Malignant obstruction of superior vena cava: Endovascular stenting using Y-configuration stent in stent technique

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SUMMARY

Malignant intrathoracic disease is the commonest cause of superior vena cava (SVC) obstruction. Life threatening SVC obstruction with intense dyspnoea requires urgent treatment. SVC stenting has been developed in recent years which results in rapid relief of the obstruction. The Y-configuration technique has been reported to provide support for all three limbs of the bifurcation to prevent restenosis. At present, there are limited reports on the use of Y-configuration stent in stent techniques for endovascular stenting in malignant SVC obstruction. We share our clinical experience of two patients who received balloon-mounted stents using this technique.

INTRODUCTION

Malignant intrathoracic disease is the commonest cause of superior vena cava (SVC) obstruction.[1] Obstruction is mostly due to compression or invasion of the SVC and/or brachiocephalic veins by the tumour itself or malignant lymph nodes. Life threatening SVC obstruction with intense dyspnoea requires urgent intervention.

Recent developments have enabled stenting of the SVC, resulting in the rapid relief of SVC obstruction. Treatment of bifurcation stenosis using metallic stents with various deployment techniques have been described, with the Y-configuration technique reported as being able to provide complete support of all three limbs of the bifurcation to prevent restenosis.[2]

There are limited reports on the use of Y-configuration endovascular stent in stent technique in malignant SVC obstruction. We report our experience with two patients who received balloon-mounted stents using this technique.

CASE STUDY

Case 1

A 48-year-old woman with a history of cervical carcinoma with lung metastases, who had completed her treatment, presented with a chronic cough and difficulty in breathing for three days associated with swelling of her upper chest and arms. Dilated veins were seen at the neck and upper chest regions.

A computed tomography (CT) of the thorax was done showing mediastinal nodal metastases causing compression of the trachea, right main bronchus, bilateral brachiocephalic veins and SVC. The right lung had collapsed, and a large right pleural effusion was seen. A right pleural drainage was subsequently performed.

Her bilateral upper-extremity venograms revealed a complete occlusion of distal left brachiocephalic vein, severe stenoses of distal right brachiocephalic vein and proximal SVC, with presence of collateral veins (Figure 1). As such, endovascular stenting was done to relieve the symptoms. After dilatation of both brachiocephalic veins and SVC using a 10-mm ultra non-compliant balloon (Conquest, Bard Peripheral Vascular, Inc., United States of America) was performed, balloon-mounted stents (9 x 59mm and 8 x 79mm) (Genesis, Cordis Corporation, United States of America) were then deployed into the right and left brachiocephalic veins respectively with distal end of the stents in the distal SVC via the stent in stent approach, conforming to a Y-shaped stent. Post stent deployment showed recanalisation of both brachiocephalic veins and SVC with good blood flow into the right atrium. The collaterals were no longer visualised. An intra-procedural bolus dose of intravenous heparin and a loading dose of aspirin were given. The patient was then maintained on low dose aspirin. Her chest and arms swelling decreased dramatically. She was later discharged well, with further follow-up revealing no recurrent symptoms.

Case 2

A 57-year-old man, with a history of right lung adenocarcinoma with nodal metastases, on treatment, presented with neck swelling for one week and progressive difficulty in breathing. Dilated veins were seen at his neck and upper chest regions. A CT of the thorax and abdomen was done demonstrating matted lymph nodes in the right supraclavicular and paratracheal regions encasing the SVC, causing narrowing of both brachiocephalic veins. Multiple collateral veins were seen in the mediastinum. The primary lung lesion was essentially unchanged from a previous scan. New metastatic deposits were seen in the liver and pancreas.

Complete occlusion of the SVC and both distal brachiocephalic veins with collateral veins were seen on bilateral upper-extremity venograms (Figure 2). Similar to case 1,

This article was accepted: 27 January 2018
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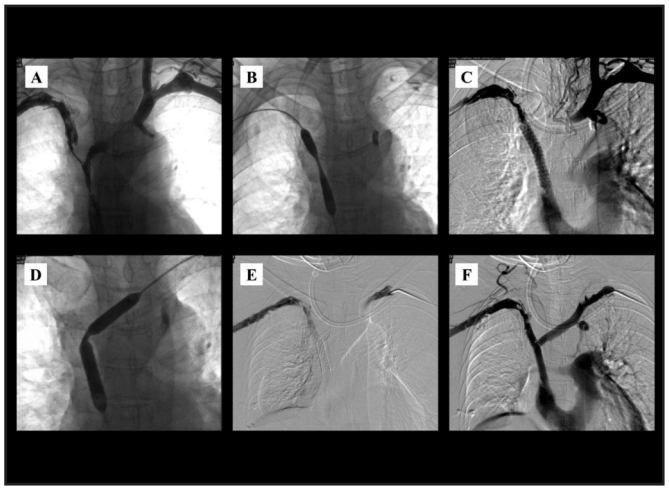

Fig. 1: **A** Bilateral upper-extremity diagnostic digital subtraction venograms (Case 1) showed complete occlusion of distal left brachiocephalic vein, severe stenoses of distal right brachiocephalic vein and proximal SVC, with collateral vessels seen. Prior CT scan of the thorax showed compression of these vessels by metastatic lymph nodes.
B A 0.035" Terumo J curved guide wire which was loaded in a 5 Fr Bern catheter was advanced through the right brachiocephalic vein and SVC into the right atrium via right basilic vein access. After the wire successfully crossed the stenotic lesion, the Terumo wire was exchanged with a 0.035" Bentson wire to provide better support. Subsequently, balloon angioplasty was performed to the right brachiocephalic vein extending into distal SVC. The 'dog bone' effect was seen at nominal pressure inflation due to significant stenosis.
C Balloon-mounted stent was inserted and positioned in the right brachiocephalic vein extending to SVC. The stent was eventually deployed and post-dilated at nominal pressure with a good result obtained.
D Similar steps were repeated on the opposite side via left basilic vein access. The guide wire managed to cross the left brachiocephalic stenosis and was later negotiated through the first stent struts into the SVC. Balloon angioplasty was performed on the left brachiocephalic vein and SVC as well as creating fenestration on the first stent.
E The second balloon-mounted stent was inserted via the stent in stent approach, conforming to a Y-shaped stent.
F Post stent deployment showing recanalisation of both brachiocephalic veins and SVC with good blood flow into the right atrium. The collaterals were no longer visualised fluoroscopically.

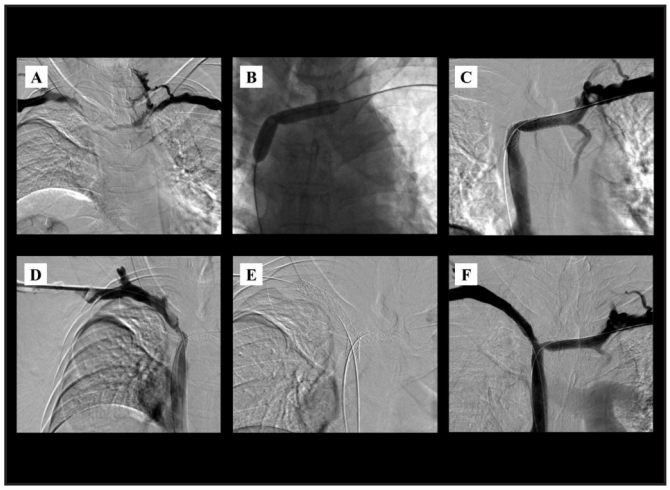

Fig. 2: **A** Bilateral upper-extremity diagnostic venograms (Case 2) revealing complete occlusion of the SVC and both distal brachiocephalic veins with collateral vessels seen. Prior CT scan of the thorax showed compression of these vessels by metastatic lymph nodes.
B A 0.035" Terumo J curved guide wire which was loaded in a 5 Fr Bern catheter was advanced through the left brachiocephalic vein and SVC into the right atrium via left basilic vein access. After the wire successfully crossed the stenotic lesion, the Terumo wire was exchanged with a 0.035" Bentson wire to provide better support. Subsequently, balloon angioplasty was performed to the left brachiocephalic vein extending into proximal SVC. The balloon was then inflated at nominal pressure to achieve optimal result.
C Balloon-mounted stent was inserted and positioned in the left brachiocephalic vein extending to SVC. The stent was eventually deployed and post-dilated at nominal pressure with recanalisation of the left brachiocephalic vein and SVC seen.
D Similar steps were repeated on the opposite side via right basilic vein access. The guide wire managed to cross the right brachiocephalic stenosis and was later negotiated through the first stent struts into the SVC. Balloon angioplasty was performed on the right brachiocephalic vein and SVC as well as creating fenestration on the first stent.
E Balloon-mounted stent was inserted in the right brachiocephalic vein into the proximal SVC via the stent in stent approach, conforming to a Y-shaped stent.
F Post stent deployment showing significant improvement in the lumen of both brachiocephalic veins and SVC with good blood flow into the right atrium.

a Y-configuration endovascular stent in stent technique was performed involving both brachiocephalic veins with distal end of the stents in the proximal SVC. There were significant improvements in the lumen of both brachiocephalic veins and SVC. His neck swelling subsided over a few days, with relief of his symptoms. He was discharged well, with no documented recurrent symptoms during his follow-up. However, the patient passed away two months later due to disease progression.

DISCUSSION

Alternative methods of relieving obstruction such as transluminal balloon angioplasty and endovascular stenting, although technically challenging, have become important options in the treatment of SVC obstruction in both malignant and benign conditions, offering significant improvement and relief of symptoms.[3] There have been several reports on the feasibility of Y-configuration stenting in treating bifurcation stenosis.[2] A fenestrated deployment configuration is done to avoid obstructing the vessel branches. The entire bifurcation is supported to minimise prolapse, and the size of each arm of the stent is tailored to anatomical requirements.

The double-barrel configuration of 'kissing' stents causing overdilatation of the venous wall is thus avoided.

In our cases, the creation of a Y-shaped stent using the stent in stent technique for the treatment of bifurcation stenosis involves deployment of a stent from the brachiocephalic vein into the SVC and obstructing the opposite brachiocephalic vein. Via the opposite brachiocephalic vein, the hydrophilic Terumo guide wire and catheter are navigated into the distal of the first deployed stent via the stent struts. Following this, a second balloon-mounted stent is then navigated through the first stent struts with the distal end of the second stent lying within the distal end of the first deployed stent within the SVC, creating a stent in stent formation. Subsequently, the second balloon-mounted stent is inflated slowly, creating a large fenestration within the first stent. This iatrogenic fenestration allows communication between both brachiocephalic veins. The Y-configuration technique has a higher radial force, allowing better fixation of both stents, longer patency periods and recanalisation of SVC and both brachiocephalic veins. This result can potentially be optimised by performing an additional post-dilatation with a 'kissing balloon' technique in order to create a second fenestration in the second stent as well as to optimise the neo-carina of the bifurcation.

The application of covered versus non-covered stents have been described previously and recent evidence has suggested superior cumulative patency with the use of covered stents after 12 months in malignant SVC obstruction in comparison with bare metal stents.[4] Nevertheless, covered stents should be used with caution due to concerns of stent migration and when covering important venous pathways or collaterals.

Studies have shown that endovascular stenting allows rapid restoration of normal pattern of flow with majority showing resolution of symptoms.[5] Both our patients experienced immediate relief of venous congestion. Despite known procedural risks, this immediate decompression procedure markedly alleviates patients' symptoms and improves their quality of life although with short life expectancy.

CONCLUSION

It is our belief that Y-configuration stenting is a feasible technique to treat true bifurcation stenosis in the context of malignant SVC obstruction as this confers the additional advantage of preserving both brachiocephalic veins. This markedly improves drainage of the upper extremities to the right heart and subsequently the SVC syndrome.

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