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Case report

Hybrid repair of aortic arch aneurysm

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ABSTRACT

Aneurysms of the transverse aortic arch requiring surgery most often affects elderly patients with multiple co-morbidities and represents a significant challenge to both patient and surgeon. The hybrid approach developed in recent years (debranching followed by endovascular repair) may improve the morbidity and mortality of the population risk. We present the case report of a 72-year-old man with aortic arch aneurysm arising at the origin of the left subclavian artery involving whole caudal segment of an aortic arch with concomitant single vessel coronary disease. The hybrid procedure was carried out in two stages, first (open surgical approach) performing an extra-anatomic bypass – debranching combining with concomitant coronary artery bypass procedure without heart-lung machine and following day deploying the aortic endograft. Postoperative period was uneventful. On the 15th day after hybrid procedure, the patient was discharged in a stabilized condition for ambulatory care. This approach may be an alternative to standard open procedures in high-risk patients with promising midterm results.

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Introduction

Thoracic aortic aneurysm is a life-threatening condition with an estimated incidence of 6–10 cases per 100,000 person-years [1]. The natural history of untreated patients with thoracic aortic aneurysms is characterized by progressive expansion and eventual rupture [2,3]. Five-year survival in patients with untreated thoracic aortic aneurysms has been estimated to range from 15% to 55% [2,3]. In the past years, conventional surgical repair has been the only therapeutic method for extensive aortic diseases. However, this approach, which uses cardiopulmonary bypass, deep hypothermic circulatory arrest, retrograde or antegrade cerebral perfusion still carries a

substantial rate of mortality and morbidity; furthermore, it predicts a high incidence of permanent neurological injury in old series.

Endovascular stent-grafting has developed as a safe and effective treatment for descending aorta pathologies, and recently, even for delicate anatomic regions such as the aortic arch. However, in case of total involvement of the aortic arch, the challenge is to maintain blood flow to the brain and upper extremities that may require covering one or more aortic branches in order to establish a secure proximal landing zone, and to ensure complete exclusion of the lesion [4]. Endovascular exclusion of aortic arch pathologies combined with an open surgical component effectively called “hybrid” have been recently

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introduced in an attempt to reduce morbidity and mortality [5].

Case report

A 72-year-old man with a symptomatic (dysphagia, tingling of left upper extremity) saccular aortic arch aneurysm was treated with the hybrid procedure. The lesion, with a maximum diameter of 53 mm, neck 38 mm, was located on the lateral left side of the aortic arch at the level of the origins of the left subclavian artery (Fig. 1).

Preprocedural CT angiography was done to confirm aneurysm morphology, adequacy of the iliofemoral access sites and assess the patency and dominance of the vertebral arteries as well as the anatomy of the circle of Willis in order to define what to do with the left subclavian artery (LSA).

He had history of coronary artery disease (single vessel disease), chronic renal failure, hypertension and hepatopathy and was assessed as extremely high risk for conventional open aortic arch surgery. The hybrid procedure was carried out in two single stages, first (open surgical approach) performing an



Fig. 1 – Preprocedural computer tomography angiogram of the aorta showing the aortic arch aneurysm.

extra-anatomic bypass – debranching including coronary artery bypass grafting without a pump.

After median sternotomy, the pericardium was opened and the ascending aorta was exposed in standard fashion. The brachiocephalic trunk, the left common carotid, and the left subclavian arteries were also circumferentially dissected. After systemic heparinization the ascending aorta was side-clamped, and a proximal end-to-side anastomosis was performed with a bifurcated Dacron graft using a 4-0 Prolene (Ethicon, Inc, Somerville, NJ) running suture. Consecutively the brachiocephalic trunk was then partially clamped, longitudinally opened, and an end-to-side anastomosis performed with the initial branch of the bifurcated prosthesis using 5-0 Prolene running suture. After flushing, blood flow was re-established. The brachiocephalic trunk was then ligated to prevent a type II endoleak. The left common carotid artery was then test-clamped and if no anomalies were recorded by (INVOS® System) cerebral oxymetry the artery was ligated proximally and an end-to side anastomosis done with the other branch of the bifurcated graft using a 5-0 Prolene running suture. After flushing, blood flow was re-established. Thereafter, single venous bypass to marginal branch of circumflex artery has been performed without using heart lung machine (Fig. 2).

Subsequent to the surgical procedure an endograft deployment (Valiant 38 34 160 endograft) was accomplished. Left subclavian artery was embolized by Amplatzer Vascular Plug. Final angiography showed bypass patency as well as total aneurysm sac exclusion (Fig. 3).

Discussion

Hypothermic circulatory arrest is the traditional method to treat aortic arch aneurysms, but deep hypothermia is associated with prolonged extracorporeal circulation and increased mortality and morbidity rates due to microembolisation and a total body inflammatory reaction, particularly coagulopathy, respiratory distress, and renal, cardiac and endothelial dysfunction [6,7].

Many patients with aortic arch have a significant number of medical and surgical comorbidities that make their surgical options limited. A less invasive and potentially safer group of techniques using both endovascular and open technical techniques (hybrid) have been developed to offer patients treatment who might otherwise not have been operative surgical candidates using standard open surgical techniques [8].

Usually, patients presenting with multisegmental thoracic aortic pathology originating at the level of the aortic arch have an atherosclerotic etiology, which is fundamentally different when compared to patients having aortic disease in the root and the ascending aorta. This is reflected by a very high incidence of obliterative arteriopathy especially in patients with penetrating atherosclerotic ulcers (PAU). Therefore, these patients may benefit most from these combined approaches [9].

Atherosclerotic ulcers of the aortic arch are a clear sign of extensive atherosclerotic lesions involving the aorta and brachiocephalic branches of the arch. The ulcers are the clinical equivalent of aneurysms and pose, among other

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