Rev Bras Cardiol Invasiva.
2014;22(4):386-9

Case Report

Endovascular Repair of Abdominal Aortic Aneurism Using the Chimney Graft Technique

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ABSTRACT

An elderly patient with non-dialysis renal failure and oxygen-dependent chronic obstructive pulmonary disease was admitted to the emergency room with lancinating abdominal pain. Angiotomography of the abdomen revealed the presence of a large aortic aneurysm with involvement of visceral arteries. Due to the high surgical risk, endovascular repair was proposed, using the chimney graft technique for the preservation of the visceral vessels. This technique is promising because it enables endovascular repair of aneurysms, be it in elective cases, emergencies, or rescue of a visceral artery accidentally covered by an aortic stent graft.

DESCRIPTORS: Aortic aneurysm. Aorta, abdominal. Endovascular procedures. Stents. Treatment outcome.

RESUMO

Tratamento Endovascular de Aneurisma de Aorta Abdominal pela Técnica de Chaminé

Paciente idoso, portador de insuficiência renal não dialítica e doença pulmonar obstrutiva crônica dependente de oxigênio, foi admitido no pronto-socorro com quadro de dor abdominal lancinante. A angiotomografia de abdome revelou a presença de grande aneurisma aórtico com comprometimento das artérias viscerais. Devido ao elevado risco cirúrgico, foi proposto o tratamento endovascular pela técnica de chaminé para a preservação dos vasos viscerais. Essa técnica mostra-se promissora por permitir o reparo endovascular desses aneurismas, seja em casos eletivos, em situações de urgência/emergência ou de resgate de uma artéria visceral acidentalmente encoberta por uma endoprótese aórtica.

DESCRITORES: Aneurisma aórtico. Aorta abdominal. Procedimentos endovasculares. Stents. Resultado do tratamento.

The endovascular treatment of abdominal aortic aneurysms has been established in the last two decades as a minimally-invasive alternative to classical open surgery, thus becoming the procedure of choice for elderly and high surgical-risk patients. This is due to the fact that the technique is associated with significant decrease in operative time, blood loss volume, hospital length of stay, and morbimortality in the first 30 days postoperatively; it also allows for the use of anesthetic techniques that dispense the use of mechanical ventilation.[1,2]

However, 20% to 50% of patients with abdominal aortic aneurysm do not have favorable anatomy for endovascular treatment, due to the presence of short infrarenal neck or even the involvement of visceral branches by the aneurysm. Due to the high surgical risk of these patients, endovascular technique modifications have emerged as a viable alternative.[3]

The first of these options is the use of fenestrated and branched stent grafts, which are custom-made for each patient. Given the lack of prompt availability of these endoprosthesis, several centers have proposed the chimney technique alternative as an adjunct measure to extend the proximal neck in patients with juxtarenal or suprarenal aneurysms.[4,5]

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Received on: 8/30/2014 • Accepted on: 11/21/2014

The chimney technique, initially described by Greenberg et al. in 2003,[6] is based on stent implantation in the visceral vessels in parallel to the main body of the endoprosthesis, thus allowing the proximal neck of the latter to be located in the most proximal portion of the aorta, but without impairing blood flow to the visceral branches.

The present article reports the case of an elderly patient with several comorbidities, treated at the emergency department, in whom a large abdominal aortic aneurysm was diagnosed, which involved the renal and superior mesenteric arteries, and was treated with minimally-invasive surgery using the chimney technique.

CASE REPORT

The 77-year-old male patient was admitted to the emergency room of this institution, presenting with excruciating abdominal pain, which had started approximately 3 hours before. On physical examination, he had good overall status and a large, pulsatile abdominal mass. He had severe chronic obstructive pulmonary disease and was in home oxygen therapy. He also had systemic arterial hypertension, was a smoker, and had chronic renal failure that did not require dialysis. He underwent an abdominal angiography, which disclosed the presence of a large abdominal aortic aneurysm with visceral artery involvement (Figure 1).

Although initially there was no rupture sign, given the clinical and computed tomography (CT) findings, the diagnosis was that of an expanding aneurysm, and invasive treatment was proposed for this emergency situation.

The following therapeutic options were considered: (1) conventional surgical treatment; (2) endovascular treatment with fenestrated or branched stent graft implantation; and (3) endovascular treatment with endoprosthesis implantation using the chimney technique, aiming at visceral artery preservation. The first option was shown to be an unviable approach, considering the patient's frailty and severe lung impairment. Of the endovascular approaches, the fenestrated or branched stent graft was shown to be a technically good option. However, this type of stent demands plenty of time for its preparation, which was not available in this emergency situation. Thus, the authors chose to use an aortic endoprosthesis using the chimney technique, for visceral artery preservation.

The patient underwent conscious sedation and a continuous epidural anesthesia was administered. Subsequently, five arterial accesses were obtained, three in the upper limbs, in both brachial arteries and in the left axillary artery, through which long valved 12-F sheaths were introduced; and two lower-limb accesses, in both femoral arteries, through which two long valved 6-F sheaths were introduced. Through the upper-limb accesses, Amplatz Super Stiff™ guide wires (Boston Scientific Corporation, Natick, United Stated) were passed in the visceral arteries that would be addressed: right renal artery, superior mesenteric artery, and left renal artery. The lower accesses were used for the positioning of the aortic endoprosthesis over the Lunderquist® guide wire (Cook Inc, Bloomington, Indiana, United States) with the aid of a calibrated pigtail catheter, maintained in the abdominal aorta through the left femoral artery (Figure 2A). Subsequently, coated, self-expanding 6 × 80 mm Fluency® stents (C.R. Bard Inc, Tempe, United States) were implanted in both renal arteries, whereas an 8 × 60 mm one was implanted in the superior mesenteric artery; the aortic endoprosthesis Excluder® (GORE®, Flagstaff, United States) was positioned below the level of the proximal extremity of these stents (Figure 2B).

After angiographic confirmation that the prostheses were correctly positioned, the aortic endoprosthesis was released, followed by each of the visceral stents. The contralateral segment of the aortic endoprosthesis was then attached to its main body. Subsequently, control

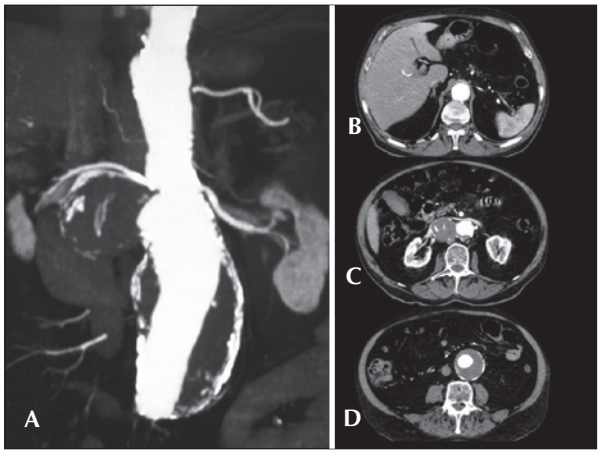

Figure 1 – Abdominal computed tomography. Saccular and fusiform aneurysm of the abdominal aorta (A). Dilation of the abdominal aorta at the level of the celiac trunk (B). Saccular aneurysm (77 mm) of the abdominal aorta, involving the renal arteries (C). Fusiform aneurysm (58 mm) of the abdominal aorta below the level of the renal arteries (D).

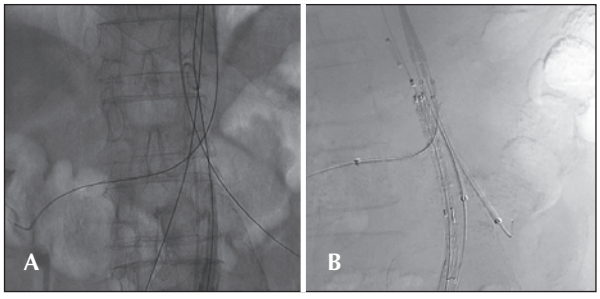

Figure 2 – Positioning of guide wires in the aorta, superior mesenteric artery, and right and left renal arteries (A). Prostheses ready to be released (B).

angiographies of the iliac arteries, of the visceral branches and the main body of the aortic endoprosthesis demonstrated the absence of endoleaks with complete aneurysm exclusion while maintaining the patency of the involved branches, without the use of additional stents or balloons.

The patient had very favorable evolution and was discharged on the fourth day post-intervention. Tomographic control was performed on the third day of evolution and new control CTs were planned at 30 days, 6, 12, and 18 months after the procedure. The CT assessment was performed aiming to verify the patency of the visceral stents and whether they were positioned above the level of the aortic endoprosthesis, aneurysm exclusion, and the presence of leaks (Figure 3).

DISCUSSION

The endovascular treatment of abdominal aortic aneurysm with unfavorable neck for endoprosthesis fixation or visceral vessel impairment and emergency signs has recently become a reality, after the development of the chimney technique. This was shown to be an alternative to the complex conventional open surgery, especially in high-risk surgical patients such as those with severe pulmonary disease, left ventricular dysfunction, renal failure, older age, or presence of multiple comorbidities.

Although robust studies are still necessary, the chimney technique was shown to be promising as it allows for aortic aneurysm endovascular repair, either in scheduled elective cases or in urgency/emergency situations or, ultimately, as a rescue method for a visceral artery accidentally occluded by an aortic endoprosthesis.

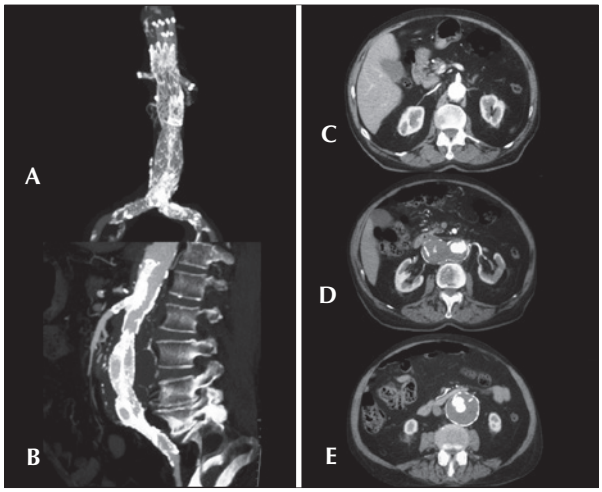

Figure 3 – Tomographic reconstruction of the abdominal aorta after endoprosthesis and stent implantation in the renal arteries (A) and superior mesenteric artery (B). Control computed tomography showing complete aneurysm exclusion and absence of leaks (C to E).

In emergency situations, the chimney technique is a valuable method and has been used as a safe, less expensive alternative. It is sometimes preferred over the branched and fenestrated prostheses, as it eliminates the time needed for prosthesis manufacture, thus being an excellent choice, especially in cases where time is a limiting factor.

The contraindications for the performance of this technique include aortic dissection or stenosis, or other factors that reduce the vessel luminal diameter, limiting the space available for adequate placement of the aortic endoprosthesis and visceral stents in parallel.[7]

Good planning is critical to a successful procedure. The proximal zone in which the prosthesis is anchored must be carefully assessed, as well as the involved visceral branches, the aortic arch, and the axillary arterial access. An overlap of the endoprosthesis is desirable, in addition to visceral stents of at least 20 mm, in order to prevent the occurrence of leaks. Type-I endoleaks and complications due to the insertion of these devices are the most commonly reported problems.[8]

A recently published study presented data on 77 patients followed-up for two years after treatment of complex aortic aneurysm involving the visceral vessels, using the chimney technique. The success rate of this procedure was 99%, with aneurysm diameter reduction or maintenance in 95% of cases and patency of the approached visceral vessels of 98%. No stent migration or leaks were observed. Renal function remained stable in all patients. These data support the safety and effectiveness of this method for the correction of abdominal aneurysms, with adequate blood flow maintenance toinvolved visceral vessels in the medium-term.[9]

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

FUNDING SOURCES

None declared.

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