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Vascular Interventions *Case Report*

Endovascular treatment of superior vena cava syndrome does not preclude continued use of indwelling hemodialysis and chemotherapy lines

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ABSTRACT

Obstruction of the Super Vena Cava (SVC) can result in symptoms, such as facial plethora and swelling, and be due to a variety of underlying causes besides lung malignancies, the rates of which have changed over time; the underlying etiology is used to determine the best management strategy. This case report aims to discuss the role of etiology in determining the best initial treatment for SVC syndrome (SVCS) and outlines the unique management for a patient that represents the changing demographics of SVCS causes. A 73-year-old male with end-stage renal disease and metastatic carcinoma of the colon presented with swelling of the jaw, neck, and tongue. Computed tomography (CT) scan showed chronic thrombosis of the SVC and bilateral brachiocephalic veins. He had been receiving hemodialysis and chemotherapy through central venous catheters (CVCs) that traversed the SVC and terminated in the right atrium. Treatment involved double-barrel stent reconstruction of the SVC with a snare technique to temporarily reposition the chemotherapy port catheter and exchange of the hemodialysis catheter. After this single procedure, he experienced relief of symptoms without disrupting the use of his CVCs for further hemodialysis or chemotherapy appointments. For cases of SVCS due to underlying lung malignancies, which has been and remains the most common cause, endovascular stenting is reserved as a palliative measure when treatment of a refractory malignancy fails to resolve the obstruction and for when symptoms are severe because most cases are not life-threatening. However, increased use of CVCs has caused a rise in SVCS due to thrombosis, for which stenting is the first-line treatment. Of the few previously published case reports that depict using a snare technique to temporarily reposition a CVC, they all describe cases due to lung malignancies. Outlining this case presentation can increase awareness of thrombotic stenosis as an increasingly common cause of SVCS, which may occur in patients with a broader range of underlying conditions, ages, and life expectancies and require a wider array of physicians to be knowledgeable of management strategies. Furthermore, detailing this unique technique can provide therapeutic alternatives that show how endovascular interventions do not disrupt interdisciplinary treatment plans or preclude continued use of CVCs. While stenting technology has improved dramatically since its inception, follow-up on stent patency will help determine if expanding treatment for lower acuity cases is beneficial. Endovascular stenting is the treatment of choice for thrombotic causes of SVCS, which is becoming more common due to the increased use of CVCs. Techniques to temporarily reposition CVCs intra-procedurally allow for limited disruption in multidisciplinary treatment plans for patients with complex underlying conditions.

Keywords: Central venous catheters, Kissing stents, Snare technique, Superior vena cava syndrome

INTRODUCTION

In superior vena cava (SVC) syndrome, intravascular or extravascular obstruction of venous drainage of the head, neck and upper extremities to the right atrium results in a backflow of blood

to these regions. The increase in hydrostatic pressure results in symptoms such as edema and plethora which are usually bilateral. A slower rate of obstruction typically causes less severe symptoms as collateral circulation has time to form. Though rare, rapid obstruction can be life-threatening causing hemodynamic compromise, airway obstruction from laryngeal edema, and cerebral edema.[1] While thoracic malignancies remain the most common cause of SVC syndrome (SVCS), an increase in the use of pacemakers, defibrillators, and central venous catheters have caused an increase in the incidence of benign thrombotic etiologies.[2] Conventionally, endovascular treatment via stenting was reserved for life-threatening cases or malignant etiologies with little therapeutic options and a short life expectancy, such as mesothelioma. However, this approach has become the treatment of choice for symptomatic cases of benign etiologies due to rapid relief and improved quality of life.[3] We describe a unique case of endovascular double-barrel reconstruction of the SVC with a preexisting left brachiocephalic stent, placed due to arm swelling following brachiobasilic fistula creation, and indwelling hemodialysis and chemotherapy lines that was able to relieve symptoms but did not disrupt further treatment of other underlying conditions.

CASE REPORT

A 73-year-old male was referred to the emergency department (ED) from his dialysis unit for swelling of the jaw, neck, and tongue. In addition to end-stage renal disease, he had adenocarcinoma of the colon with metastatic spread to the liver and lungs. He had continued to receive hemodialysis via a right internal jugular tunneled hemodialysis catheter (DuraFlow Chronic Hemodyalysis Catheter – AngioDynamics – Latham, NY USA) with intermittent exchange for a year and a half due to an immature arteriovenous fistula. 1-month prior, palliative chemotherapy was initiated and administered bimonthly through a central venous catheter (CVC) with a port (Xcela Plus Port – AngioDynamics – Latham, NY USA) implanted in the right chest wall.

Upon arrival to the ED, the patient reported pressure in his head upon raising his arms and recent changes in his voice but no acute respiratory distress or difficulty controlling secretions. A CT scan of the chest and neck showed chronic thrombosis and significant stenosis of the SVC below the azygos vein with the hemodialysis and chest port catheters occluding the stenosed lumen [Figure 1]. Airway effacement and fluid collection in the retropharyngeal space was also evident. Nasopharyngolaryngoscopy also showed edema of the glottis and supraglottis. With a presumed diagnosis of SVCS, double barrel stent reconstruction of the SVC with extension into the bilateral brachiocephalic veins was planned. It was determined that the presence of the two indwelling CVCs and laryngeal edema would complicate the procedure, requiring pre-operative planning of the best approach and intubation to ensure airway protection while the patient was sedated.

The patient proved to have a very difficult airway following sedation. Consequently, the patient was taken to the operating room for an emergency tracheostomy. The patient stabilized and SVC recanalization occurred on postoperative day 2. The procedure goals were to exchange the hemodialysis catheter and reposition the implanted chemotherapy CVC with a snare technique so that they could be replaced in their original positions following endovascular reconstruction. This approach ensured no interruptions in hemodialysis or chemotherapy with only one procedure. Though discontinuing their use and reestablishing at new alternative sites, such as the femoral veins, was another reasonable approach, it was deemed unnecessary and unfavorable as this site is associated with an increased rate of infection.

The right internal jugular tunneled hemodialysis catheter was exchanged for a 10 French × 25 cm sheath (Super Sheath Introducer Sheath - Boston Scientific–Marlborough, MA USA) over a wire (Amplatz Super Stiff Guidewire–Boston Scientific–Marlborough, MA USA) and initial venography was performed [Figure 2]. Additional access points were gained via brachial veins bilaterally. The chemotherapy chest-port catheter was snared (Vascular Ev3 Amplatz Goose Neck Snare Kit, 15MM × 120 4FR - Medtronic–Minneapolis, MN USA) and brought into the 10 French internal jugular sheath. Balloon (Atlas PTA Dilation Catheter - Beckton Dickson – Franklin Lakes, NJ USA) angioplasty of the SVC was performed and venography demonstrated resolution of venous flow through collaterals; however, there were residual areas of stenosis [Figure 3]. Double barrel stent reconstruction of the SVC extending to bilateral brachiocephalic veins was performed using bare metal stents (Vici Venous Stent - Boston Scientific – Marlborough, MA USA) [Figure 4]. Subsequent balloon

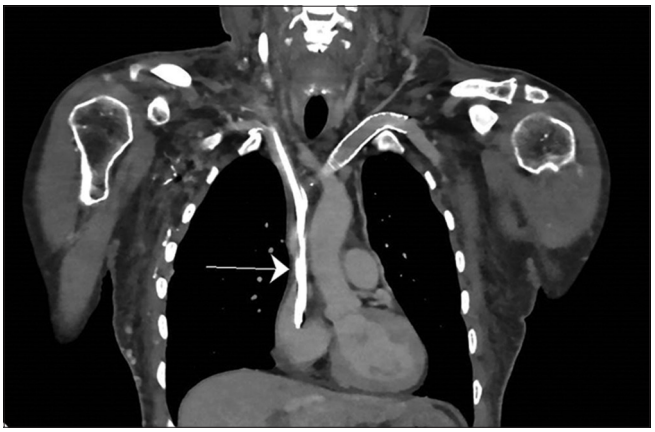

Figure 1: 73-year-old male with end-stage renal disease and colon cancer who presented with facial swelling secondary to superior vena cava syndrome. Coronal reformat of pre-procedural computed tomography venography with a filling defect (arrow) in the proximal superior vena cava.

angioplasty was performed within the stents and repeat venography demonstrated brisk flow of contrast through central veins. A focal area of stenosis remained with the right subclavian vein which was treated with angioplasty. The chemotherapy chest-port catheter was advanced with a snare and a new hemodialysis catheter was advanced over existing wire (Amplatz Super Stiff Guidewire – Boston Scientific – Marlborough, MA USA). Great care was taken to ensure both catheters were placed through the right brachiocephalic stent with catheter tips terminating in the right atrium. Final central venography was performed, demonstrating improved flow and uniform luminal caliber through the central veins [Figure 5].

The patient was followed for 5 days post-procedure. On post-procedure day 1, a chest radiograph was performed, demonstrating the right internal jugular tunneled hemodialysis catheter and chemotherapy port traveling along the course of the right brachiocephalic-SVC stent [Figure 6]. A significant improvement in facial swelling was noted and no complications occurred. Hemodialysis and chemotherapy continued as scheduled. Anticoagulation with Lovenox for 4 weeks followed by Eliquis 5 mg twice a day was prescribed. Long term anticoagulation following SVC stenting is currently recommended. However, evidence of any benefit remains limited.[4] If contraindications exist, dual antiplatelet therapy for 3 months is a reasonable alternative. Outpatient follow up was planned to ensure continued patency. The pre-existing stent in the left subclavian vein, initially placed for arm swelling following brachiobasilic fistula creation three and a half months prior to the case presented, required angioplasty due to reocclusion and arm swelling 4 and a ½ months' following the SVC reconstruction described in this report and 8 months following its placement. However, further follow up to evaluate the patency of the double barrel SVC stents extending into the bilateral brachiocephalic veins was not possible as the patient passed three months later from cardiac arrest secondary to sepsis.

Figure 2: 73-year-old male with end-stage renal disease and colon cancer who presented with facial swelling secondary to superior vena cava syndrome. Fluoroscopic contrast enhanced venography image shows reflux (bracket) of contrast into the right internal jugular secondary to central obstruction of superior vena cava (arrow).

Figure 3: 73-year-old male with end-stage renal disease and colon cancer who presented with facial swelling secondary to superior vena cava syndrome. Fluoroscopic contrast enhanced venography image with bilateral brachial access shows superior vena cava following angioplasty and chest port snaring.

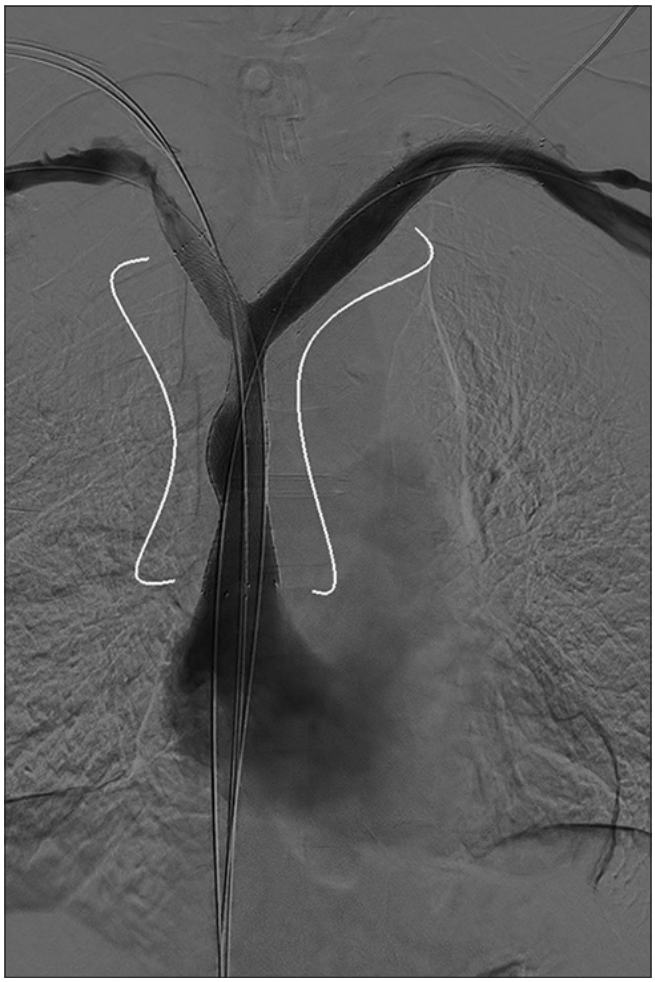

Figure 4: 73-year-old male with end-stage renal disease and colon cancer who presented with facial swelling secondary to superior vena cava syndrome. Fluoroscopic contrast enhanced venography image shows superior vena cava following double barrel stent reconstruction with 16 × 120 mm bare-metal venous stent (Vici Venous Stent - Boston Scientific – Marlborough, MA USA) on the left (bracket) and 12 × 90 mm bare-metal venous stent (Vici Venous Stent - Boston Scientific – Marlborough, MA USA) on the right (bracket).

Figure 5: 73-year-old male with end-stage renal disease and colon cancer who presented with facial swelling secondary to superior vena cava syndrome. Fluoroscopic contrast enhanced venography image at completion of procedure.

DISCUSSION

No formal guidelines exist in the management of SVCS, but treatment algorithms have been proposed.[5] These recommendations have drawn upon compilations of case reports and retrospective analyses with no randomized control trials available comparing management strategies.[2] Choosing a treatment strategy depends primarily on the etiology and severity of symptoms.[1] With malignant causes, treating the underlying cancer is often sufficient to relieve symptoms with time, especially when the response to chemotherapy or radiation is rapid. In these cases, endovascular stenting is most often reserved as a palliative measure when specific cancer therapies were insufficient in improving obstruction or when symptoms are severe, distressing.

In contrast, stenting is considered the first-line treatment for symptomatic, benign thrombotic causes of SVCS. Due to increased use of intravenous lines and devices, benign causes have steadily risen over time to now comprise 35% of cases seen in the United States.[1] If this trend continues, it can be expected that endovascular management of SVCS will also increase. Outlining successful SVC reconstruction strategies despite indwelling venous lines can help provide therapeutic alternatives that show how endovascular interventions do not disrupt interdisciplinary treatment plans or preclude continued use of CVCs.

Many case reports have outlined rapid symptom relief with SVC stenting for an overall success rate of over 95%.[6] However, most of these reports depict refractory thorax malignancies, which remains the most common cause of SVCS despite the previously discussed etiology changes over time. The few case reports that address successful stenting of the SVC with intraprocedural repositioning of CVCs for continued use post-procedurally also describe patients with non-curative lung malignancies.[7]

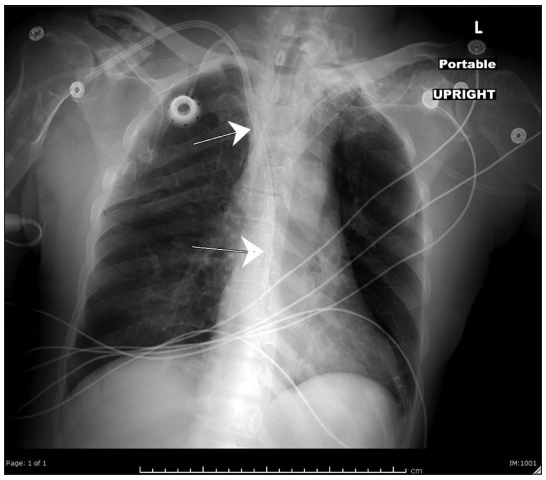

Figure 6: 73-year-old male with end-stage renal disease and colon cancer who presented with facial swelling secondary to superior vena cava syndrome. (a) Post-procedural day one chest radiograph demonstrating right internal jugular tunneled hemodialysis catheter (arrow) and chemotherapy port (arrow) traveling along the course of the right brachiocephalic-superior vena cava stent.

While the patient described in this case had metastatic cancer that may have contributed to a hypercoagulable state, his chronic thrombotic stenosis seen on CT imaging from long-term indwelling CVCs use represents the slowly changing demographics of SVCS patients. This change may require physicians from a wider range of specialties to have knowledge of the endovascular management possibilities available for SVCS.

Limitations of this case include a lack of longitudinal follow-up past 4 and a ½ months to determine long-term patency. Despite an average life-expectancy for SVCS patients under six months, this topic may become increasingly relevant as the number of benign but symptomatic cases rises with the increased use of indwelling catheters and permanent cardiac devices. These patients may have a more diverse range of underlying conditions and longer life-expectancies than the classically depicted SVCS patient on palliative chemotherapy for refractory lung cancer. Recommendations on whether stenting should be used in those with longer life-expectancies or those with significant but not severe symptoms are inconsistent.[2] Reported reocclusion rates following endovascular reconstruction have ranged from 9% to 20% for patients treated with SVC stenting, which is lower than the recurrence rate for other treatment modalities.[1] The bilateral SVC stenting technique used when CVCs are replaced into the right atrium at the end of the procedure and described in this report has been associated with higher occlusion rates than unilateral stenting.[7] However, recent studies have shown that four of five patients with stent occlusion were amenable to a second endovascular procedure for long-term patency of 92%.[2] This appears promising for proponents contending the improvement of stenting technology since its inception warrants expanding this minimally invasive management approach to more symptomatic patients.

CONCLUSION

Benign thrombotic cases of SVCS are rising in the US due to increased use of long-term indwelling CVCs. Interventionalists have techniques available that allow for successful treatment without disrupting the functionality of the indwelling CVCs. This gives patients a therapeutic alternative for rapid relief of symptoms without concern of disrupting other essential treatment plans, such as hemodialysis and chemotherapy.

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

Dr. Vinit Khanna is in the Editorial Board of the journal.

REFERENCES

1. Wilson LD, Detterbeck FC, Yahalom J. Clinical practice. Superior vena cava syndrome with malignant causes. N Engl J Med 2007;356:1862-9.
2. Straka C, Ying J, Kong FM, Willey CD, Kaminski J, Kim DW. Review of evolving etiologies, implications and treatment strategies for the superior vena cava syndrome. Springerplus 2016;5:229.
3. Wei S, Liu J, Li X, Song Z, Dong M, Zhao H, *et al*. A retrospective stenting study on superior vena cava syndrome caused by lung cancer. Thorac Cancer 2020;11:1835-9.
4. Lepper PM, Ott SR, Hoppe H, Schumann C, Stammberger U, Bugalho A, *et al*. Superior vena cava syndrome in thoracic malignancies. Respir Care 2011;56:653-66.
5. Yu JB, Wilson LD, Detterbeck FC. Superior vena cava syndrome-a proposed classification system and algorithm for management. J Thorac Oncol 2008;3:811-4.
6. Sfyroeras GS, Antonopoulos CN, Mantas G, Moulakakis KG, Kakisis JD, Brountzos E, *et al*. A review of open and endovascular treatment of superior vena cava syndrome of benign aetiology. Eur J Vasc Endovasc Surg 2017;53:238-54.
7. Volpi S, Doenz F, Qanadli SD. Superior vena cava (SVC) endovascular reconstruction with implanted central venous catheter repositioning for treatment of malignant SVC obstruction. Front Surg 2018;5:4.

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