 3 days. Patient underwent hemodialysis twice but did not have consistent improvement and died on 5th postoperative day.

The remaining 25 patients were followed up from discharge till recent past. The follow-up period ranged from 2 to 44 months. These patients showed remarkable improvement in NYHA grade. On postoperative CT angiography in all patients, there was no residual false lumen. There were no delayed mortalities and neurological events till recent follow-up.

The limitations in the present study, included the retrospective nature of study and small sample size consisting of only 27 patients.

Conclusion

It can be concluded from the observations of this study that some factors profoundly affect the mortality in patients undergoing type A aortic dissection repair. The most important of these factors is early intervention limiting the time elapsed between onset of symptoms and surgery. Also, in our experience, preoperative use of levosimendan improved outcomes in patients with preexisting LV dysfunction. The better neurological outcomes can be the result of using selective antegrade cerebral perfusion with moderate hypothermia thus limiting use of TCA. Other factors contributing to limited mortality and morbidity in our patient group are comparatively shorter CPB time and aortic cross-clamping time limiting the detrimental effects of extracorporeal circulation, and strict maintenance and detailed counselling regarding anticoagulation helping to prevent late neurological complications and deaths.

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