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Original Article

Endovascular stenting for end-stage lung cancer patients with superior vena cava syndrome post first-line treatments − A single-center experience and literature review

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Abstract

Background: Superior vena cava (SVC) syndrome is a major complication that occurs when a growing lung malignancy compresses the SVC extrinsically. Current treatment options include radiotherapy or chemotherapy to shrink the tumor or endovascular stenting of the SVC to restore flow. Herein, we report a case series treated in a single institution to demonstrate the safety, effectiveness, and outcomes of salvage and primary stenting for malignant SVC obstruction.
Methods: A total of 12 male patients with malignant superior vena cava obstruction caused by lung cancer underwent SVC stenting from October 2009 to May 2015. Data were reviewed retrospectively, including demographic and clinical characteristics, procedural details, and outcomes.
Results: Seven patients had received radiotherapy prior to SVC stenting, while the other five patients received stenting as first-line therapy for SVC syndrome. Only one patient experienced initial symptomatic improvement after radiotherapy, and symptoms of SVC syndrome recurred one year later. Wallstents® (Boston Scientific, Natick MA, USA) were used in all patients. Preoperatively, the mean narrowest SVC diameter measured by CT was 2.16 mm (0−5.5 mm). Technical success was achieved in all patients without complications such as pulmonary embolism, rupture or bleeding. Postoperative mean narrowest SVC diameter measured by CT during follow-up was 11.17 mm (8−13.5 mm). Symptoms of SVC syndrome such as arm and face swelling and dyspnea improved within 1−5 days in all patients. After median follow-up duration of 11.5 months, only one patient presented recurrent SVC syndrome due to in-stent thrombosis two months after stenting.
Conclusion: Salvage SVC stenting remains a safe and effective treatment for patients with SVC obstruction after failure of radiotherapy and chemotherapy. Primary stenting may be considered at initial presentation of SVC syndrome to improve patients' quality of life.

Keywords: Lung neoplasm; Stent; Superior vena cava syndrome

1. Introduction

Superior vena cava (SVC) syndrome comprises a group of signs and symptoms secondary to SVC obstruction. Obstruction occurs when venous return from the SVC to the right atrium is compromised, mostly by a growing malignancy compressing the SVC extrinsically.[1−5] In the absence of adequate collaterals, the resulting elevated venous pressure in the upper body leads to edema of the head, neck, and upper extremities. Rarely, swelling of the larynx may cause life-threatening airway obstruction and cerebral edema, which can result in confusion and coma. While treatment of underlying malignant disease is paramount, it may be slow to alleviate the patient's discomfort. In some radiosensitive malignancies, radiotherapy may effectively reduce

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symptoms by reducing the tumor size,[3,6] but this process can take weeks to months and has a higher recurrence rate. The increasing technical and clinical success rate of SVC stenting makes it another option for salvage therapy after conventional radiochemotherapy has failed. In fact, Ganeshan et al. suggested that primary SVC stenting should be the first-line treatment to relieve the symptoms of SVC syndrome.[4] The aim of the present study was to review our SVC stenting experience retrospectively in order to validate the safety, effectiveness, and outcomes of salvage and primary stenting for malignant SVC obstruction.

2. Methods

2.1. Patients

The data of 12 patients with clinical symptoms of SVC obstruction who underwent SVC stenting in Taipei Veterans General Hospital between October 2009 and May 2015 were reviewed retrospectively, including chart review of indications, clinical characteristics, procedures, complications, and outcomes (Table 1). The Institutional Review Board of Taipei Veterans General Hospital approved the study protocol, and patients' informed consent was waived due to the retrospective nature of the study. All included patients had SVC syndrome caused by lung cancer, including adenocarcinoma, large cell carcinoma and small cell carcinoma. All the patients experienced swelling over their faces, neck and arms, which limited their range of motion and caused distended discomfort or even pain. Except for one patient who received chemotherapy during the month prior to SVC stenting, all other patients had received chemotherapy for at least two months prior to SVC stenting. Seven patients had received radiotherapy targeting the lesion adjacent to the SVC. Only one patient experienced symptom improvement after radiotherapy; however, symptoms of SVC syndrome recurred in that patient one year later and were not resolved by the second radiotherapy. All patients received chest CT scan follow-up at 3 months, 6 months and then yearly after the procedure.

Table 1
Patients' demographic and clinical characteristics.

Characteristic	Value
Age (years)	58.4 (37–76)
Gender	
Male	12
Female	0
Cause of superior vena cava syndrome	
Adenocarcinoma	6
Squamous cell carcinoma	1
Large cell carcinoma	2
Small cell lung cancer	3
Previous treatment	
Radiotherapy	7
Chemotherapy	12
Duration of superior vena cava syndrome since diagnosis (months)	20.3 (1–53)
Stenosis site	
SVC	10
SVC + Right internal jugular vein	1
SVC + Right internal jugular vein + Innominate vein	1
Thrombosis	5
Previous port-A insertion	2

2.2. Methods

Interventions were performed using local anesthesia in nine patients and general anesthesia in three patients. Right femoral venous access was used in 11 patients (Table 2). Each patient received 3000 IU heparin bolus prior to the procedure. After cavography was performed and the route was confirmed (Fig. 1A), a 0.035-in 180-cm Terumo wire (Radifocus®, Terumo, Tokyo, Japan) under support of a Glide catheter (Glidecath®, Terumo, Tokyo, Japan) was used to traverse the stenosis to the right internal jugular vein (RIJV) or right subclavian vein. Five patients had thrombosis within the SVC, and three with extensive thrombus burden needed thrombolytic therapy with urokinase 120,000 IU injections locally in the SVC. A 0.018-in guidewire was needed in an occasional patient with severely stenotic lesions. After crossing the lesion, the hydrophilic wire was replaced with Amplatz Super Stiff ™ Guidewire (Boston Scientific, Boston, MA, USA). Predilatation of SVC was usually not necessary unless the SVC was chronically occluded. In this case series, only three patients needed predilatation of SVC with a 10-mm-in-diameter balloon (Fig. 1B). Once the lesion was confirmed, the diameter of the proximal and distal end of the lesion was measured over the relatively healthy site. A Wallstent™ (Boston Scientific, Boston, MA, USA) was deployed across the lesion. Additional stents were used in cases in which a single stent could not safely bridge the lesion. The XXL™ balloon dilatation catheter (Boston Scientific, Boston, MA,

Table 2
Treatment characteristics of 12 patients receiving SVC stenting.

Procedure and outcomes	
Approach site	
Right internal jugular vein	1
Right common femoral vein	11
Anesthesia	
General anesthesia	3
Local anesthesia	9
Pre-dilatation	3
Post-dilatation	12
Thrombolytic therapy with urokinase	3
Number of stents	
1	9
2	2
3	1
Postoperative anti-thrombosis therapy	
Warfarin	2
Clopidogrel	10
Follow-up (months)	11.5 (0.3–17)
Symptoms relieved	12
6-Month primary patency rate	91.67%
6-Month secondary patency rate	100%
Pre-stenting SVC narrowest diameter (mm)	2.16 (0–5.5)
Post-stenting SVC narrowest diameter (mm)	11.17 (8–13.5)
Stent thrombosis	2
Total	1
Partial	1