

Surgical Treatment of Benign Superior Vena Cava Syndrome



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The obstruction of blood flow through the superior vena cava (SVC) into the right atrium may present as a severe clinical syndrome. One of the benign causes of SVC obstruction is the long-term use of indwelling catheters and wires, increasing the chances of SVC thrombosis. The treatment of the benign SVC syndrome is focused on achieving long-term durability and patency of the superior venocaval system and normal

life expectancy. We report the successful surgical management of a patient with severe symptomatic SVC syndrome and emphasize technical details that might be of value in treating this challenging pathologic condition.

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In 90% of cases, the SVC syndrome is caused by extrinsic compression from an intrathoracic cancer (malignant cause) [1]. Benign causes (10%) can result in extrinsic vascular compression secondary to mediastinitis, benign tumor, or intrinsic obstruction from thrombosis caused by long-term indwelling catheters in patients receiving hemodialysis or wires in patients with endocardial pacemakers [2]. Patients who have no improvement of symptoms with first-line medical and interventional therapy frequently require elective surgical treatment.

Technique

The patient is a 44-year-old man with a history of chronic renal failure and subsequent kidney transplantation. The patient had multiple central venous catheters placed in the neck and upper extremity for hemodialysis before transplantation and gradually experienced stenosis of the left innominate vein. He had been treated previously with multiple percutaneous balloon angioplasties and intravascular stenting of the innominate vein, with resolution of edema. He received a kidney transplant in 2009 and has not required any vascular intervention since then. In the past 10 months, he gradually experienced swelling of the veins of the upper extremities and neck (Fig 1A). Ultrasonographic imaging of the neck showed jugular vein dilatation with thrombotic occlusion (Fig 2A). Venography showed occlusion of the junction of the innominate veins, the right axillary vein, and the SVC, including the azygos vein (Fig 2B). A percutaneous

angioplasty and stent recanalization attempt at an outside hospital failed. He was referred to our institution for surgical treatment. A median sternotomy was performed followed by extensive dissection of the right atrium, SVC, and ascending aorta secondary to severe uremic pericarditis. Occlusion of the innominate vein was confirmed, and the incision was extended for 4 cm from the sternal notch onto the right side of the neck (reversed L shape) (Fig 3A). The patient underwent systemic heparinization before the application of a partially occluding clamp on the right internal jugular vein. Venotomy was performed and an end-to-side anastomosis was carried out with a beveled 10-mm ring Gore-Tex (W. L. Gore and Associates, Flagstaff, AZ) graft using 4-0 Prolene (Ethicon, Somerville, NJ) suture. Patency was ensured and the distance to the right atrium was measured and the graft cut to length. The right atrial appendage was clamped and transected, and an end-to-end anastomosis was fashioned with 4-0 Prolene. Removal of air from the graft was then undertaken and the clamp was released (Fig 3B). On release of the clamp, the venous pressure dropped precipitously from 28 to 16 mm Hg. The venous engorgement began to improve almost immediately. The patient was transferred to the intensive care unit in stable condition and had an uneventful remainder of his hospital stay. Anticoagulation was initiated with warfarin and titrated to therapeutic levels secondary to use of the Gore-Tex graft. On the day of his discharge, his neck swelling had significantly resolved (Fig 1B). After 6 months of follow-up, the patient has complete relief of symptoms and has not experienced any recurrent upper extremity or neck swelling (Fig 1C).

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Comment

Endovascular treatment (EVT) of a patient with benign SVC syndrome is emerging as first-line treatment;



Fig 1. (A) Preoperatively, patient presented with palpable left jugular vein distention with dilatation and tortuosity of veins of upper body. (B) Postoperatively, patient experienced relief of symptoms and regression of upper body swelling. (C) After 6 months, left jugular vein distention had disappeared.

surgical treatment is an excellent solution in patients not suitable for EVT or in whom EVT fails [3]. Complications after EVT have been reported in 3% to 7% of patients with SVC syndrome and include occlusion, infection, pulmonary embolus, stent migration, hematoma at the insertion site, bleeding and, very rarely, perforation [4]. Various bypass techniques for the SVC obstruction have been reported in recent years and describe different surgical incisions, sites of anastomoses, and types of grafts used. The surgical access route should be selected to optimize dissection around critical obstruction to visualize the proximal and distal sites when performing the anastomoses. In a series of 38 patients, median sternotomy was used in 71%, followed by thoracotomy in 18%, clamshell incision in 8%, and trapdoor incision (hemi-clamshell) in 3% [5]. Other incisions are sternotomy with elongated cervical incision (reversed L shape), reported here, or double access with sternotomy and right-sided neck incision [4]. The site and type of anastomosis are based on the site of the obstruction and the cause of the SVC syndrome. Operations to remove thrombus are not suggested because of the high risk of relapse and embolization. In benign conditions, the SVC is rarely resected, and reconstruction is typically performed using bypass with an end-to-side anastomosis.

In most cases of benign causes, a single graft achieves adequate intracranial venous drainage because of the extensive intracranial sinus venous connections. The ideal graft or conduit, or both, should maintain long-term flow patency with a nonthrombotic surface and durability to resist external compressions. Use of various conduits have been reported in the past, including autografts, homografts, and grafts made from synthetic materials, but there is lack of consensus about the superiority of 1 type of graft over the others. The spiral saphenous vein, superficial femoral vein, and autologous pericardial tube are the most commonly used autograft solutions [2, 6, 7]. Kalra and associates [2] presented a series of 32 patients showing superior long-term patency of spiral saphenous vein grafts compared with bifurcated vein and polytetrafluoroethylene (PTFE) grafts. Synthetic grafts are an attractive option because of the variety of sizes and easy availability for off-the-shelf use. The rationale behind using the ring Gore-Tex graft in this immunosuppressed patient was to avoid extrinsic compression of the graft between the clavicle bone and the thrombosed jugular vein and the unavailability of good-quality saphenous veins (varicose) because of long-term hemodialysis. At 1 year, the patency of PTFE bypass grafts placed for benign SVC syndrome was 100% and for



Fig 2. Ultrasonographic imaging of venous system in neck confirms (A) jugular vein dilatation and (B) thrombosis. (Asterisk indicates thrombosis in jugular vein.) (C) Contrast venography shows type IV complete obstruction of superior vena cava and major caval tributaries including the azygos system. Previous multiple stents are completely occluded with no venographic opacification. (CA = carotid artery; RIV = right innominate vein.)

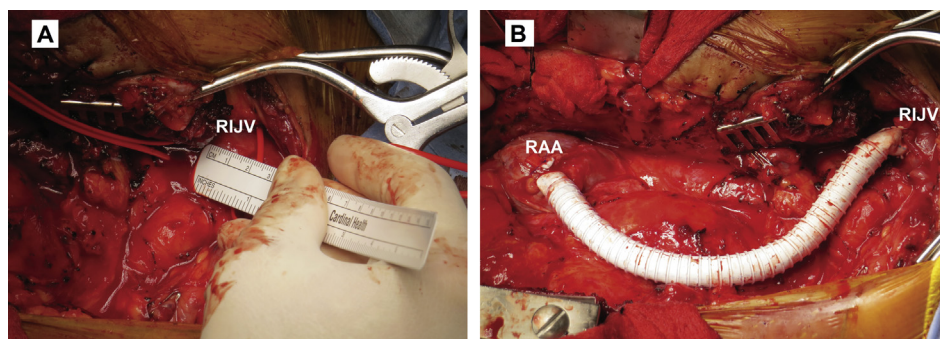


Fig 3. (A) Intraoperatively, right internal jugular vein was measured as being 2 cm in diameter. (B) Bypass with 10-mm ring polytetrafluoroethylene was performed from right internal jugular vein (RIJV) to right atrial appendage (RAA).

malignant causes, it was reported to be 95% (with externally stented PTFE grafts) [3, 5]. The use of polyester grafts is another proposed solution for synthetic material [4]. Because there is no randomized clinical study to identify the best surgical conduit, the choice is still based on surgeon and institutional experience and observational study.

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