Surgery of chronic traumatic aneurysm of the aortic isthmus: benefit of direct suture

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Abstract

Objective: Retrospective evaluation of long term results after direct suture repair of chronic traumatic aneurysm of the aortic isthmus.

Methods: From March 1979 to June 1998, a total of 19 patients with chronic traumatic aneurysm of the aortic isthmus were operated on, among whom 12 (63%) underwent direct suture. These 12 patients (age ranging from 19 to 68 years; mean 34.2 years) constitute the subject of this study. All but one suffered traffic accidents. Mean delay between trauma and surgery was 4 years (range 3 months to 12 years). All patients underwent a left posterolateral thoracotomy through the fourth intercostal space. Extracorporeal circulation for spinal cord protection was installed in six patients (five ilio-iliac shunts, one atrio-iliac shunt). Aortic rupture was partial in five and circumferential in seven patients. The mean clamping time was 25 min. The absence of loss of aortic substance and a careful mobilization of the aorta made the repair by direct suture easier; this technique could thus be achieved in 63.2% of all 19 patients operated on of chronic traumatic aneurysm within the same period.

Results: There was no in-hospital death and no postoperative paraplegia. With a median follow-up of 15 years 3 months (ranging from 22 to 10 years), there were no late complications. Chest X-ray was normal in all patients; eight of them underwent a control angiography between 18 and 72 postoperative months; all these angiographies but one (20% stenosis without gradient) demonstrated a normal appearance of aortic isthmus.

Conclusion: Direct suture for repair of chronic traumatic thoracic aneurysm is a safe procedure: long-term outcome was excellent and the complications observed with prosthetic grafts or with aortic endoprosthetic stent-grafts were avoided.

Keywords: Descending aorta; Chronic traumatic aneurysm

1. Introduction

The severity of the immediate prognosis of the rupture of the thoracic isthmic aorta after blunt chest trauma was clearly demonstrated as severe by Parmley et al. [1]. Emergency or delayed surgical treatment is generally mandatory [2,3], but about 10–15% of injured patients leave hospital with an undiagnosed aortic rupture and are able to survive long enough to develop a chronic lesion [1,4]. Healing of the aorta includes a fibrous thickening of adventitia and surrounding tissues, and a neointimal formation on the internal aortic wall. With Finkelmeyer et al. [5] and others [6,7] we believe that 3 months after injury are sufficient to consider the lesion as chronic.

Conventional surgical treatment of this lesion is an aorto-aortic graft interposition [5,6]. Nowadays, endovascular stent-graft repair [8,9] is proposed. Both these procedures require prosthetic material which intrinsically is a possible cause of long-term complications.

We report 12 cases of chronic traumatic thoracic aneurysms operated on by direct suture. This study was undertaken to evaluate long-term results of this procedure in our patients.

2. Material and methods

From March 1979 to June 1998, 19 patients were operated on for a chronic traumatic aneurysm of the aortic isthmus. Twelve benefited from direct suture without prosthetic material and constitute the subject of this study.

There were ten males and two females, with a mean age of 34.2 years (range 19–68 years). All patients had history of thoracic injury and mean age at the time of trauma was 30.5 years (range 15–64 years). The mechanism of the isthmic aortic rupture was an abrupt deceleration provoked by a road traffic accident in 11 cases, and a direct impact invol-
ving an industrial injury in one case. Mean delay between trauma and surgery was 4 years (range 3 months to 12 years).

Seven patients (58%) were symptomatic and complained of pain or hoarseness, but also dry cough, dyspnea and dysphagia. All patients had a highly suggestive X-ray with disappearance of the aortic knob replaced by a pseudo-tumor type enlargement of the superior mediastinum. Diagnosis was suspected from these abnormal serial X-ray findings only, in five patients. It was confirmed by angiography in eight and computed tomography scan in four patients (Fig. 1). At the moment of surgery, other traumatic lesions had healed (fractures, neurosurgical, facial, and abdominal injuries), except in two patients who still presented severe neurologic sequelae due to serious neurosurgical trauma.

2.1. Surgical technique

All patients had a non-selective tracheal intubation and underwent a left postero-lateral thoracotomy through the fourth intercostal space.

For spinal cord and abdominal visceral protection, an extracorporeal circulation was installed in six patients: five partial ilio-iliac arterio-venous bypasses, and one left atrium iliac bypass. Nowadays, as a duration of aortic clamping is not always predictable, we apply this technique in all cases. But until 1995, six patients were operated on with simple aortic clamping, and this without any neurologic complications.

In order to perform an easier direct suture, extensive mobilization of the upstream aorta up to the left common carotid artery, and downstream on the descending aorta as distal as possible, was performed. The clamps were placed close to the lesion. Intercostal arteries were not ligated in any case. The aneurysm was opened by a median transverse incision. We carefully exposed and brought together both superior and inferior cylinders of the disrupted aorta. In four cases the simple approximation of the clamps allowed direct repair. A long time span between injury and repair resulted in a more pronounced distance between aortic edges and necessitated a more extensive dissection. The most important retraction extended to 6 cm in two cases.

Aortic rupture was circumferential in seven patients and partial in five with a preservation of a posterior flap of the aortic wall. One patient presented with huge calcifications in the aortic wall. A running suture or interrupted stitches using 4-0 polypropylene was performed, taking together both internal cylinder and adventitia. Only the adventitia was thick, firm and secure.

Aortic declamping was executed in the usual way, first distal for de-airing, and afterwards proximal, while controlling radial arterial pressure. The mean clamping time was 25 min (ranging from 9 to 40 min).

3. Results

3.1. Early results

There was no in-hospital death and no postoperative paraplegia. There were three regressive pulmonary complications, one chylothorax, one pneumothorax, and one resisting atelectasia, but nevertheless each patient was extubated within 48 h. There were two left recurrent nerve lesions with permanent dysphonia. The mean hospital stay was 9 days.

3.2. Late results

Patients were re-evaluated in 1992, 1996 and 2001. One patient was lost to follow-up after 1996. She was 65 years at operation, and her current age would have been 87 years. Follow-up information was obtained for 11 patients who, at our request, were re-evaluated in 2001 by their general practitioner or their referent cardiologist. With a median follow-up of 15 years and 3 months (ranging from 22 to 10 years) there was no late death. Eight patients lead normal professional lives. Two patients with neurologic sequelae before repair had a disability which prevented them from working. One patient had retired. All chest X-rays were normal. Eight patients had a control digital subtraction angiography (before 1992) between 18 and 72 months postoperatively: all were normal except one that showed an asymptomatic 20% stenosis (Fig. 2).

4. Discussion

Chronic traumatic thoracic aortic aneurysm occurs in young patients [3,5]. In our series, at the time of the intervention, two thirds of the patients were aged less than thirty. They obviously had a long life expectancy. Risk of rupture...
in such young patients persists. Finkelmeyer et al. [5] demonstrated that 20 of 60 patients died from their untreated aortic lesions within a period of 20 years after the initial trauma, and that the probability of being alive and free of signs or symptoms related to aneurysm expansion within the same period was of 33%. Other authors estimated that the risk of death by rupture 10–15 years after injury [3,6,10] was 20%. Some surgeons are reluctant to operate because of the risk of paraplegia or discuss the appropriate time for surgery. We consider surgery to be mandatory when the false aneurysm is larger than 5 cm [11] or becomes symptomatic, or shows evidence of radiographic changes. In hypertensive patients, surgical treatment should be more aggressive.

Our first patients underwent conventional angiography. Nowadays, angioscanning is the technique used to establish diagnosis and specify aneurysm dimensions.

Repair technique remains controversial. When using conventional surgery, most authors prefer a graft to restore aortic continuity. Becker et al. [7], Prat et al. [12], Fraedrich et al. [13], and Weimann et al. [14] applied it respectively in all of 22, 19, 28 and 13 patients. Others used grafts in more of 90% of their patients [5]. But aortic graft implantation implicates risks of specific long-term complications such as late infections observed in 0.8% to 1.9% [15,16], late false aneurysm as reported by Heberer’s and Hemmerich’s groups [17,18] in 0.9–3.7% of their patients, or thromboembolic episodes [19].

Direct suture is used by some surgeons in acute aortic rupture [20]. In chronic traumatic aneurysm it is an exception. Thevenet and Ducailar [21] reported a series of 18 cases operated on within 10 years, and used direct suture in 12 cases (66%). Fernandez et al. [22] used direct repair in 62% of 13 patients. In the same way we were able to achieve direct repair in 12 out of 19 (63%) patients operated on between 1979 and 1998.

The advantage of direct suture is the absence of long-term complications due to graft interposition. In our series of 12 patients, with a median follow-up of 16 years, there were no late complications. This is all the more desirable as young patients are involved, in whom life expectancy is theoretically long. Moreover long-term angiographic controls showed an ad integrum restitution of the aorta in 90% of these patients.

Importance of the distance between both aortic segments is not a technical contraindication since there is no loss of the aortic wall tissue. After a careful dissection and mobilization of the thoracic aorta, both aortic segments can be brought together, at least in young patients, without atherosclerosis. In two of our 12 patients the distance between both aortic edges was 6 cm. Nevertheless a direct suture technique was feasible. A Brom clamp approximator can be very useful, even if there are calcifications (one patient). Moreover, two patients aged 66 and 68 years underwent repair using this technique.

Over the same period (1979–1998) we had to use an aorto-aortic graft interposition in seven other patients. In five of them the delay between injury and surgery was very long: 27, 19, 17, 16 and 15 years (with a mean of 18.8 years versus 4 years for direct suture). This delay resulted in severe fibrous retraction of intimal cylinders, atheromatous foci, and finally calcifications. In the other two patients the distance between both aortic segments was over 10 cm, and aorta was very thin and fragile. In all these cases, direct suture was considered as dangerous and was not attempted.

It appears that a long interval between injury and repair and important retraction of aortic segments are the main factors making direct suture unsuitable. Transluminal stent grafts have been proposed for almost 10 years as an alternative technique. Some authors have reported its feasibility and safety [23,24]. However, major complications have already been observed: perigraft leak [9,25], graft migration [9,24], left arm ischemia [9] and even aorto-bronchial fistula [26]. This recently reported technique requires further follow-up to clearly evaluate long-term reliability, but could be a valid alternative mainly in cases where direct suture is at risk.

5. Conclusion

This study demonstrates the feasibility of direct repair in two thirds of the patients presenting with a chronic traumatic thoracic aneurysm. The absence of severe early, and particularly long-term complications, shows that this technique is the most suitable for young patients. It should be employed whenever possible. In old patients, or if there is a long time interval (over 10 years) between injury and
surgery, an endovascular aortic stent graft can be an attractive alternative.

References


Appendix A. Conference discussion

Dr A. Haverich (Hannover, Germany): If we do see these patients for late surgery, they usually come with a ruptured aneurysm, and so my first question is whether there is a routine follow-up of these patients after the initial event or whether these data were obtained in the context of a retrospective study?

Dr Remes: The pathology in most of the patients was undiagnosed. It was a routine check up, an X-ray or other examination, that discovered the problem a year or more after the accident.

Dr Haverich: Given the fact that the cross-clamp times in this series ranged between 9 minutes and 40 minutes, what would be your current strategy as to circulatory support during replacement or repair?

Dr Remes: As you say, between 9 and 40 minutes, it is difficult to know which patient will need only 9 minutes and which patient will need 40 minutes, so I think it is better to use extracorporeal circulation.

Dr Haverich: If you could expand a little bit on the role of stents in these patients. In your current practice would you separate the younger patient from the older one or would you uniformly treat it by stent implantation? What are your thoughts about that?

Dr Remes: Until now there is no long-term follow-up with endovascular thoracic stents. On the other hand there is information that in medium follow-up, secondary leakage may arrive. Also, a stent is a rigid structure and the aortic arch is anagulated. So there are quite some problems left with endovascular stents. As our population was very young, I think it is better to perform a single suture technique. Otherwise, if there are contraindications to perform a thoracotomy, the endovascular procedures can be a good alternative.