

Reconstruction Using a Pericardial Tube and Ringed Gore-Tex Graft for Malignant Superior Vena Cava Syndrome: Report of Two Cases

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Superior vena cava (SVC) syndrome caused by malignant tumors in the upper mediastinum is not uncommon. Radiation therapy or endovascular treatment with stenting is the first choice of treatment to relieve symptoms. However, surgical treatment may be considered when the less invasive treatment modalities failed. In this report, we present two cases of severe symptomatic SVC syndrome as a result of invasive thymomas, which were treated successfully using a composite graft made by pericardial tube and ringed polytetrafluorethylene (PTFE) graft. Symptoms soon subsided after operation. The patients were symptom free at 8 months and 24 months after the surgical management, respectively. In this report, we also reviewed reports in the literature relating to the surgical management in SVC syndrome. Based on our limited experience in these cases, we think that bypass with pericardial tube could be an effective palliative treatment technique offering durable clinical symptom relief for SVC symptoms caused by malignant tumors in certain cases. (*Chang Gung Med J* 2004;27:222-7)

Key words: superior vena cava syndrome, pericardial tube, invasive thymoma.

Superior vena cava (SVC) syndrome is caused by primary bronchial carcinomas or malignant tumors in the upper mediastinum in more than 90% of patients.⁽¹⁾ The remaining 5% to 10% of cases have benign causes, such as aneurysms of the aortic arch, constrictive pericarditis, mediastinal fibrosis, sarcoidosis, or retrosternal goiter. With the increasing use of central venous catheters, upper extremity central venous obstruction occurs more frequently. Acute obstruction of the SVC is considered a surgical emergency, with a potentially fatal outcome resulting from cerebral edema with cerebellar herniation. However, the slow development of SVC obstruction can be asymptomatic since collateral vessels establish with time. At the present time,

symptomatic SVC obstruction resulting from malignant disease is preferably treated with endovascular stenting when possible. Surgical treatment for SVC syndrome had been limited to the cases with benign etiology only.

Various grafts have been used for surgical reconstruction for patients with SVC syndrome. All of the cases reported in the literature were on the management of SVC syndrome caused by benign lesions. Ring-supported Polytetrafluorethylene (PTFE) grafts, Dacron grafts, and autogenous grafts such as spiral vein grafts were reported in the literature. Most surgeons favor the use of autogenous graft for the SVC bypass because of the better long-term patency of vein graft over the synthetic graft in

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low-pressure venous circulation. In this report, we present two cases of invasive thymoma treated successfully with a pericardial tube bypass graft. We also examined the advantages of this procedure and reviewed the related reports in the literature.

CASE REPORT

Case 1

A 73-year-old man presented with a puffy face and progressive swelling of the neck and arms for 3 months. Chest x-ray examination revealed multiple nodules on the right upper lung, hyperinflation with chronic infiltration and old calcified TB lesions on the bilateral upper lung fields. Computed tomography (CT) of the chest showed multiple nodules in the anterior and right upper mediastinum, with SVC compression (Fig. 1). Bronchial washing cytology for malignancy was negative. A CT-guided biopsy was attempted twice without success. Malignant lung cancer with SVC syndrome was suggested. Antegrade venogram examination was arranged and revealed total occlusion of the SVC at the confluence of the brachiocephalic veins and SVC. The right internal jugular vein was not filled up, and neck veins were engorged with many collaterals leading to

the azygos vein and paravertebral plexus (Fig. 2). It was thought that the venous return from the upper neck might have to be diverted to the inferior vena cava (IVC) via non-opacified collateral veins. An endovascular stent for SVC syndrome was attempted but failed. The patient was severely symptomatic from the SVC obstruction. Palliative surgery for SVC syndrome relief was therefore performed under general anesthesia. Surgical approach was through the median sternotomy; a single lumen endotracheal tube (7 mm in diameter) was used. The invasive thymoma, which was confirmed using results of an intra-operative biopsy, had encased the SVC at its origin, from the right atrium. Venous pressure measured preoperatively from the left brachiocephalic vein was 36 mmHg. The pericardium was harvested between the left and right pleura above the bilateral phrenic nerves. Wrapping the harvested pericardium around a 32 Fr chest tube created a pericardial tube graft. The visceral surface was oriented to the inner side. The pericardial tube was shaped and subsequently sewn end-to-side to the innominate vein. The proximal end of this graft was anastomosed to the superior aspect of the right atrial appendage.⁽¹⁾ Simultaneously, an 8-mm ringed PTFE graft was used to construct a Y-shape composite graft. The

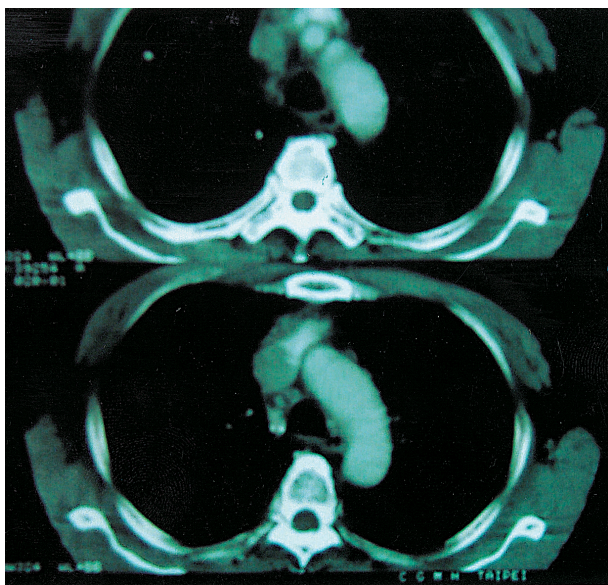


Fig. 1 CT scan disclosing superior vena cava syndrome caused by mediastinal mass compression and encasement.

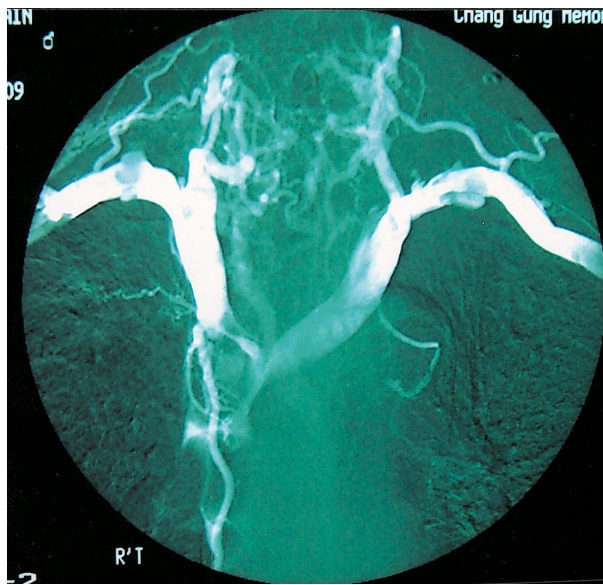


Fig. 2 Venography showed total occlusion of the SVC at the confluence of the brachiocephalic veins and SVC.

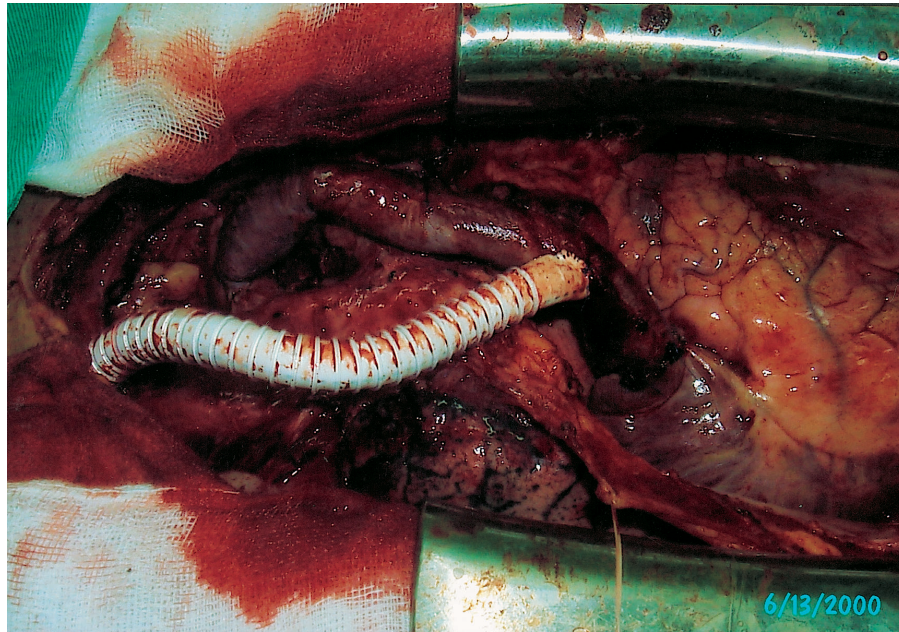


Fig. 3 Operative figure shows a composite Y-graft, comprised of a pericardial tube and a ringed PTFE graft, draining the bilateral venous return to the right atrium

proximal end of the PTFE graft was sewn end-to-side to the pericardial tube and the distal end was anastomosed to the right subclavian vein, explored via the subclavian deltoid-pectoris major fossa (Fig. 3). After reestablishment of blood flow through the bypass graft, the central venous pressure in the left brachiocephalic vein and right subclavian vein fell to 28 mmHg. The postoperative course was uneventful. The patient was extubated 14 hours after the operation and discharged 12 days after the operation with warfarin prescribed. There was no SVC syndrome recurrence during the 32 months of follow up.

Case 2

A 39-year-old woman was admitted with the problem of chest discomfort, dyspnea, and severe facial swelling for weeks. Chest radiography revealed a right side mediastinal mass. The patient had experienced palpitations, heat intolerance, insomnia, and body weight loss recently. Computed tomography of the chest revealed a large soft tissue mass approximately 12×7×5 cm in the right upper lobe and right middle lobe, with evidence of mediastinal invasion to adjacent pleural cavity. Direct

invasion to the SVC of the tumor had caused SVC syndrome with the presentation of a puffy face and edematous neck and arms. The CT-guided biopsy revealed a malignant thymoma. An operation was performed for her intractable symptoms. The surgical approach was through the median sternotomy. Maximal debulking of the mediastinal mass was followed by SVC bypass procedure. The pericardium was harvested and wrapped as a bypass tubal graft from the innominate vein to the right atrium. A 6-mm ringed PTFE graft was used for the right subclavian vein to the pericardial tube bypass to aid with right side venous return. Preoperative venous pressure, which was greater than 30 mmHg immediately, fell to 16 mmHg after the venous bypass procedure. Symptoms and signs of SVC syndrome disappeared on the second postoperative day. The patient was discharged 1 month after the operation and was followed up for more than 8 months without recurrence of symptoms.

DISCUSSION

The most frequent symptoms and signs caused by SVC obstruction include cough, headache, nau-

sea, dyspnea, tongue swelling, facial swelling, and dyspnea.⁽²⁾ Stridor, hoarseness, and respiratory distress are also not uncommon presentations. Among the etiologies of non-malignant occlusion of SVC, mediastinal fibrosis and indwelling catheters (Hickman catheter, pacemaker wire, central line) are the common causes. In addition, malignant tumor invasion, compression, or thrombosis cause SVC syndrome in most of the patients.

Although endovascular techniques are the preferred method for relieving SVC syndrome,⁽³⁻⁵⁾ percutaneous stent placement is not technically suitable for all patients with SVC occlusion. An endovascular stent was attempted but failed in the first patient in this report. Other researchers revealed that stents could be performed in Alimi classification types I and II SVC obstruction successfully.⁽⁶⁾ The two patients reported here were both with Alimi type IV SVC obstruction, therefore, the percutaneous stent method would have failed.⁽⁶⁾ Although an endovascular stent can provide successful short-term palliation for malignant SVC syndrome patients, the price of the stent is so high that it may not be cost-effective for patients in Taiwan. Surgical bypass may be the rational solution for these patients.

Computed tomographic scanning is the first step in the diagnosis of SVC syndrome as it easily shows the site and degree of SVC compression as well as the presence of any mediastinal or intrathoracic mass. Bilateral arm contrast venography is, however, the best preoperative procedure for determining the level and degree of SVC obstruction. Available data did not support the use of routine venography in all patients, but venography could show the location and degree of obstruction or stenosis.⁽⁷⁾ Thus allowing for the surgical procedure to be best planned in advance.

Available surgical methods include spiral saphenous vein grafting^(8,9) and superficial femoral-popliteal vein grafting.⁽¹⁰⁾ The pericardial tube method⁽¹⁾ has been used in our surgical team since 2000 to treat symptomatic SVC syndrome patients. The autogenous bypass graft in low pressure system is better than synthetic grafts, such as the PTFE graft or the Dacron graft, in long-term patency. In addition, among the autogenous grafts, the pericardial tube is an alternative to the spiral vein graft. Spiral saphenous vein grafting has the disadvantages of a long vein harvesting time, a long suture line, difficul-

ty in making the spiral graft, and a long operation time. The pericardium has been used to treat various congenital heart diseases. The advantages of the pericardial tube method over the spiral vein graft include a shorter graft preparation time, creation of a groin wound is unnecessary, and ease of the tubular graft creation. In the Alimi type IV SVC⁽⁶⁾ obstruction, the length of the pericardium might be insufficient to create a Y-shaped tubular graft, so a PTFE graft segment was needed for complete venous return decompress. Surgical bypass can be easily performed in reconstructions of a conduit for SVC obstruction, using a composite pericardial tubular graft. The technique is feasible and easy to perform, and has the potential for a long-term high patency rate.

The grafts of the two patients herein remained patent after a mid-term follow-up of 8 months and 30 months, respectively. In conclusion, the pericardial tube graft combined with the PTFE graft can be used for obstructed SVC in patients with malignant tumor invasion. The technique is feasible and easy to perform. This method may have a better long-term patency than the PTFE graft alone and it is easier to perform than the venous spiral graft procedure.

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心包膜管及環狀人工血管在惡性上腔靜脈症候群應用： 二例報告

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上腔靜脈症候群常由上中縱隔腔惡性腫瘤造成。經皮置放的上腔靜脈支架是主要的治療方式，然而並非所有的病人都可以用支架治療。我們報告兩位惡性上腔靜脈症候群病人用心包膜管及環狀人工血管方法成功治療的經驗。兩位病人的臨床症狀包括漸漸式，臉部、頸部及雙手腫脹，一位病人曾經嘗試支架治療三次但是都失敗。於是轉到外科用心包膜管及環狀人工血管並用手術法處理。另一位病人則來不及做支架治療就發生了嚴重的急性症狀，這位病人在手術當中也同時用心包膜管及環狀人工血管並用手術法處理。兩位病人胸部電腦斷層在前縱膈腔的部分，可見明顯腫瘤，此腫瘤完全圍繞上腔靜脈，第一位病人靜脈攝影顯式上腔靜脈因腫脹而完全阻塞。患者在接受手術後，其症狀有明顯改善。我們回顧文獻，關於用心包膜管及環狀人工血管並用手術法的病例很少。我們認為，經由審慎的判斷及評估，此手術對於在惡性上腔靜脈症候群的治療是一項有效的選擇。(長庚醫誌 2004;27:222-7)

關鍵字：上腔靜脈症候群，心包膜管，侵犯性胸腺瘤。