Surgical Management of Acute Aortic Occlusion: A Single-center Experience

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Abstract

Objective: Acute aortic occlusion (AAO) is an uncommon vascular emergency with a high mortality rate of around 25%–80%. The management relies heavily on the timely presentation, early recognition, and prompt institution of appropriate treatment to decrease the morbidity and mortality. The objective of this study was to analyze the results of aortic thrombectomy for AAO in our center. Patients and Methods: This retrospective study included ten consecutive patients from November 2014 to July 2015 who presented to the Emergency Department of our hospital with features of AAO. The intraoperative and postoperative data were recorded, and the patients were followed up for 30 months. Results: Of the total of 10 patients, 6 were male. The age range was between 21 and 60 years. Three patients had an identifiable embolic source. The shortest duration of presentation was 12 h while the longest duration was 1 week. Only one patient presented with pain abdomen and vomiting whereas the rest presented with features suggestive of lower-limb ischemia. The mean duration of ischemia and presentation to hospital was 3.33 days in case of embolic etiology while it was 2.64 days in case of thrombotic etiology. We had two postoperative mortalities. Conclusion: AAO though rare has a favorable prognosis irrespective of the duration of presentation depending on the severity of ischemia and end-organ dysfunction at the time of presentation. It also has decreased morbidity and mortality with appropriate and timely treatment. Aortic thrombectomy (infrarenal, suprarenal, or thoracic aorta) is a safe and cost-effective management with less morbidity and mortality.

Keywords: Acute aortic occlusion, aortic thrombectomy, aortofemoral bypass, surgical management

Introduction

Acute aortic occlusion (AAO) is an uncommon vascular emergency with a high mortality rate of around 25%–80%.[1,2] Thrombosis and embolism are the two principal causes by which AAO can occur. The etiology for AAO can be due to primary cardiac or aortic pathology, prothrombotic conditions, nonatherosclerotic nonaneurysmal aortic etiology, or idiopathic causes.[3-4] The management of this entity relies on the timely presentation, early recognition, and prompt institution of appropriate treatment modality to decrease the morbidity and mortality associated with this condition. AAO presents in myriad ways, and it may present as acute limb ischemia, acute onset of limb weakness, acute hypertension, or can even present with abdominal symptoms. Thus, the treating physician should have a high index of suspicion and examine the peripheral pulses in these patients, to avoid unnecessary investigations and thus to save time. The objective of this study was to analyze the results of aortic thrombectomy for AAO in our center.

Patients and Methods

The study was approved by the institutional ethical clearance board. The study period included consecutive patients from November 2014 to May 2015, who presented to our emergency department, with features of AAO. The patients were identified based on the intraoperative confirmation of AAO. All the patients underwent a contrast-enhanced computed tomography from the arch of aorta and both lower limbs apart from a duplex scan and echocardiography. A total of 10 patients were identified, and the records of these patients were analyzed. Age, gender, the timing of presentation, symptomatology, comorbid conditions, intraoperative findings, and the outcome of the patients were analyzed. As the sample size was small, data were not subjected to test for any significance or correlation.

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RESULTS

A total of 10 patients (six males and four females) were detected to have AAO. The risk factors are documented in Table 1. Our study comprised patients of predominantly younger age group with four of them <35 years. In the study population, three patients developed AAO due to embolism in which two patients had rheumatic heart disease and one patient had hypertrophic nonobstructive cardiomyopathy with atrial fibrillation and left atrial thrombus, and the remaining seven patients had AAO due to thrombotic etiology.

Eight patients presented with infrarenal aortic occlusion, of them two also had concomitant thoracic aorta involvement. Two patients had severe motor and sensory deficit [Table 2]. The mean duration of ischemia and presentation to hospital was 3.33 days in case of embolic etiology while it was 2.64 days in case of thrombotic etiology. The minimum interval between the onset of symptoms and arrival at the hospital was 12 h while the maximum interval was 1 week in a patient with rheumatic heart disease. None of the patients in the present series presented within 6 h of onset of symptoms. Patients presented within 3 days of onset had higher mortality compared to that of >3 days of onset of symptoms [Table 3]. Only one patient presented with pain abdomen and vomiting whereas the rest presented with features suggestive of lower-limb ischemia. All the patients underwent laparotomy for abdominal aortic exposure with bilateral transfemoral embolectomy and added posterolateral thoracotomy when descending thoracic aorta was also involved. One patient required open-heart procedure for left atrial thrombectomy. Two patients did not survive; one patient had reperfusion injury while the other had an acute coronary event causing intractable ventricular tachycardia. All the eight patients who survived have been followed up regularly for the past 30 months.

DISCUSSION

The study reflects a positive note regarding both morbidity and mortality with only 20% mortality and no morbidity at the end of 60 days postoperatively, despite delayed arrival to the hospital. As per the available literature, AAO has the mortality rate ranging between 14% and as high as 100%. In the present study, patients with thrombotic etiology were more in number than those with embolic etiology. Although the mean duration of presentation was longer in the embolic group, their outcome is better than the thrombotic group.

The symptomatology in acute arterial occlusion could be due to reversible spinal cord ischemic neuropathy as proposed by Babu et al. or due to the arterial occlusion. The patients who presented with pain and sensory–motor disturbance of the lower limbs regained their sensation and motor power after flow was reestablished except one patient who probably had ischemic spinal cord neuropathy; there was no postoperative morbidity in patients who recovered.

Paralysis of lower limbs can be due to ischemic spinal cord neuropathy or acute arterial occlusion with no collateral reformation of blood supply to the lower limbs. In the present series, two patients had severe paralysis. We suspect that one patient had paralysis due to spinal cord ischemia and the other due to acute arterial occlusion with no collateral reformation. A patient with spinal cord ischemia had warm limbs with good collateral reformation and hence did not have reperfusion injury and did well postaortic thrombectomy. A patient with paralysis due to acute arterial occlusion and no reformation of lower-limb vessels did not do well postvascularization as he developed severe reperfusion injury and required hemodialysis, bilateral below knee amputation, and finally succumbed.

Hence, we propose that if a patient with AAO has evidence of acute symptomatology with no evidence of collateral reformation, the likelihood of postoperative recovery is poor. The markers of poor outcome on computed tomography are

### Table 1: Risk factors for acute aortic occlusion

| Risk factors       | Embolism | Thrombosis |
|--------------------|----------|------------|
| Preexisting heart disease | 3        | 0          |
| Diabetes           | 0        | 2          |
| Hypertension       | 0        | 1          |
| Smoking            | 0        | 2          |
| History of claudication | 0      | 0          |
| Female             | 3        | 1          |

### Table 2: Classification of motor and sensory deficits

| Motor deficit | Sensory deficit | None | Moderate* | Severe* |
|---------------|-----------------|------|-----------|---------|
| None          |                 | 1    | 3         | 2       |
| Paralysis     |                 | -    | 1         | -       |
| Paralysis     |                 | -    | 1         | 2       |

*Moderate is defined as diminished sensation to light touch. *Severe is defined as anesthetic

### Table 3: Effect of duration of ischemia on mortality rates

| Symptom interval | Number of patients | Cause       | Number of deaths | Mortality rate (%) |
|------------------|--------------------|-------------|------------------|-------------------|
|                  |                    | Embolism    | Thrombosis       |                   |
| ≤6 h             | -                  | -           | -                | -                 |
| >6 h             | 10                 | 3           | 7                | 2                 |
| ≤3 days          | 6                  | 2           | 4                | 2                 | 33                |
| >3 days          | 4                  | 1           | 3                | 0                 | 0                 |
depicted in Figure 1. The authors of the study realize that more than the ischemic duration, the severity and the extent of ischemia has an impact on the outcome of the patient as reported in the study by Dossa et al.[5]. Patients, though presented late, did well postaortic thrombectomy probably due to the good collateral reformation of the bilateral lower-limb vessels and hence limited reperfusion injury postrevascularization, decreasing the postoperative morbidity and mortality.

The reformation of lower-limb vasculature appears a positive factor and a good prognostic indicator despite their delayed presentation. End-organ failure and complete motor weakness (not due to spinal cord involvement) appear to be a detrimental factor.

There are various modalities of managing thoracic aortic occlusion with peripheral arterial occlusion which include anticoagulation with heparin, thrombolysis, thromboaspiration, surgery, and endovascular stenting.[6,7] There have been reports of initiating medical management in the form of anticoagulation with heparin for resolution of aortic thrombi and examining the lesion at the end of 2 weeks with the help of transesophageal echocardiography or magnetic resonance imaging and surgical management if there was no decrease in the size of the thrombi. Endovascular stenting of the thoracic aortic pathology[8] has also been tried successfully to treat the lesions in conjunction with other modalities of treatment. Recent literature suggests an increasing role for endovascular management of infrarenal occlusion.[9] In the present study, eight patients with infrarenal occlusion were managed only with surgical aortic thrombectomy with no morbidity and mortality. The present study lucidly depicts that infrarenal occlusions have a better prognosis compared to juxtarenal and suprarenal occlusions.

The use of axillobifemoral bypass[1] for AAO has been followed, but the cost of the graft and short-term patency were the issues which prevented us from utilizing axillobifemoral bypass as our treatment modality. Aortofemoral bypass could have been an option for our patients. However, we did not perform aortofemoral bypass as the patients had acute symptomatology rather than chronic symptoms. Hence, we performed aortic thrombectomy alone. Furthermore, the chance of infection and possibility of graft thrombosis prevented us from considering aortofemoral bypass.

The authors of the present study suggest that even a combined procedure with infrarenal aortic thrombectomy and thoracic aortic thrombectomy by laparotomy and thoracotomy in the same sitting can be safely done with minimal morbidity and mortality. Surgical management can still be used as a prime modality of treatment considering acceptable morbidity and mortality.

The limitations of our study are the small sample size owing to the rare presentation of this condition. We have not compared our results with other surgical options such as aortofemoral bypass or axillobifemoral bypass and endovascular management. Definitive conclusions could not be drawn regarding the ideal treatment modality.

**CONCLUSION**

AAO though rare has favorable prognosis irrespective of the duration of presentation and prognosis depends on the severity of ischemia and end-organ dysfunction at the time of presentation. It also has decreased morbidity and mortality with appropriate and timely treatment. Aortic thrombectomy (infrarenal, suprarenal, or thoracic aorta) is a safe and cost-effective management with acceptable morbidity and mortality.

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**Conflicts of Interest**

There are no conflicts of interest.

**REFERENCES**

1. Crawford JD, Perrone KH, Wong VW, Mitchell EL, Azarbal AF, Liem TK, et al. A modern series of acute aortic occlusion. J Vasc Surg 2014;59:1044-50.
2. Dossa CD, Shepard AD, Reddy DJ, Jones CM, Elliott JP, Smith RF, et al. Acute aortic occlusion. A 40-year experience. Arch Surg 1994;129:603-7.
3. Verma H, Meda N, Vora S, George RK, Tripathi RK. Contemporary management of symptomatic primary aortic mural thrombus. J Vasc Surg 2014;60:1524-34.
4. Tsilimparis N, Hanack U, Pisisimis G, Yousefi S, Wintzer C, Rückert RI, et al. Thrombus in the non-aneurysmal, non-atherosclerotic descending thoracic aorta – An unusual source of arterial embolism. Eur J Vasc Endovasc Surg 2011;41:450-7.
5. Babu SC, Shah PM, Nitahara J. Acute aortic occlusion – Factors that influence outcome. J Vasc Surg 1995;21:567-72.
6. Malyar NM, Janosi RA, Brkovic Z, Erbel R. Large mobile thrombus in non-atherosclerotic thoracic aorta as the source of peripheral arterial embolism. Thromb J 2005;3:19.
7. Choukroun EM, Labrousse LM, Madonna FP, Deville C. Mobile thrombus of the thoracic aorta: Diagnosis and treatment in 9 cases. Ann Vasc Surg 2002;16:714-22.
8. Morris ME, Galifanes EL, Nichols WK, Ross CB, Chauvupun J. Thoracic mural thrombi: A case series and literature review. Ann Vasc Surg 2011;25:1140.e17-21.