Left brachiocephalic vein–right atrial bypass in superior vena cava syndrome

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Abstract
Superior vena cava syndrome (SVCS) is a condition with total or partial stenosis in the superior vena cava (SVC) as a result of intrathoracic malignancies or microtrauma caused by central venous catheterisation. Various invasive and surgical interventions are performed to provide venous drainage in these patients whose head and neck venous blood flow is impaired. In this case report, we report on a bypass performed with a synthetic graft between the left brachiocephalic vein and the right atrium in a patient with SVCS.

Keywords: superior vena cava obstruction, brachiocephalic vein, bypass

Case report
The patient, who was on a haemodialysis programme due to chronic renal failure at the age of 58 years, was admitted to our department with symptoms of swelling in the neck and face, with shortness of breath. The patient had a history of coronary artery bypass surgery eight years earlier. On physical examination, there was oedema in the face and increased venous collateral circulation in the neck. Total occlusion and fibrosis in the superior vena cava (SVC) were determined in thorax computed tomographic (CT) angiography (Fig. 1). The right and left brachiocephalic veins were patent on CT.

A median sternotomy was performed, followed by the SVC being investigated by lysing the adhesions. In the exploration, the SVC was found to be highly fibrotic. The left brachiocephalic vein was prepared. After heparinisation, an 8-mm ring-reinforced polytetrafluoroethylene (PTFE) graft was first anastomosed to the right atrial appendage with 5/0 prolene sutures (Fig. 2A). By adjusting the length of the graft, the proximal end was anastomosed to the left brachiocephalic vein with 5/0 prolene sutures and the bypass was completed (Fig. 2B).

While the venous pressure measurement taken from the brachiocephalic vein before the bypass was 22 mmHg, following the bypass the measurements were 8 mmHg. The sternotomy was closed and the patient was taken to the intensive care unit. Low molecular-weight heparin was started when the risk of surgical bleeding disappeared in the sixth hour following surgery.

On the second postoperative day, oral anticoagulation (warfarin) was started. The patient did not develop any postoperative complications. It was observed that the oedema of the face regressed and shortness of breath started decreasing, beginning from the first postoperative day. Doppler ultrasonography performed on the third postoperative day revealed that the graft was patent and the patient was discharged. Based on the venography performed on the patient, the graft was patent in the third postoperative month (Fig. 3).
Discussion

In SVCS, which was first described in 1757 by William Hunter in a patient with aortic aneurysm, the aetiology is 80–90% intrathoracic or metastatic malignancies, with 20% from benign causes.1-3,6 The main cause in benign aetiology is intimal hyperplasia and fibrosis, which is the result of long-term microtrauma of venous catheters (haemodialysis catheter, port catheter and central venous catheter).4-6

The main condition with SVCS is restriction of the head, neck, upper extremity and thorax venous blood in the right atrial drainage.4 Venous pressure increases in the upper limb, head and neck. Cerebral venous pressure can increase to 20–50 mmHg in these patients.7 The patient may present with symptoms such as oedema, shortness of breath, headache, dizziness and fainting.4 The diagnosis of SVCS can be made by CT angiography, magnetic resonance angiography or upper extremity venography.

Our patient presented with symptoms of shortness of breath. Since haemodialysis is performed from the patient’s right brachiocephalic fistula, it is possible that the increased venous blood flow, especially during haemodialysis, increased the existing dyspnoea. In addition, the patient had undergone haemodialysis via a permanent haemodialysis catheter for a long period of time, which may have been the underlying aetiology of fibrosis and occlusion in the SVC.

The treatment options in SVCS depend on the prognosis of the underlying malignancy and its treatment. Medical treatment, chemotherapy, radiotherapy, endovascular stent and surgical intervention are the alternative treatment options to reduce oedema in the head and neck.

Endovascular intervention, thrombo-endarterectomy, patch plasty, resection and reconstruction of the SVC or bypass from the upper venous system to the right atrium are surgical techniques that have been commonly used.4-6 Successful endovascular interventions with balloon angioplasty and stent have been reported, especially in partial stenosis.4 Saphenous vein, pericardium or synthetic material (PTFE) are frequently used in patch plasty.7 Autologous pericardium, spiral saphenous vein graft, vascular homograft obtained from cadaver, or synthetic PTFE are the most frequently used grafts in resection and reconstruction.4,5,6 The purpose of resection and reconstruction is to create a new SVC.

Veno-atrial bypasses, in which venous drainage is redirected to the right atrium, are frequently performed between the right jugular vein or brachiocephalic vein and the right atrium. For this purpose, ring-reinforced PTFE grafts are the preferred grafts because they are easy to obtain and resistant to compression.

The most important challenge of reconstructive surgery, compared to veno-atrial bypass surgery, is clamping of the SVC during the procedure. Especially in cases where collateral flow is insufficient, clamping the SVC for more than 30–35 minutes may cause postoperative neurological problems and systemic hypotension during surgery due to impaired cerebral venous return.7 In veno-atrial bypasses, since there is no SVC clamping, the risk of postoperative cerebral oedema and neurological complications are eliminated.

In our case, the SVC was completely occluded and the patient had severe fibrosis. In addition, there was an advanced degree of adhesion to the mediastinum due to cardiac surgery the patient had undergone. SVC reconstruction using a pericardial graft was not performed for these two reasons. Resistance of the ring-reinforced PTFE graft to compression was also an advantage. We did not encounter neurological complications or peri-operative
hypotension since there was no SVC clamping during surgery. We observed a significant decrease in the upper hemithorax venous pressure and a significant improvement in the patient’s symptoms in the peri-operative period. These findings indicate that an effective surgical intervention was carried out.

**Conclusion**

A left brachiocephalic vein–right atrial bypass using a synthetic graft may be an alternative and preferable surgical method in complicated cases with total occlusion in the SVC and severe mediastinal adhesion due to previous cardiac surgery.

**References**