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CLINICAL CASE

Vertebral-subclavian bifurcation treatment. "The wedding ring technique" for a vertebral in-stent restenosis associated with stent fracture

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Abstract

This report describes a solution for a restenosis and for the fracture of a stent in the vertebral artery in a patient suffering from vertebrobasilar symptoms. Angiography demonstrates restenosis of a vertebral stent as well as its fracture and migration into the subclavian artery. This complication was managed percutaneously by passing a guide wire through the fractured stent. Pre-dilatation and kissing balloon techniques were applied in both the vertebral and subclavian arteries to modify the stent's dimensions and shape it into the form of a "ring." Postprocedural angiography demonstrated an excellent final result with the assistance of StentBoost visualization. Control angiography at six months also utilized StentBoost imaging and confirmed the patency of the bifurcation and that the stent was not displaced. (Gac Med Mex. 2015;151:610-3)

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Background

For patients experiencing vertebrobasilar transient ischemic attacks, vertebral artery (VA) stenosis portends a 22-35% stroke risk over five years[1]. Angiographic and necropsy studies demonstrate that the first 1-2 cm of the proximal extracranial segment of the vessel is the most frequent site of VA stenosis[2]. Following endovascular treatment, the rate of major stroke or death after 30 days is 3.2%[3,4], but the rate of periprocedural stroke has reached 7.3%[5] in selected series. The SSYLVIA group reported a 6.6% prevalence of post-procedural stroke, but it is not clear how many of these strokes occurred within the vertebrobasilar territory. Additionally, the risk of stroke between 30 days and one year following treatment was 7.3%. The subgroup of vertebral artery stenosis included in the CAVATAS study shows that the degree of mean vessel stenosis at follow up was 47%[6]. The endovascular procedure is not free from long-term complications. The rate of in-stent restenosis varies between 30 and 43%[7,8]. It has been associated with stent fracture in selected series at follow-up. In a Japanese series involving patients treated with coronary stents, a fractured stent was detected in 50% of cases[9]. StentBoost is a decompilation of acquired images of two fixed markers (balloons) that have been recompiled into a highlighted still

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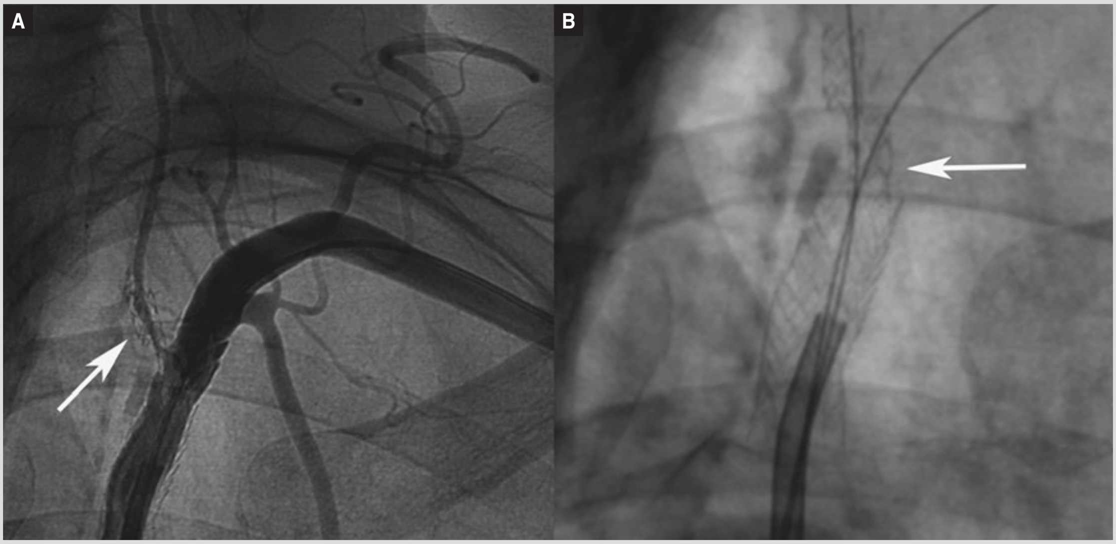

Figure 1. A: *Diagnostic angiography, critical restenosis in the vertebral artery (arrow) and middle hyperplasia in the subclavian artery.* **B:** *In the image without contrast, a fractured vertebral stent lodged in the subclavian artery may be seen (arrow).*

image using the same markers. This case report details the unusual behavior of a previously deployed stent at the location of a previously diagnosed VA stenosis, and aims to demonstrate a technique of approaching the lesion, controlling the stent, and subsequently visualizing the stent at follow-up using StentBoost imaging.

Case report

A 68-year-old female patient presented to our facility with a history of smoking, arterial hypertension, and mild stenosis of the right and left internal carotid arteries. She had undergone an angioplasty of the left common iliac artery in 2007, as well as an angioplasty with stent placement in the left subclavian (SC) and VA in 2008. In July 2008, following the return of vertiginous symptoms, a follow-up evaluation utilizing Doppler technology showed increases in the systolic peak velocity of the VA. The subsequent procedure was initiated utilizing a femoral approach. Diagnostic angiography was performed using a Judkins right 5 Fr guiding catheter, the preferred device of the authors because it facilitates the use of multiple guide wires and simultaneous injections when navigating the challenging anatomy of the aortic arch. Initial angiographic images revealed in-stent restenosis within the vertebral artery, as well as the image of a fractured vertebral stent, which had apparently been dislodged into the lumen of the SC artery (Fig. 1). We subsequently placed a 0.0014-inch ChoICE™ Extra support guide wire (Boston Scientific Corporation Natick, MA, USA) into both the SC and VA. In the SC artery, the wire was passed through the cells of the fractured stent. An initial kissing balloon and two Sprinter® Legend balloons (2.5 × 20 mm) (Medtronic Inc, Minneapolis, USA), facilitated the advance of a Quantum® balloon (5.0 × 15 mm) (Boston Scientific, MA, USA) through the SC artery, making it possible to use sequential kissing balloons. The fractured stent was then shaped into a thin ring, similar to the shape of a "wedding ring." The origin of the VA was stented with a Taxus® stent (4.0 × 16 mm) (Boston Scientific, MA, USA). A final kissing balloon was utilized, and the final results of the procedure are depicted in figure 2. Control angiography performed eight months later demonstrated a patent bifurcation, and normal flow within the VA and SC arteries and only minimal intimal hyperplasia. StentBoost imaging revealed preservation of the bifurcation, as well as mild deformity of the ostial segment of the VA (Fig. 3).

Discussion

This report depicts a fractured stent from the VA that became lodged in the lumen of the SC artery. Unfortunately, we do not have the angiographic images of the first stent implantation as this procedure was

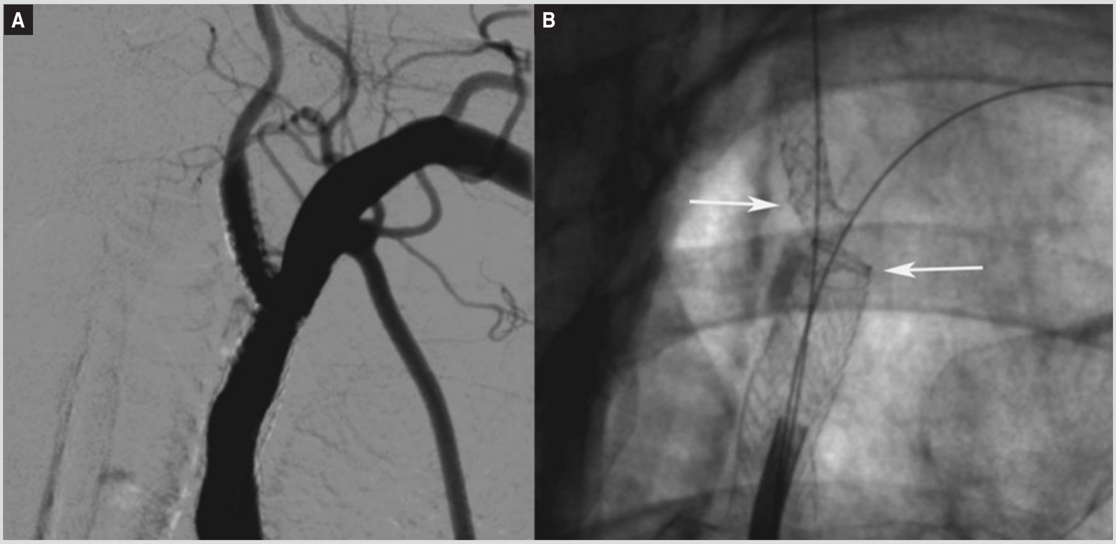

Figure 2. A: *Digital subtraction angiography showing complete stenosis resolution and confirmation of a new bifurcation.* **B:** *The image showing the segment where the fractured stent was located has been completely reconstructed. The vertebral artery ostium is covered by a drug-eluting stent (upper and right arrow), and the fractured stent is dilated and attached to the arterial wall, having taken the shape of a ring (lower and left arrow).*

performed at another institution. This situation presented the challenge of changing both the natural form and the dimensions of the stent. Fortunately, the device was a balloon expandable stent without "thermal memory," which afforded us an opportunity that may not have been possible with a nitinol self-expandable stent. The new shape of the fractured stent was similar to that of a ring. This shape was preserved throughout the six

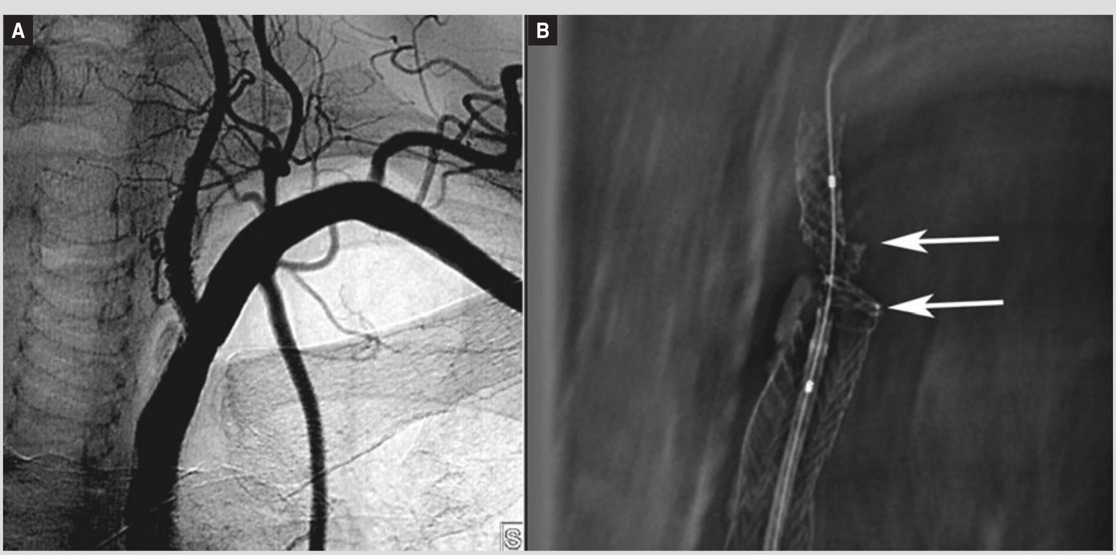

Figure 3. A*: Angiographic follow-up, with minimal hyperplasia at the subclavian and vertebral stents.* **B:** *The StentBoost control enhances the modification of the stent struts in the ostial segment of the vertebral artery (upper arrow), as well as the new bifurcation architecture. The ring shape image is preserved (lower arrow).*

months that elapsed between the procedure and follow-up as the shape was verified via angiography during the follow-up appointment. Another possible solution for this problem could have been surgical treatment. However, open surgical procedures, including vertebral endarterectomy and bypass operations, have been associated with a high frequency of non-stroke-related complications, including Horner's syndrome, lymphatic injury, VA thrombosis, and laryngeal nerve injury[10]. By contrast, Albuquerque, et al. reported a series in which technically successful VA stenting was achieved in 97% of patients (32/33). The only case of technical failure was associated with the slippage of a hand-mounted stent[11]. This series, as well as another series in which bare metal stents were utilized, achieved excellent technical success rates of between 92 and 100%; however, the restenosis rate ranges between 28 and 48% when using bare metal stents[12-15]. The choice of a drug-eluting stent was based on selected series with low restenosis rates, although these series included low numbers of patients; the largest series included 31 patients, but did not include specifications about stenting the VA origin. Ogilvy, et al., Weber, et al. and Edgell, et al.[16,17] published the most recent series with drug-eluting stents, series in which restenosis rates ranged between 7 and 17%. The quantity of patients who participated in these studies was small, but the benefits of drug-eluting stents seem to be reasonable. Another option for bifurcation treatment was reported by Rouguin and Alhaddad[18], who used the crush technique at both the VA origin and at the SC artery with excellent angiographic results. In our case, however, the crush technique may have compromised the origin of the VA. Of course, the use of complex techniques to treat bifurcations must be clearly justified, depending on the characteristics of the lesion. In the example of the kissing balloon, the use of two stents, as well as the rewiring of a single stent, carries the risk of embolization but may be useful if applied only in special cases. The angiographic follow-up images and StentBoost images demonstrated the durability of this technique. At present, the fractured stent that was lodged in the SC artery remains in both the same form and position, with endothelium having covered its surface. The patient remained asymptomatic as of her six-month follow-up appointment.

Conclusions

This case is special as decisions were made during the course of the procedure. Providers may consider this option in the setting of fractured stents in the lumen of the SC artery. Practitioners may offer the patient another feasible treatment when required by the case.

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