Abstract:

BACKGROUND - Ruptured abdominal aortic aneurysms (AAA) are a dramatic life threatening emergency. Ruptured AAAs can be repaired by open or endovascular method. However, 4 to 5 of sudden deaths in the west are attributed to undiagnosed ruptured AAA. METHODS - We report the clinical features and the outcome of patients presenting with ruptured AAA who underwent open repair at a tertiary care centre in South India. A retrospective analysis of inpatients and outpatient records from January 2010 to July 2011 was done. Diagnosis of ruptured abdominal aortic aneurysm or impending rupture was made on clinical grounds and confirmed with an abdominal ultrasound or computed tomographic scan. RESULTS - Five patients presented with ruptured AAA from January 2010 to July 2011. There were four males and one female patient. The mean age at presentation was 57 years. All the patients presented with abdominal pain and a pulsatile abdominal mass (n5), one patient presented with shock. Computed tomographic scan, ultrasound or angiogram showed aneurysm involving infra renal abdominal aorta (n3), supra renal abdominal aorta (n1) and juxtarenal abdominal aorta (n1). The mean diameter of the aneurysm was 8.7 cm. The mean intraoperative blood loss was 1700 ml. The mean duration of stay in ICU was 11 days and the mean hospital stay was 23 days. There was one patient who needed a reexploration due to renal graft thrombosis. The outcome was favorable in four patients. One patient was discharged moribund. CONCLUSION - Early diagnosis, aggressive resuscitation and early surgical intervention is essential in the treatment for ruptured aortic aneurysm. A triad of abdominal pain hypotension and a pulsatile mass is pathognomonic for diagnosis of ruptured AAA. Morbidity and mortality rates of open surgical repair
are similar to those reported in the West. Open surgical repair remains the preferred mode of management for ruptured AAA.

**Keyword**: Ruptured abdominal aortic aneurysm, early diagnosis, open surgery, mortality.

**BACKGROUND**

An abdominal aortic aneurysm (AAA) is defined as an aortic diameter of at least one and one-half times the normal diameter at the level of the renal arteries, which is approximately 2.0 cm. A segment of abdominal aorta with a diameter of greater than 3.0 cm is considered an aortic aneurysm (1, 2). Approximately 80% of aortic aneurysms that occur are infra renal. The prevalence of AAA in men is approximately three times greater than in women and the incidence increases with advancing age.(6) The risk of aneurysm rupture has been shown to be proportional to aneurysm size, with aneurysms measuring less than 5.0 cm having an annual rupture rate of approximately 1% whereas those greater than 7.0 cm in diameter have an annual rupture rate of over 30%.(7) The other risk factors for rupture are chronic obstructive pulmonary disease, ischemic heart disease, smoking and hypertension. The common modes of presentation include being asymptomatic, vague abdominal or back pain. Early diagnosis and treatment (open repair/EVAR) are essential.

**METHODS**

We report the clinical characteristics and the outcome of patients presenting with ruptured aortic aneurysms who underwent open repair in a tertiary care hospital in South India. A retrospective analysis of inpatients and outpatient records of patients from January 2010 to July 2011 was done. Diagnosis of ruptured abdominal aortic aneurysm or impending rupture was made on clinical grounds and confirmed with an abdominal ultrasound, computed tomographic scan or angiogram. The preoperative risk factors analysed were age, sex, shock at presentation, mean diameter of the aneurysm (cm), presence of co-morbidities (cardiac, pulmonary). The outcomes assessed were intra-operative and 30 day mortality, systemic complications and duration of hospital stay.

**RESULTS**

There were five patients included in this study from July 2010 to July 2011. The characteristics of these patients are summarized in Table 1. All patients presented with abdominal pain and a pulsatile abdominal mass (n=5, 100%). One patient presented with shock (20%). Computed tomographic scan, ultrasound or angiogram showed aneurysm involving infra renal abdominal aorta (n=3), suprarenal abdominal aorta (n=1) and juxtarenal abdominal aorta (n=1). The postoperative outcomes are summarized in table 2. The average amount of blood loss was 1700 ml. There was one patient who needed a re-exploration due to renal graft thrombosis. This patient later developed a ventilator acquired pneumonia and multi organ dysfunction and was discharged moribund. There was another patient who developed transient renal dysfunction which was managed conservatively. There were two patients who developed postoperative pulmonary complications. The mean duration of stay in ICU was 11 days and the mean hospital stay was 23 days.
DISCUSSION:
We have reviewed 5 patients who have undergone open repair for ruptured abdominal aortic aneurysm over a period of one year. In this series, the mean age at presentation was 57 years with a male preponderance (4:1). The common clinical presentation was pulsatile abdominal mass with one person presenting with shock. CT scan, ultrasound or angiogram was used to confirm the diagnosis. Following open aneurysmorrhaphy, the mean duration of stay in ICU was 11 days and in hospital stay was 23 days. The outcome was favorable in four patients; the one remaining patient was discharged moribund. The main problems treating patients with AAA rupture are the following:

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<table>
<thead>
<tr>
<th>Demographic data and preoperative risk factors</th>
<th>No: (%)</th>
</tr>
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<tbody>
<tr>
<td>Mean age in years</td>
<td>57</td>
</tr>
<tr>
<td>Male</td>
<td>4(80)</td>
</tr>
<tr>
<td>Systolic BP less than 70 mm Hg</td>
<td>1(20)</td>
</tr>
<tr>
<td>CT scan done</td>
<td>4(60)</td>
</tr>
<tr>
<td>Mean Diameter of the aneurysm (cm)</td>
<td>8.7</td>
</tr>
</tbody>
</table>

| Cardiac co-morbidities | 2(40) |
| Pulmonary co-morbidities | NIL   |

**Table 2: Open repair of ruptured AAA – postoperative outcomes assessed**

<table>
<thead>
<tr>
<th>Postoperative outcomes</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intra-operative mortality</td>
<td>Nil</td>
</tr>
<tr>
<td>30 day mortality</td>
<td>1</td>
</tr>
<tr>
<td>Average intra-operative blood loss in ml</td>
<td>1700</td>
</tr>
<tr>
<td>Blood transfusion intra-operatively( unit packed cells )</td>
<td>5.6</td>
</tr>
<tr>
<td>Blood transfusion post-operatively( unit packed cells )</td>
<td>4</td>
</tr>
<tr>
<td>Postoperative complication</td>
<td>Cardiac</td>
</tr>
<tr>
<td>Renal</td>
<td>2</td>
</tr>
<tr>
<td>Reoperation</td>
<td>1</td>
</tr>
<tr>
<td>Duration of in hospital stay</td>
<td>11 (3-27)</td>
</tr>
<tr>
<td>Mean length of ICU stay in days (range)</td>
<td>11 (3-27)</td>
</tr>
<tr>
<td>Mean length of hospital stay in days (range)</td>
<td>23 (14-44)</td>
</tr>
</tbody>
</table>
The main problems treating patients with AAA rupture are the following:


2. Early arrival of the patient to the specialized Department of Vascular surgery.

3. Timely diagnosis of the AAA (before the rupture) and operative treatment in the planned order. A high index of suspicion is required in patients with known AAA who complain of pain or tenderness. It should be stressed that most intact aneurysms are not tender. They can also present as SMA (superior mesenteric artery) syndrome. The triad of abdominal pain, pulsatile abdominal mass and hypotension are characteristic. Most of the ruptures are posterior and they present with retroperitoneal bleeding, as opposed to bleeding into abdominal cavity itself. Anterior ruptures are more dramatic and they present with sudden and intense abdominal pain, vomiting or syncope. Aortic aneurysm rupture constitute the 14th leading cause of death in the United States of America (USA) (3). Ultrasound is an excellent screening tool to identify AAA in a stable patient, but is less reliable for detection of rupture. Ultrasound is the preferred mode because it is able to accurately identify AAA with sensitivity and specificity that approach 100%. (8, 9) Visualization may be limited in 2% to 3% of patients because of overlying bowel gas or truncal obesity. Computed tomography angiogram (CTA) is accurate for both detection of an AAA and identifying leak or rupture. CT is more useful in evaluation of symptomatic but stable patients. Angiography represents another option for evaluation of patient with symptomatic AAA. Its primary function is for surgeons who may obtain anatomic information that will aid in the plan for endovascular management. Each year in the USA, AAA rupture causes 4500 deaths (4). Only 30 - 50% of patients with ruptured AAAs reach the hospital alive. Operative mortality after rupture is 40% to 50%, making overall mortality with rupture 80% to 90%.(5)

In 1996 Hardman et al (27) noted that the mortality rates depended on the speed of diagnosis. For patients, to whom AAA rupture was diagnosed early, the mortality rate was 35 percent, while for patients in whom the diagnosis was delayed, the mortality rate was 53.6 percent. A ruptured AAA is usually a fatal condition unless treated surgically. There are two major choices of surgical intervention: open repair and stent graft placement or EVAR. Despite improvement in the peri-operative intensive care, the mortality of ruptured abdominal aortic aneurysms ranges from 24 – 80% (10, 11). Emergency open repair for a ruptured AAA, in these critically ill patients carries a mortality rate of 30% to 65% (12-14). Open repair of AAA was popularized by Creech (15) in 1966. The aorta is exposed through a laparotomy and clamped above the aneurysm; the iliac arteries are clamped below. The AAA sac is opened and a prosthetic graft is sutured in place directly. The sac is closed over the graft. Over the last two decades endovascular aneurysm repair (EVAR), has offered an alternative therapy to conventional open repair for selected patients with AAA and has shown significant reductions in early complications and mortality (16, 17). EVAR was introduced by Parodi et al (18) in 1991. US Food and Drug Administration approval was granted in 1999. Since then, use of this technique has expanded such that nearly 60% of AAA repairs in the United States are now EVAR. (19)
Compared with open surgery, EVAR has lower operative mortality (1.2% vs 4.8%), lower morbidity, shorter length of hospital stay (3 vs 9 days), and greater likelihood of discharge to home (95% vs 82% for discharge to home vs to rehabilitation or nursing home).(20) These data were confirmed in the recently published Open Versus Endovascular Repair (OVER) randomized trial.(21) The EVAR procedure involves transfemoral insertion of a stent graft made of fabric and self-expanding metal stents that attach to a segment of healthy aorta below the renal arteries and again to the healthy iliac arteries below, thereby excluding the aneurysm. To be a candidate for EVAR, there must be an adequate segment of healthy aorta below the renal arteries as well as adequate access vessels (iliac arteries). This is typically assessed by preoperative CTA with 3-dimensional reconstructions. Because of these anatomic constraints, not all patients are candidates for EVAR. Because stent grafts are not sutured in place as with open repair, the long-term durability of EVAR is not equal to open repair(22). EVAR patients typically undergo surveillance at 1 and 6 months and then annually, usually with CTA, to ensure adequacy of the repair.(22) A small proportion (2%-5% per year) need to undergo a revision procedure to maintain the integrity of the repair and prevent rupture. Recent published data (23, 24) suggests that EVAR is feasible in selected patients in institutions with experience of endovascular techniques for the treatment of ruptured abdominal aortic aneurysm. Even with devices versatile enough for emergency cases, slightly less than half of patients with ruptured AAA have anatomy amenable to EVAR. Many of the studies published to date have shown improved mortality for EVAR as opposed to open repair in patients with ruptured AAAs, whereas others have shown no difference. Most, however, show that in patients who can undergo EVAR, the morbidity, blood loss, and intensive care unit length of stay are decreased endovascular repair is an acceptable treatment method, but not necessarily superior to open repair. D.E.L Schaal et al compared open versus endovascular repair for rupture abdominal aortic aneurysms and found a lower complication rate, less blood loss and lower mortality in the endovascular group. A systematic review published by Harkins et al (29) found that there was no benefit in the primary outcome of mortality was noted in the only RCT. Evidence from non-randomised studies suggest that EVAR is feasible in selected patients, where it may be associated with a trend towards reductions in blood loss, duration of intensive care treatment, early complications, and mortality. The EVAR1 trial compared open repair to EVAR in patients undergoing elective repair of a non ruptured AAA (28). The group undergoing EVAR had a lower early mortality and fewer complications. Given this finding, and given the fact that open repair for ruptured AAA has continued to have a high mortality, the question has arisen as to whether EVAR should be preferred over open repair for patients presenting with ruptured AAA.

**CONCLUSION:**

Ruptured AAA is a challenge to the modern vascular surgeon. Early diagnosis is essential in planning management and reducing mortality. Open surgical repair does carry a high morbidity and mortality rate but is still the preferred mode of management in regions with limited expertise in endovascular repair. This case series demonstrates that results with open repair for abdominal aortic aneurysms are good.
The 30 day mortality rate of 20% with nil in hospital mortality and the few incidences of complications can be attributed to good anesthesiology, surgical, transfusion medicine and critical care facilities in the hospital. Re-operation is a significant risk factor for mortality. The operative mortality is high despite the developments in treatment. The age at presentation, delay in reaching the hospital and associated co-morbid illnesses (Hypertension, smoking, ischemic heart disease and COPD) can be attributed to the poor operative outcomes in these patients. Published data suggests that endovascular ruptured abdominal aortic aneurysm repair (EVRAR) is feasible in selected patients in institutions with experience of endovascular techniques for the treatment of ruptured abdominal aortic aneurysm. In those selected patients EVRAR may also be accompanied by reductions in blood loss, Intensive Care Unit (ICU) stay, and mortality. However, a significant proportion of patients with ruptured abdominal aortic aneurysm remain anatomically unsuitable for contemporary endovascular repair. Also higher cost, need of repeat imaging, lifelong follow up, need of secondary intervention and device availability may be limiting factors in our patients.

REFERENCES


