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CHRONIC DISSECTION OF THORACIC AORTA: TREATMENT BY ENDOLUMINAL STENT GRAFTING

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SUMMARY – Chronic dissection of thoracic aorta is the subject of cardiac surgery and its treatment is burdened with high mortality and morbidity. The procedure of endoluminal stent graft placement in a 53-year-old male patient with an 8 cm wide false lumen is presented. Two stent grafts of 148 and 94 mm in length, both 44 mm in diameter, were applied. The surgical procedure lasted 6 hours. Thrombosis of the false lumen was registered perioperatively. The postoperative period proceeded without serious complications.

Key words: *Aorta – thoracic, surgery; Vascular surgical procedures; Blood vessel prosthesis, implantation; Stents*

Introduction

Aortic dissection represents separation of the layers of the aortic wall and is based on degenerative changes of the media. Any event that weakens the aortic wall represents an etiologic factor; these include the process of atherosclerosis and weakness of the aortic media due to the lack of elastic fibers. Historically, syphilis had a significant role in the etiology but nowadays it is quite rare. Arterial hypertension, endocrine factors and trauma contribute to its development. The disease is more common in males between 45 and 70 years, especially in patients with Marfan's syndrome; congenital heart disease such as aortic coarctation and bicuspid aortic valve are also predisposing factors. In females it is more common during pregnancy[1].

Surgical management by use of fenestrations was initially introduced in the 1950s, however, with quite poor results. DeBakey, Coolley and Creech achieved better results; they decreased the mortality rate to 21 percent according to a report from 1965[2,3]. The improvement in results is mostly related to major medical centers with the possibility to cumulate experience based on larger series of operated patients.

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Patient and Method

Type B aortic dissection according to Stanford classification was detected in a 53-year-old male patient. The dissection had occurred about two years before. The false lumen had a tendency to grow, which was proven by control computed tomography (CT) scans. At the time of considering surgery, the false lumen had a diameter of 8 cm. Arteriography showed a false lumen that started beneath the orifice of the left subclavian artery. Arteriography was performed through both femoral arteries, and during both attempts the catheter went into the false lumen. A mild tortuosity of the iliac arteries was also observed.

Arteriography of the aortic arch was attempted twice through the right subclavian and brachial arteries but the

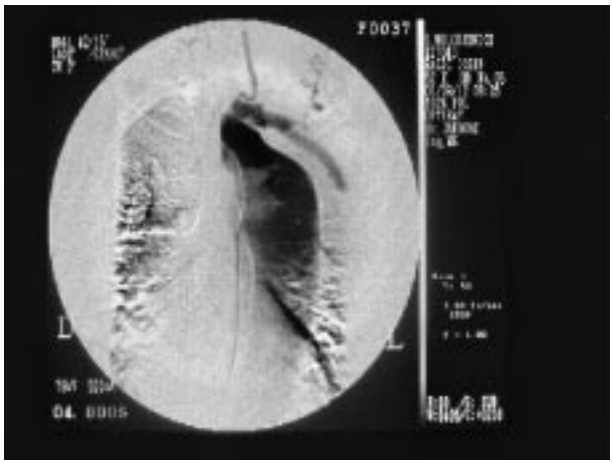

Fig. 1. Arteriography showing a thoracic aortic aneurysm.

catheter could not pass through the brachiocephalic trunk, which gave rise to a suspicion of a pathologic process in the aortic arch.

Perioperative evaluation was complemented with CT, which showed the false lumen in the descending thoracic aorta; the ascending aorta and aortic arch had no signs of dissection. The false lumen surpassed significantly the diameter of the aortic lumen. Dissection was not found at the level of iliac arteries. Finally, magnetic resonance imaging (MRI) showed that one part of the descending aortic wall beneath the subclavian artery was preserved in the length of 0.5 cm. Transesophageal ultrasonography confirmed the anticipated morphology of the descending aorta but could not solve the morphology of the brachiocephalic trunk and aortic arch.

The surgical procedure in general anesthesia was commenced following preoperative evaluation and preparation. The patient was intravenously heparinized. The left subclavian artery was visualized by catheterization through the left brachial artery and no pathologic changes were noticeable at the aortic arch. Introduction of a guide wire into the true lumen of descending aorta was successful only after several attempts. The right groin was exposed and retrograde introduction of the guide wire through the iliac arteries into the true lumen of descending aorta was obtained after several attempts as well. Despite multiple attempts, the catheters placed proximally and distally could not be joined. At last, Luderquist's guide wire introduced through the left subclavian artery was positioned through the true aortic lumen into the right femoral artery. The whole procedure was controlled with interventional vascular radiology techniques and monitored by transesophageal ultrasonography.

The procedure of introducing a Talent stent (bare spring type) by means of endovascular stent implantation techniques followed. The entire length of the stent was 165 mm and the covered lumen was 148 mm. The graft diameter was 44 mm. The stent was positioned just beneath the orifice of the left subclavian artery. Due to the length of the descending aorta, an additional stent of the same diameter but 130/94 mm in length was placed. The anesthesiologist decreased the systolic arterial pressure to 50 mm Hg during stent expansion and balloon dilatation. The dilatation was performed under pressure of 2-3 atm.

Intraoperative arteriography showed only the real aortic lumen and transesophageal ultrasound demonstrated

Fig. 2. Magnetic resonance image of the aortic arch.

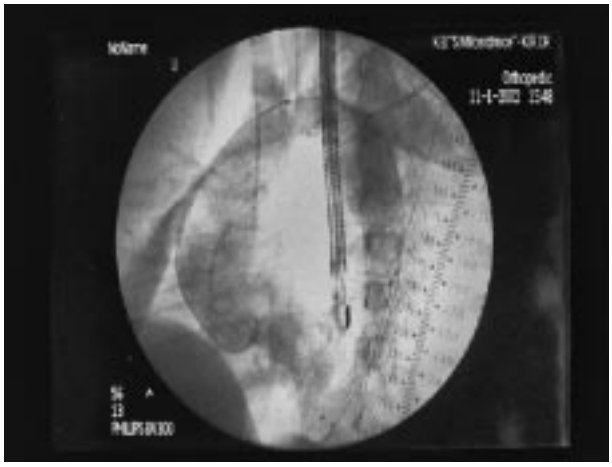

Fig. 3. Intraoperative arteriography showing the stent graft.

occlusion of the pseudonaeurysmatic sac in the thoracic aorta. The patient was hemodynamically stable but with signs of decreased cerebral activity and somewhat labored emergence from anesthesia. During the next two hours the functions were normalized. The patient spent the following three days in the intensive care unit (ICU) for congestive lung changes. The remaining course was normal and the patient was discharged.

Discussion

Aortic dissection represents a catastrophe associated with high mortality. There are two types of aortic dissection according to Stanford's classification, i.e. one that begins at the aortic valve and the other which occurs distally to the left subclavian artery. Surgery for type 1 dissection often represents a lifesaving solution, while surgery for type 2 dissection is often an emergency procedure but elective surgical procedure for patients with chronic dissection is also an extensive surgical procedure with high mortality and the results are between 6% and 67%[4-8]. These results vary often with the decision on conservative treatment. The decision complexity is aggravated by the fact that surgery is burdened with paraplegia or at least paraparesis in 7%-36% of cases. This results from surgical occlusion or intraoperative circulatory stasis due to clamping above the orifices of the great radicular arteries, i.e. the Adamkiewitz's arteries (T8-L2). Chronic dissection represents survival of the acute phase longer than two weeks.

The endovascular approach represents a modern solution and goes back to 1994. It is the result of endovascular treatment development continuation following successful endovascular graft placement in patients with AAA. The basic idea is that entrance into the false lumen is occluded by the endoprosthesis, i.e. the stent graft is placed into the lumen of descending aorta just beneath the orifice of the left subclavian artery using a previously positioned guide wire. Such a graft is usually about 15 cm in length and is too short to impede circulation in the spinal arteries, i.e. in the great radicular arteries.

The indication for the endovascular procedure is the same as for the conventional surgical procedure, that is the diagnosis of a pseudoaneurysm with a diameter larger than 5.5 cm. While considering the repair, it is important to know whether the pseudoaneurysm content is not thrombosed and that a growth tendency of the pseudoaneurysm exists. The presence of backpain is also important on considering surgery, as it indicates the risk of rupture[4,6-9].

Additional factors that influence the feasibility of the endovascular approach are the existence of at least 0.5 cm of descending aortic wall beneath the left subclavian artery orifice, and that at least one iliac artery is not dissected and is suitable for introducing the delivery catheter, i.e. significant stenosis or kinking must not be present. The stent graft diameter is determined individually according to the aortic diameter in the manner that it is oversized by 2-3 mm in diameter.

The arterial hypotension that is induced while expanding the stent graft and balloon dilation lasts shortly, only a few minutes, and does not compromise the cerebral circulation.

This endovascular approach in the treatment of type B aortic dissection in the described series of operated patients has yielded results that significantly ameliorate the prognosis for these patients despite the sophistication of the procedure and the necessity of participation of several professional profiles. This surgical approach necessitates the involvement of vascular surgeons, interventional radiologists and interventional cardiologists, anesthesiologists as well as radiology technicians, complete surgical and anesthesiologic personnel and, potentially, a cardiosurgical team with devices for Biomedicus pump and left aortic bypass on stand-by; it also requires highly sophisticated radiology and ultrasonography equipment. In a series of 12 patients in two university centers in Hamburg and Bologna[10], there were no lethal outcomes, paraplegia, embolization, stroke, etc. A postimplantation syndrome with transient elevation of C-reactive protein, fever and mild elevation in white blood cell count was recorded in nine patients, hence it can be said that none of the patients had serious complications.

The catheterization procedure requires high proficiency and usage of various types of catheters since the catheter is often introduced into the pseudoaneurysm instead of the aortic lumen, as was the case in our patient. Rational use of the radiologic contrast must not be neglected due to the demanding nature of the procedure.

Thrombosis of the false lumen represents the goal and patients with postoperative demonstration of thrombosed pseudoaneurysm have a good long-term prognosis[11]. This model of thrombotic occlusion of the false lumen and aortic remodeling and its compression on the false lumen occurs in the vast majority, in up to 95% of cases[12]. The hinder in the process of thrombosis lies in the fact that the false lumen often communicates with the true lumen through several openings.

The endovascular approach with stent graft placement represents the method of choice and the future in treating type B chronic aortic dissection, as evidenced by the initial experience with this new surgical intervention approach both on the international scale and from our own experience.

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Sažetak

KRONIČNA DISEKCIJA PRSNE AORTE: LIJEČENJE UGRADNJOM ENDOLUMINALNOG STENTA

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Kronična disekcija prsne aorte predmetom je srčane kirurgije, a njezino liječenje opterećeno je visokom smrtnošću i pobolom. Prikazan je zahvat ugradnje endoluminalnog stenta u 53-godišnjeg bolesnika s 8 cm širokim lažnim lumenom. Primijenjena su dva stent usatka duljine 148 i 94 mm i promjera 44 mm oba. Kirurški zahvat trajao je 6 sati. Prijeoperacijski je zabilježena tromboza lažnog lumena. Poslijeoperacijski tijek protekao je bez ozbiljnijih komplikacija.

Ključne riječi: *Aorta, prsna – kirurgija; Vaskularno kirurški zahvati; Krvožilna proteza, ugradnja; Stentovi*