Malignant Superior Vena Cava Obstruction: Stent Placement via the Subclavian Route

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Abstract

Over a 3-year period 23 patients with malignant superior vena cava obstruction were referred for interventional management. They underwent repeat localized central venography and deployment of self-expanding Wallstents. All patients (age range 26–89 years) were approached by the subclavian route using 29 stents. The stent was used to exclude thrombus in the contralateral brachiocephalic vein in five patients and histologic information was available in all patients. Retrospective analysis of the clinical records was used to assess symptom-free survival and symptom recurrence.

All patients reported an improvement in symptoms within 24 hr of the procedure. There was 100% technical success. Primary clinical success was achieved in 19 of 23 patients followed-up to their death with no symptom recurrence (range 1–34, mean 15 weeks). In four patients symptoms recurred but only one patient was referred for re-intervention, which was successful. Complications included single cases of early post-stent rethrombosis, distal slip on deployment, and distal slip on balloon dilatation. There were no puncture-related complications.

Key words: Lung cancer—Stent angioplasty—Subclavian vein—Superior vena cava obstruction

Malignant superior vena caval obstruction (SVCO) is rarely fatal in itself but is a distressing condition which degrades the quality of life during the limited survival time available to these patients [1]. Thus rapid and effective palliative treatment is the accepted goal [2]. The use of percutaneous endovascular metallic expandable stents in SVCO has been widely reported since 1986 [3]. A recent comparative study has shown measurable superiority of stenting over radiotherapy and confirms its position as a primary treatment in this patient group [4]. The conventional approach for stent deployment in the literature has been via the femoral vein, with brief mention of the internal jugular or basilic veins [5, 6]. We describe our experience using the subclavian route to deploy the short delivery device "Easy" Wallstent (Boston Scientific International, La Garenne Cedex, France) in the treatment of malignant SVCO.

Materials and Methods

Twenty-three patients with malignant SVCO were referred from a regional oncology center for interventional radiological management over a 3-year period. All had recent imaging including bilateral arm venography and thoracic CT scans. All were approached via the subclavian vein by one operator (K.McB.). Age range was 26–89 years (mean 64 years); 14 were men and nine were women. Fifteen patients (65%) were de novo referrals with no previous radiotherapy. Seven patients had received maximum tolerance radiotherapy prior to stenting and one patient had had previous radio- and chemotherapy. Histologic information was available before stent insertion in all but three patients and included non-small-cell lung cancer ($n = 8$), small cell lung cancer ($n = 6$), mediastinal metastatic disease ($n = 4$), lymphoma ($n = 2$), sarcoma ($n = 2$), and mesothelioma ($n = 1$). Periprocedural endovascular biopsy secured the diagnosis in the three unknown cases. All patients had a 14-mm Wallstent placed via a short delivery device. Retrospective analysis of clinical notes was used to assess symptom-free survival and symptom recurrence.

Technique of Superior Approach

Bilateral, upper-limb central venography confirmed the central venous obstruction. The subclavian vein chosen was either that on the side more involved by the obstructing lesion or with the lesser thrombus load. Using a "road map" and the technique described by Jaques [7] a 10 Fr "Opta", 11-cm sheath (Cordis Europa, Roden, The Netherlands) over a standard J-wire secured the subclavian access site. Accurate puncture, using fluoroscopic or ultrasound guidance over the first rib, is imperative to avoid a possible pneumothorax, as these patients are often dyspneic with central cyanosis and respiratory compromise. By passing a 4 Fr pigtail to just above the lesion a further localized central venogram was performed (Fig. 1). This provides accurate assessment of tumor size and/or ingrowth and vein diameter.

The obstructing lesion was crossed using a stiff hydrophilic 0.035-inch guidewire (Terumo, Tokyo, Japan) which was then exchanged for a stiff nonhydrophilic wire (Amplatz Super-Stiff, Meditech, Watertown, MA, USA). A 14 mm × 64 mm Wallstent (nominal dimensions) was positioned and deployed through the subclavian sheath over a stiff wire in all cases using a fluoroscopic "road map". If the stenosis was long another stent was used. The majority of lesions were balloon dilated following stent deployment using a 12-mm "Blue Max" balloon (Boston Scientific). If there was excessive contralateral brachiocephalic thrombus then the brachiocephalic confluence was covered, thus excluding the clot.

If the stenosis was abolished then postprocedural anticoagulation was considered unnecessary but oral aspirin was advised. If ipsilateral nonocclusive thrombus remained following stenting then formal anticoagulation was instituted after the procedure. If symptoms recurred then follow-up venography was obtained.

Results

No major procedural complications occurred. Prestenting thrombolysis was necessary and successful in two cases where occlusive thrombus was found at cavography with adequate recanalization. Five patients (22%) had venographic evidence of tumor ingrowth, confirmed in three cases by endoluminal biopsy (Fig. 2). The Wallstent was deployed over the brachiocephalic confluence excluding thrombus (Fig. 1C) in five cases. No discernible episodes of pulmonary emboli were noted. No puncture-related complications occurred.

One case of forward slip on stent deployment across a tight stenosis occurred. Similarly in another case the stent slipped forward, partially into the right atrium, but only after balloon dilatation

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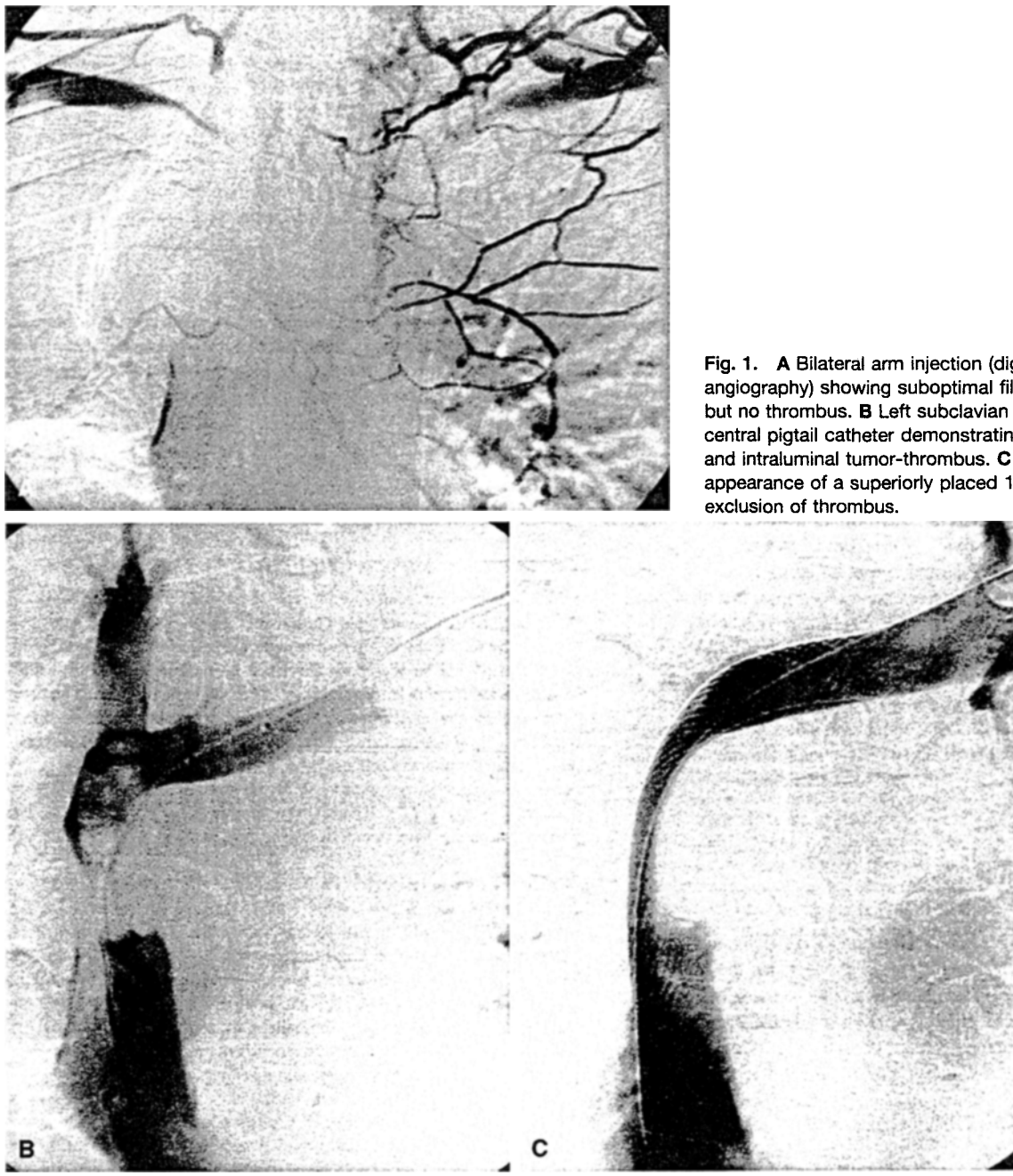


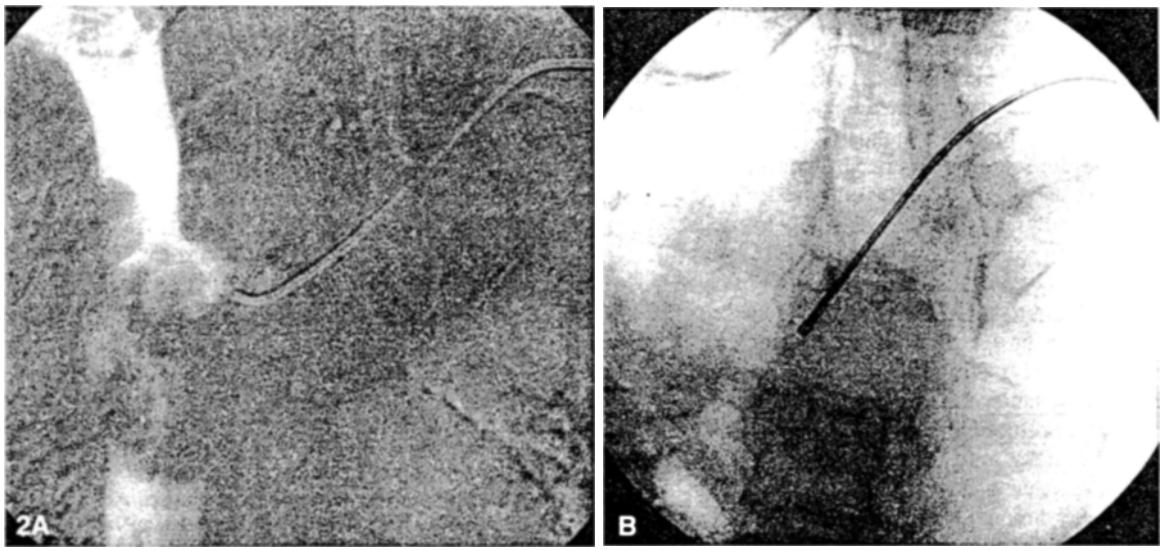
Fig. 1. **A** Bilateral arm injection (digital subtraction angiography) showing suboptimal filling of central veins but no thrombus. **B** Left subclavian vein access with a central pigtail catheter demonstrating localized stenosis and intraluminal tumor-thrombus. **C** Final venographic appearance of a superiorly placed 14-mm Wallstent with exclusion of thrombus.

for a residual stenosis. These situations were remedied by deploying a second stent (10-mm × 70-mm) to fully cover the stenosis (Fig. 3). In three uncomplicated cases a second stent was necessary to cover a longer stenosis. There was technical success with restoration of patency in all cases. Clinical success (freedom from symptom recurrence until death) was achieved in 19 of 23 patients. No cases of overt cardiac decompensation or hypovolemia secondary to an induced diuresis following stenting were recorded. The survival range was 1–34 weeks with an average of 15 weeks. Four symptomatic recurrences were recorded, but only one patient was referred back for further intervention. She survived 33 weeks from initial stenting, compared with an average of less than 10 weeks for the remaining three patients. One of these had an early rethrombosis at 1 week, which was left untreated. Thus prompt and lasting palliation was obtained in 20 of 23 patients. The mean room time from patient entry to exit was 51 min.

Discussion

The efficacy of stenting a central venous obstruction is not in doubt [4, 8–10]. Nicholson et al. [4] have provided convincing data comparing palliative radiotherapy and percutaneous stenting. However, there is difficulty comparing outcome between established therapies in a histologically homogeneous group [11] and our heterogeneous series.

This technical report demonstrates the efficacy of the subclavian vein as our preferred access route to deploy the Wallstent on a short



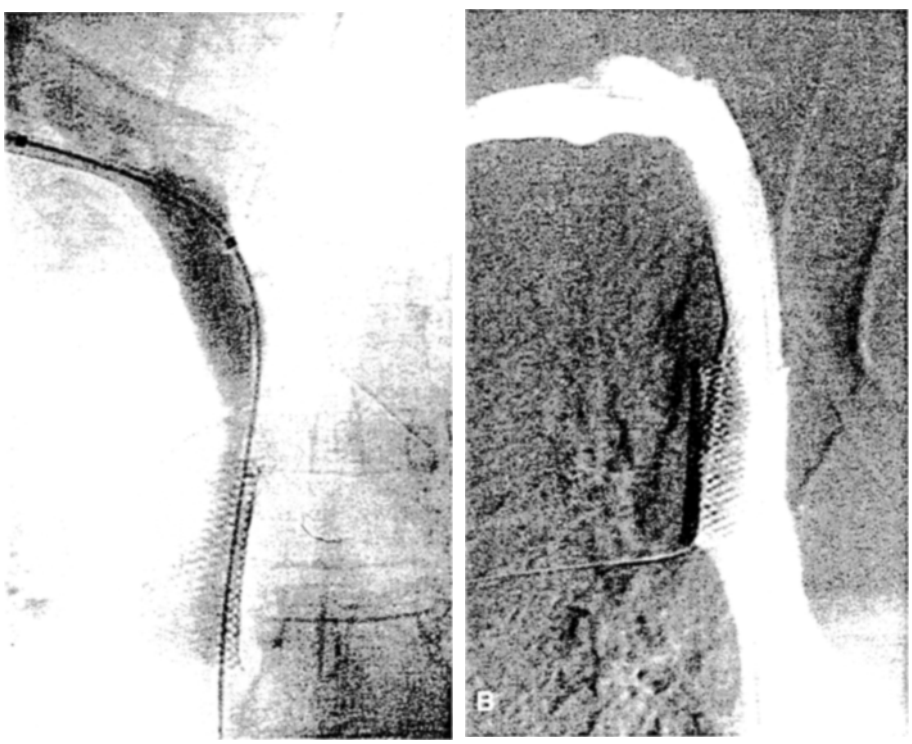


Fig. 2. **A** Localized central catheter cavogram via left subclavian sheath access demonstrating abundant tumor ingrowth. **B** Subsequent passage of endoluminal myocardial biopsy forceps to the intraluminal lesion.

Fig. 3. **A** Access via the subclavian vein sheath with a venogram demonstrating slip of the 14-mm Wallstent beyond the localized SVC stenosis. **B** Final appearance of the right brachiocephalic vein and SVC following placement of a second (10-mm × 7-cm) Wallstent through the first stent, across the lesion.

delivery device. Jaques et al. [7] and others [12] have shown how the complication rates for central venous punctures can be reduced to an almost negligible rate using imaging. The shorter device gives excellent control, with a shorter wire and stent delivery device to manipulate. The distal end (with respect to the operator) of the self-expanding "Easy" Wallstent can be controlled accurately and placed, or even repositioned, above the right atrium from the subclavian route. Conversely, it has been our experience previously that, when using a femoral approach, during deployment the proximal end of the stent (with respect to the operator) may protrude into the right atrium, depending on the unpredictable degree of expansion within a stenosis. We regard the accurate positioning and relative lack of shortening of the anchored distal end (at the proximal SVC) of the "Easy" Wallstent as the major advantages when placed from the subclavian route.

Ostler et al. [1] challenge the need for immediate treatment of SVCO as the condition is rarely fatal and the natural course is that of collateralization. We would argue that prompt therapy is essential in symptomatic patients with a limited life expectancy. One advantage of using the subclavian vein is that the endoluminal biopsy forceps can be directed with confidence to the occluding lesion to confirm the histologic diagnosis, as was done in three of our patients when tumor ingrowth was seen on the central localized venogram. No thromboembolic events occurred in this series, although they have been described elsewhere [4, 6, 13]. The risks of embolus may be perceived to be reduced by our technique, but as yet the evidence is lacking. The early and rapid palliation obtained by stenting avoids late features such as extensive supracaval thrombosis, radiotherapy-induced mediastinal edema, and intracranial venous hypertension. Stenting also immediately palliates the symp-

toms of headache and tinnitus (although dyspnea appears to be more resistant) in patients with a guarded prognosis [4]. The costs of a stent placement service are justifiable when a more realistic view of the costs of inpatient care and multiple outpatient attendances at radiotherapy are taken into consideration [1, 4, 8].

There has been no consensus strategy supported by the literature to advise on thrombolysis or anticoagulation. It is our practice now to avoid preprocedural thrombolysis, as most cases are now referred earlier and consequently have a reduced thrombotic load. Kee et al. [6] suggest that residual thrombus compromises the diameter of the lumen and increases the number of stents required. However, thrombolysis has been shown prospectively to incur significant risks, especially in the elderly [14]. If a residual stenosis persists after stenting and balloon dilatation then formal anticoagulation would seem prudent. If residual thrombus is present in any substantial amount we would consider intravenous heparin and possibly thrombolysis. As demonstrated in one of our more complicated cases, there was symptomatic, thrombotic occlusion at 1 week after stent placement despite systemic heparinization. It appears that patients presenting with significant thrombosis have a poorer outcome [4].

The other complications we encountered were two forward slips, the first on stent deployment and the second on balloon dilatation; both were related to tight local stenoses. It is recognized that stents may be unstable on these lesions, which can be predilated to reduce this complication [15]. These minor misplacements did not affect the technical adequacy of the procedures when a second stent was used. One patient with symptomatic recurrence was referred back at 6 weeks after stenting for further intervention and underwent thrombectomy, endovascular biopsy, and restenting for tumor ingrowth. She remained symptom-free till death 33 weeks after initial stenting.

We feel that the importance of adequate venographic assessment cannot be overstated, as there is a very real risk of dismissing eminently treatable lesions by acquiring suboptimal venograms, usually from low-volume arm injections which preferentially bypass the region of interest via collaterals. It is imperative that bilateral, simultaneous, high-volume proximal injections be performed. This allows an assessment of central venous patency and indicates which subclavian vein to puncture. If available, MR imaging using time-of-flight [16] or breath-hold techniques, gadolinium-enhanced MR angiography, or helical CT phlebography [17] are useful adjuncts to assist in planning central venous interventions and can show thrombus in situ. When subclavian access has been secured a localized and catheter-directed central venogram can be performed, which in all our cases proved that a treatable lesion was present despite some previous suboptimal venographic imaging. An alternative but possibly more difficult option is to place a central catheter via an arm vein first, before proceeding with a femoral puncture. Our technique avoids this.

The preferred stent for the treatment of malignant SVCO is the Wallstent [4, 8, 9], although the Palmaz and Gianturco Rosch stents have their proponents [6, 18]. Most experience is now with the former device. We have not used "kissing" Wallstents at the brachiocephalic confluence [6, 19] as symptoms have been relieved by opening up one brachiocephalic vein and the SVC. Natural collateralization will occur from the other side of the head and neck. No clinical failure was seen in the five patients who had a brachiocephalic vein excluded by the Wallstent, with the bonus of excluding potentially embolic thrombus and shortening the procedure time.

In conclusion, using the subclavian approach, we achieved technical success in all cases and clinical success in 20 of 23 cases, with no increase in complications compared with other series. We have found the subclavian approach advantageous when treating central venous obstruction.

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