Late complications after surgical exclusion of the thoracic aorta

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Abstract  Two patients who underwent surgical exclusion of the thoracic aorta for chronic dissecting aneurysms of the descending aorta died 4 and 8 years after surgery due to complications in part related to the operative technique. One patient developed pseudoaneurysm of the proximal aortic stump with fatal exsanguination through an aortopulmonary fistula. The other patient developed progressive dilatation of the remaining abdominal aorta with subsequent rupture. The surgical approach in this case was extremely difficult because of the previous exclusion procedure which determined a highly demanding reoperation. Although surgical exclusion of the thoracic aortic may be a useful technique in some situations, we must be aware of its early and late complications and, in our opinion, it should be seen only as an alternative treatment for very special patients with diseases of the descending thoracic aorta.

Key words  Thoracic aortic aneurysms · Thoracic aortic diseases

Introduction

The technique of exclusion of the thoracic aorta has been used by some centers in the surgical management of diseases of the thoracic aorta. The technique requires proximal closure of the aorta, resulting in a blind-ended aortic stump, and an extra-anatomical bypass from the ascending aorta to the abdominal aorta. In this way, reverse aortic blood flow is provided to the distal aorta which can also be occluded at the diaphragm level (total exclusion) or can be left open (thrombo-exclusion), which results in gradual clotting of the proximal aortic lumen.

In 1988 we reported our experience with this technique in 14 patients [4], most of them with ruptured aortic aneurysms with severe preoperative complications. Long-term follow-up was achieved in six of the eight hospital survivors. There were two late deaths (acute myocardial infarction and cerebrovascular accident); two other patients are in regular follow-up without major complications. The present report refers to the other two patients who developed late surgical complications.

Case reports

Case 1

A 45-year-old man was referred to our hospital complaining of chest pain and hemoptysis with diagnosis of a huge thoracic aneurysm caused by chronic aortic dissection (Fig. 1A). Six years previously he had submitted to a left thoracotomy elsewhere, but no attempt had been made to resect the aneurysm. Preoperative angiography showed a normal ascending aorta and aortic arch and a giant aneurysm arising immediately after the left subclavian artery. In August 1985 he was operated on through a median sternotomy which was extended to the abdomen. A 22 mm Dacron prosthesis was anastomosed to the ascending aorta and to the abdominal aorta close to its bifurcation. The graft was placed in a very posterior position, avoiding contact with the abdominal organs. The aorta was then transected close to the left subclavian artery and each stump was doubly oversewn. Since the origin of the left subclavian artery was partially included in the suture line, an 8 mm straight graft was used to restore its blood flow.

Total exclusion of the thoracic aorta was then achieved after transection of the aorta at the diaphragmatic level. In the immediate postoperative period the patient developed a stroke with subsequent recovery. In the following 2 months after discharge he showed elevated bilirubin levels, probably related to the intra-aortic blood retention and reabsorption. A progressive reduction of the intrathoracic...
mass was observed in subsequent chest X-rays (Fig. 1B). In July 1989 he was readmitted with a history of fever and hemoptysis. The chest X-ray showed an opacity at the upper left lobe with an image of cavitation. Shortly after his admission the patient had a massive hemoptysis and died after exsanguination. A post mortem examination was performed and an infected pseudoaneurysm of the proximal aortic stump was found with erosion to the lung parenchyma.

Case 2

A 55-year-old male patient was admitted to our hospital with the diagnosis of aneurysm of the descending aorta. He had a previous history of severe chest pain 8 years before, which was probably related to acute dissection of his thoracic aorta. Six months before his admission he started with progressive hoarseness and his chest X-ray showed important dilatation of the thoracic aorta. An angiography confirmed the diagnosis of aortic dissection. Surgery was performed on 19.06.86 using the same procedure as case 1. The abdominal aorta, although affected by the dissection, showed only a slight increase in its diameter (3.5 cm).

The distal anastomosis was accomplished with external reinforcement restoring blood flow to the true lumen. The patient had an uneventful recovery. In November 1994 he was readmitted to our hospital with abdominal pain of recent onset and a large pulsatile abdominal mass. An angiography was performed and showed normal flow through the graft and aneurysm dilatation of the dissected abdominal aorta (Fig. 2). Because of the rapid progression of his symptoms, urgent operation was necessary. A thoraco-abdominal incision was made for exposure of the aorta, which was found to be diffusely dilated and showed a plugged rupture in its upper segment. Since exposure of the aortic graft could not be achieved through the thoraco-abdominal incision, deep hypothermia was induced by femoro-femoral cardiopulmonary bypass and the circulation was arrested. The abdominal aorta was opened and replaced by a segment of 22 mm Dacron prosthesis in such a way that its upper opening was bevelled and anastomosed to the celiac artery, superior mesenteric and right renal arteries. The left renal artery was connected separately to the graft. The distal opening of the previous aortic bypass graft was identified and sutured laterally to the new prosthesis. Finally the distal anastomosis to the aortic bifurcation was performed. The period of circulatory arrest was 42 min. After re-establishment of circulation, the patient showed diffuse bleeding, which eventually led to severe metabolic disturbance and death in the operating room.

Discussion

In 1968, Schumaker described a new approach to difficult cases of coarctation of the aorta, based on an extra-anatomical bypass from the ascending aorta to the abdominal aorta, thus avoiding direct contact with the thoracic aorta...
The retrograde blood flow throughout the abdominal and thoracic aorta provided normal perfusion of the organs. In 1981 Carpentier expanded this concept, using it in the treatment of dissection of the aorta [2] introducing the "thrombo-exclusion" concept. Besides the obvious advantage of not touching the fragile dissected aorta, the technique was intended to be more radical than the conventional one, by eliminating a longer segment of involved aorta which was then perfused by retrograde flow. In his original abstract, Carpentier advised the performance of the distal anastomosis in a non-dissected area of the abdominal aorta to achieve this intent, but this may not be feasible in many patients with aortic dissection who have involvement of the whole aorta. In the present report, case 2 reflects this particular situation. This patient needed urgent operation for a ruptured abdominal aorta 8 years after his operation. His chronically dissected abdominal aorta became aneurysmatic and the reoperation was very difficult in this situation, since the usual reconstruction employed in cases of thoraco-abdominal aneurysms could not be performed because of the previous exclusion procedure. The presence of an extra-anatomical bypass determines a reconstruction that must be based on a termino-lateral arrangement with the old bypass graft. Besides that, visualization of the aortic graft could not be obtained in the lateral surgical approach, determining the use of extracorporeal circulation and circulatory arrest. Although further deterioration of the abdominal aorta may occur regardless of the surgical technique, its reconstruction is definitely more difficult if an extra-anatomical bypass has been used.

The other complication described in the present report (case 1) was related to the proximal aortic stump and was caused by the direct contact of the lung with the suture line with subsequent rupture. Since this complication occurred because of the presence of a suture line, used in this patient to achieve the proximal aortic interruption, it is possible that use of special clamps or staplers could have avoided it. Although erosion of the suture line to the lung has been reported with other techniques, it is our impression that blind-ended aortic stumps favor the development of suture line problems such as pseudoaneurysms. The other concern about these stumps is the possibility of their progressive dilatation, such as those described after correction of ductus arteriosus [6].

Although the technique of exclusion of the thoracic aorta may be attractive in dealing with some difficult cases of diseases of the thoracic aorta, such as infected grafts [5], we must be aware of its complications. In the immediate postoperative period, complications such as severe aortic bleeding during proximal aortic closure [3], acute cerebrovascular accidents, and disseminated intravascular coagulopathy [7] have been reported. It is also evident that the technique does not prevent paraplegia since it has been reported in several publications [2, 3, 4, 8].

On long-term follow-up other problems can arise, such as erosion of the abdominal organs by the aortic graft [1] and those presented in this report, stressing the importance of the close follow-up of these patients. With the recent advances achieved in circulatory support techniques and the wider use of deep hypothermia, most surgical situations relating to the thoracic or thoraco-abdominal aorta can be well managed by direct approach of the diseased aorta, and probably many patients in our early experience would be managed differently in the present times.

References