SBRT requires a comprehensive evaluation, including an assessment of the clinical course. Furthermore, we suggest evaluating SUV on FDG-PET images for late recurrence suspected from CT images after SBRT.

References

Simple Technique for Reconstruction of Superior Vena Cava and Brachiocephalic Vein After Removal for Thoracic Malignancies
Mitsunori Ohta, MD, PhD, Eiji Okura, MD, PhD, Eriko Fukui, MD, Naoto Kitahara, MD, and Yoshihisa Kadota, MD, PhD
Department of General Thoracic Surgery, Osaka Prefectural Medical Center for Respiratory and Allergic Disease, Osaka, Japan

A ringed polytetrafluoroethylene graft was applied to reduce clamping time for a patent major vein. In case 1, after suturing the ringed graft to the right appendage, the other end was inserted in the distal direction of the left brachiocephalic vein and secured by ligation. In case 2, to repair an extensive superior vena cava defect, the graft was wrapped with the remnant venous wall and fixed with a continuous suture. Only 5 minutes were required to reconstruct the left brachiocephalic vein and 20 minutes for the superior vena cava. Long-term graft patency was obtained without thrombosis.

Case Reports

Case 1
CLINICAL SUMMARY. A 57-year-old man with facial edema was diagnosed with lung adenocarcinoma of the right lung and clinically staged as T4 N0 M0. The tumor was thought to involve the anterior apical chest wall and the right brachiocephalic vein, which was completely occluded (Fig 1). The patient refused preoperative chemotherapy and requested surgical resection of the tumor as initial treatment.

OPERATION. A right hemi-clamshell thoracotomy was performed through the fourth intercostal space. The tumor was completely excised from the chest wall, but the right brachiocephalic vein could not be replaced with a vascular graft because of a short distal margin and the tumor, which involved the junction of the left brachiocephalic vein (Fig 2A).

After systemic heparinization, a 10-mm ringed polytetrafluoroethylene graft (Gore-Tex vascular graft; W.L. Gore & Assoc, Flagstaff, AZ) was sutured to the right appendage, then two clamps were placed on the left brachiocephalic vein as far distally and proximally as possible (Fig 2A). A transverse venotomy was made around the midpoint of the clamped brachiocephalic vein for approximately half of its circumference to form an anastomosis orifice. Next, the other end of the ringed graft was inserted into the orifice in a distal direction so as to be wrapped in the brachiocephalic vein and then secured using a 2-0 Prolene suture (Ethicon, Somerville, NJ). After the left brachiocephalic vein was completely divided, seven stitches were added using CV-5 sutures (Gore-Tex suture; W.L. Gore & Assoc) at the end of the brachiocephalic vein (Fig 2B). When the clamps were opened, pressure in the left jugular vein decreased from 24 to 9 mm Hg. The total clamping time was about 5 minutes.

The right upper lobectomy was completed, followed by resection of the mediastinal lymph nodes and SVC, and plication of the right diaphragm. Anticoagulation therapy was administered for 6 months after the operation.

Operative and pathologic staging was T4 N1 M0. After the operation, the patient agreed to chemotherapy. In contrast-enhanced computed tomography findings obtained at 2 years after the operation, the graft was patent and there was no cancer recurrence.

Case 2
CLINICAL SUMMARY. A 44-year-old man experienced elevation of the right diaphragm caused by an anterior mediastinal tumor, and thoracoscopic examination findings led to a diagnosis of squamous cell carcinoma of the
thymus. Because of possible tumor invasion to the bilateral brachiocephalic veins and SVC, chemotherapy was performed. Venous return by these vessels was not disturbed by the tumor. After chemotherapy, partial remission was achieved.

OPERATION. We performed a median sternotomy, which revealed a tumor involving the right upper lobe, pericardium, and anterior wall of the SVC. After systemic heparinization, reconstruction of the left brachiocephalic vein was done with a 12-mm ringed graft in the same manner as in case 1. After clamping the right brachiocephalic vein and SVC, the tumor was completely removed along with the affected part of the right upper lobe, pericardium, and anterior half wall of the SVC, which was approximately 3 cm in length. A 12-mm ringed graft cut to a length of 5 cm was entirely inserted into the SVC through the anterior defect. Next, the edge of the SVC and side wall of the graft were continuously sutured so as to wrap the graft tightly with the remnant SVC wall using CV-5 sutures. Approximately 20 minutes was required to complete reconstruction of the SVC. Finally, plication of the diaphragm was performed.

Pathologic findings revealed that cancer had invaded the pericardial space and extended to the proximal edge of the SVC; thus chemoradiotherapy was subsequently performed, along with anticoagulation therapy. One year after the operation, contrast-enhanced computed tomography showed that the bilateral grafts were patent, and there was no tumor recurrence.

Comment
Although resection and graft replacement for the SVC or brachiocephalic vein in patients with thoracic malignancy is technically demanding, those were...
performed in the selected patients, and the long-term graft patency rates have been encouraging at more than 70% [1, 3]. However, cross-clamping of a patent SVC may produce cerebral venous hypertension and edema, as well as hemodynamic instability [4]. To avoid such complications, temporary shunting or a permanent graft bypass between the left brachiocephalic vein and right appendage is generally used.

In most cases, temporary shunting is performed by inserting a vinyl chloride tube into the left brachiocephalic vein and right atrial appendage, followed by use of a Rummel tourniquet or pursestring sutures to secure them [2]. Thus, the cross-clamp time is minimal. On the other hand, a permanent graft bypass requires approximately 40 minutes to restore venous return [3, 5].

In the present cases, we set up permanent graft shunting using a polytetrafluoroethylene graft with retention rings, which enable a simple procedure to secure the graft, similar to a tourniquet technique. This procedure required only a short cross-clamp time, such as with a temporary bypass method. In case 1, the right brachiocephalic vein was obstructed by the tumor; thus the cross-clamp time of the left brachiocephalic vein should be reduced as much as possible. We could restore venous return within 5 minutes using the insert and secure procedure as described above. In case 2, after the venous return through the left brachiocephalic vein was established as in case 1, we applied an intraluminal shunting procedure to repair the SVC instead of an end-to-end anastomosis. We wrapped the ringed graft with the remnant wall of the SVC and fixed it with a single continuous suture. Therefore, approximately 20 minutes were needed to reconstruct the SVC in this patient. In both cases, all three grafts were patent at more than 1 year after the operation.

We conducted a literature search for reports of SVC reconstruction after these operations and noted an outline for a similar method presented in 1991 [6]. However, no precise report of the procedure could be found. In the present two cases, the reinforced expandability of the ringed polytetrafluoroethylene grafts safely enabled reductions in clamping time for the SVC and brachiocephalic vein, with long-term graft patency.

References