

The use of endovascular stent-grafts for the treatment of common carotid-internal jugular fistula

Mohammed A. Bawazeer, MBChB, Mohammed S. Al-Jared, SBRD, KFBIR,
Khalid A. Al-Brekeit, FRCSI, RUCS (vasc), Wedad M. Al-Harbi, ABIM.

ABSTRACT

We report a case of a fistula between the common carotid artery and the internal jugular vein due to a hemodialysis catheter insertion. We managed the fistula by the insertion of a covered-stent at the common carotid artery, and completely sealed the fistula without immediate complications. We present this case to highlight this new successful method of treatment.

Saudi Med J 2006; Vol. 27 (1): 101-104

The common carotid artery-internal jugular vein (CCA-IJV) fistula is a known but rare complication of central venous catheterization. The most common cause is penetrating neck injuries.¹⁻³ Previous studies, reported other causes, including post-carotid endarterectomy,⁴ congenital and spontaneous fistulas. Arteriovenous fistulas and false aneurysms remain a clinical challenge to vascular surgeons. Their diagnosis, pathophysiology, and treatment have stimulated the intellectual curiosity of surgeons for more than 200 years.⁵ Fistulas might be asymptomatic, but they may present with a pulsatile neck mass, expanding neck hematoma, and tinnitus on the ipsilateral side.³ They may also present with cerebrovascular signs due to disturbance of the blood flow to the brain.^{1,3} A palpable thrill and an audible bruit are classical and they usually disappear after carotid compression.³ The management of such arteriovenous fistulas is not yet established; we present this case to demonstrate that a simple endovascular technique may replace the conventional surgical repair.

Case Report. A 70-year-old man, with end-stage renal disease for 3 years was treated by a kidney transplant in an international center. Prior to the kidney transplant, he was on hemodialysis in another city, using a right internal jugular hemodialysis catheter before he was shifted to a left arm arteriovenous fistula. Six months after the kidney transplant, he was admitted with fever and diarrhea and positive cytomegalovirus antigenemia (PP65). He also had tinnitus in the right ear. There was no evidence of motor, sensory or visual deficits. He was found to have a palpable thrill over the right anterior triangle of the neck with a continuous machinery bruit. Carotid ultrasound suggested a fistula between the right common carotid artery (CCA) and the right internal jugular vein (IJV) (**Figure 1a, 1b & 1c**). He was planned for carotid angiogram and possible stenting. Bilateral carotid angiogram was undertaken and confirmed the fistula (**Figures 2a & 2b**). The procedure was carried out under local anesthesia through the right femoral, using a trans-arterial approach. After confirmation

From the Departments of Vascular Surgery (Bawazeer, Al-Brekeit), Interventional Radiology (Al-Jared) and Nephrology (Al-Harbi), Armed Forces Hospital, Riyadh, Kingdom of Saudi Arabia.

Received on 18th June 2005. Accepted for publication in final form 17th September 2005.

Address correspondence and reprint request to: Dr. Mohammed A. Bawazeer, Resident, Department of Surgery, Armed Forces Hospital, PO Box 7897 e-225, Riyadh 11159, Kingdom of Saudi Arabia. Tel. +966 (1) 4777714 Ext. 5705. E-mail: masbawazeer@hotmail.com

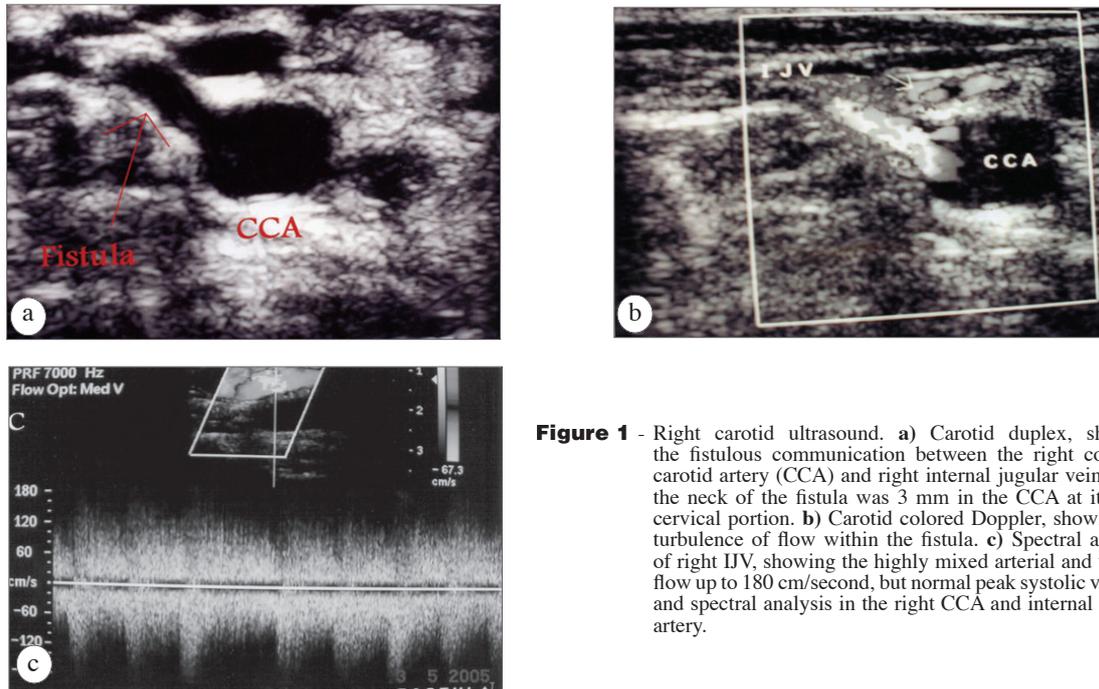


Figure 1 - Right carotid ultrasound. **a)** Carotid duplex, showing the fistulous communication between the right common carotid artery (CCA) and right internal jugular vein (IJV), the neck of the fistula was 3 mm in the CCA at its mid-cervical portion. **b)** Carotid colored Doppler, showing the turbulence of flow within the fistula. **c)** Spectral analysis of right IJV, showing the highly mixed arterial and venous flow up to 180 cm/second, but normal peak systolic velocity and spectral analysis in the right CCA and internal carotid artery.

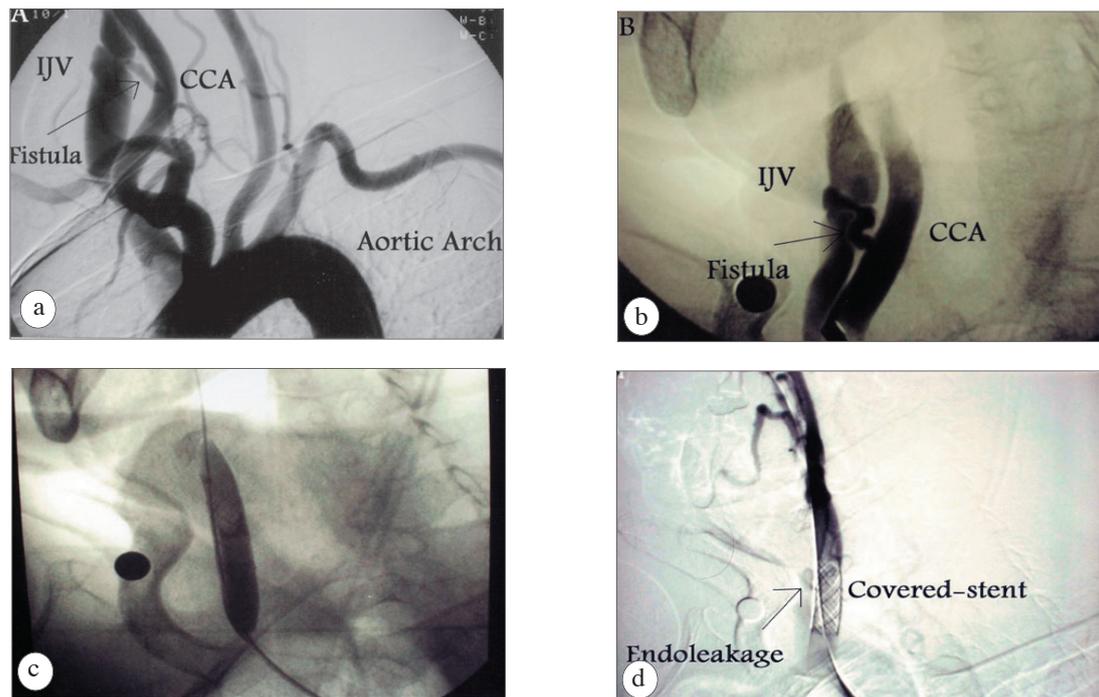


Figure 2 - Angiography and stenting of the right common carotid artery (CCA). **a)** Aortic arch angiogram, showing the fistula between the right CCA and internal jugular vein (IJV), and the origin of both carotids. **b)** Right carotid angiogram showing the fistula (3 mm neck and 13 mm long) arising from the mid-cervical portion of the right CCA and running obliquely to the right IJV. **c)** A covered-stent being deployed at the mid-cervical portion of the right CCA. **d)** A covered-stent was deployed successfully, showing only minimal endoleakage.

of the fistula, stenting of the CCA was carried out. A long 11-French vascular sheath was introduced over a stiff guidewire into the proximal portion of the right CCA, and a self-expandable wall graft endoprosthesis, 10 x 20 mm in size (Boston Scientific MEDI-TECH), was deployed at the fistula (**Figure 2c**). Post-stenting balloon dilatation was performed using a 9 mm diameter balloon, which is required to stabilize and expand the covered-stent against the wall of the artery. Immediate post-insertion angiogram of the right CCA showed proper positioning of the stent. Minimal endoleakage was noted at the site of the stent (**Figure 2d**), no intervention was carried out and eventually, it closed spontaneously. However, an endovascular protection device was not used, although it has proved its superiority in atherosclerotic carotid stenosis, as our case was free from plaque or stenosis. After the procedure, he was heparinized for 24 hours and started on aspirin 81 mg and clopidogrel 75 mg daily. Clinically, the tinnitus and the bruit disappeared. He stayed in the hospital to receive more intravenous doses of ganciclovir for the cytomegalovirus infection for a week after the procedure. Carotid duplex was performed one week later and demonstrated complete closure of the fistula and normal venous flow in the right IJV. Later, he was discharged home in a good general condition and he was planned to continue anti-platelets medications for 6 weeks. He remained asymptomatic for 3 months after the final check up.

Discussion. The fistula in our patient was discovered incidentally, and it was suggested by the presence of tinnitus in the right ear and a bruit in the neck. Because there was no evidence of neck trauma or any other systemic diseases, we assumed that the hemodialysis catheter was the most likely cause of this fistula. There are several diagnostic modalities for common carotid-internal jugular fistula. We used carotid ultrasonography, and the combination of carotid duplex with colored Doppler as the first modality as it is fast and inexpensive with high diagnostic yield. Self et al,² reported that the physical examination alone has a low sensitivity of 61%, and a low specificity of 80%, but duplex ultrasonography has been equaled to angiography with lower costs. However, angiography still is the gold standard, with an accuracy of 100%.² It helps to delineate the size, flow, and the exact location of the fistulous tract. It also helps in assessing whether the endovascular treatment can be carried out for the particular fistula or not, so it has not been used only for diagnostic purposes, but also for therapeutic ones.¹⁻⁶ Computed tomographic and magnetic resonance angiography have recently gained attention. They also help to

delineate the size and level of the fistula, to evaluate other neck structures, and to differentiate the fistula from vascular tumors situated in the neck.²

Intervention is often mandatory even if they are asymptomatic, as those fistulas may enlarge if left untreated. They also have the potential to cause several problems, including high-output cardiac failure due to the left-to-right shunt, embolization and obstructive symptoms.^{4,6} Traditionally, Maher et al,⁷ treated such cases in the past by surgical measures, including excision and ligation of the fistula. There was a high risk of injuring major vessels and nerves.^{4,6} Advances in interventional grafts and techniques now allow some of these cases to be managed by endovascular techniques. The endovascular techniques to close such lesions entail the use of detachable balloons, coils or covered-stents. Detachable balloons have been used since 1974. They are placed on the ends of special catheters to keep the valve of the balloon open. After that, they are inflated and left in the desired place. The drawbacks of this technique include premature balloon detachment and balloon embolization causing stroke.^{3,7} When the fistula cannot be closed with balloons, coils are often used. These pushable coils contain fibers, which are highly thrombogenic.^{4,7} Currently, there is a trend toward using the endoluminal grafts. Parodi et al,⁵ reported the first clinical case treated with a covered-stent and permanently sealed the arteriovenous fistula in 1992. There are several reports regarding those covered-stents and their uses. They have been used in post-traumatic false aneurysms and arteriovenous fistulas,^{2,5} post-carotid endarterectomy carotid pseudoaneurysm,⁴ and bleeding CCA due to tumor invasion.¹ However, our center has good experience with endovascular stenting of atherosclerotic carotid artery disease, so we decided to go for the endovascular option in the treatment of our patient. There are many advantages of covered stents that make them feasible. These endoluminal grafts are covered by biocompatible and elastomeric components. They are expandable, flexible and non-deformable, and available in a variety of sizes and lengths.¹ The covering may serve a physical barrier to prevent late neointimal proliferation and restenosis, and may decrease embolization during deployment.¹ Initially, autologous vein tissue or prosthetic materials, such as Gore-Tex, were manually adjoined to the stent by the surgeon. Now, numerous stent-grafts are commercially available in both balloon-expandable and self-expandable designs.¹ Although, these devices were developed initially for nonvascular applications, however, today they are used to repair many aneurysms and arteriovenous fistulas at different body sites, which is attributed

to their physical characteristics, such as flexibility and the dynamic radial force of the self-expanding design.¹ However, due to recent endovascular use of this prosthesis, the long-term patency rate and their risk of thromboembolic complications are unknown.^{1,5} Reported complications in the literature include compression, deformation, and fracture of the stent if deployed in anatomic areas that are the subject to repetitive motion.^{1,2} Another limitation of these devices is that the delivery system requires at least a 9-French arterial sheath to accommodate the outer diameter.¹ This sheath also can be rigid, which can cause problems in tortuous vascular anatomy.¹ Moreover, anticoagulation and anti-platelet therapy post-carotid artery stenting have not been adequately evaluated. Recent data from the Cleveland Clinic Carotid Stent Registry described that dual therapy with lifelong aspirin plus clopidogrel for the initial 4 weeks is the preferred strategy for patients undergoing carotid artery stenting.² Loading with anti-platelet medications is recommended before stenting of carotid atherosclerotic disease, however, it is not strongly recommended in cases of arteriovenous fistulas. Our protocol is full heparinization with intravenous heparin for 24 hours, and dual aspirin and clopidogrel therapy for 6 weeks, just as a prophylaxis to prevent platelet aggregation around the edges of the stent, and then carotid duplex follow up will be carried out at one week, followed by 6 months and then yearly. Overall, endovascular techniques including covered-stents grafts are more advantageous than the surgical option. They have less morbidity (avoidance of nerve injuries),⁴ more cost-effective and can be used to treat lesions up to the base of the skull, which is not easily applicable.⁴

In conclusion, our patient showed successful stenting of the CCA-IJV fistula with complete closure, which is consistent with the treatment of similar fistulas reported in the recent literature.

Acknowledgments. We thank Dr. Seham Alrasheedi, a Nephrology Resident, who discovered the fistula and took care of the patient. We thank also the nurses and radiology technicians, in the Radiology Department, who participated in the procedure.

References

1. Amar A, Teitelbaum G, Giannotta S, Larsen D. Covered stent-graft repair of the brachiocephalic arteries: technical note. *Neurosurgery* 2002; 51: 247-253.
2. Self M, Mangram A, Jefferson H, Slonim S, Dunn E, Kollmeyer K. Percutaneous stent-graft repair of a traumatic common carotid-internal jugular fistula and pseudoaneurysm in a patient with cervical spine fracture. *J Trauma* 2004; 57: 1331-1334.
3. Nijijima K, Yonekawa Y, Taki W. A detachable balloon procedure for a traumatic internal carotid-internal jugular fistula. *Neurosurgery* 1990; 27: 809-812.
4. Hertz J, Minion D, Quick R, Moore E, Schwartz T, Endean E. Endovascular exclusion of a postendarterectomy carotid pseudoaneurysm. *Ann Vasc Surg* 2003; 17: 558-561.
5. Parodi J, Schonholz C, Ferreira L, Bergan J. Endovascular stent-graft treatment of traumatic arterial lesions. *Ann Vasc Surg* 1999; 13: 121-129.
6. Wadlington V, Terry J. Endovascular therapy of traumatic carotid-cavernous fistulas. *Crit Care Clin* 1999; 15: 831-854.
7. Maher S, Rabee H, Takrouri M, Al-Salman M. Traumatic arteriovenous fistula. *Ann Thorac Surg* 1997; 63: 1792-1794.