

Banked Vena Caval Homograft Replacement of the Inferior Vena Cava for Primary Leiomyosarcoma

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Primary leiomyosarcoma of the inferior vena cava (IVC) is a rare malignant tumor. Herein, we report the case of a 52-year-old male patient who had postprandial abdominal distension and right upper quadrant abdominal pain. The abdominal computed tomography (CT) angiogram showed an IVC mass extending from the infrahepatic to the suprarenal inferior vena cava. The radiologic findings were suggestive of an IVC leiomyosarcoma. Surgical resection and reconstruction with a cryopreserved homograft were performed. The follow-up abdominal CT angiogram revealed the patient to be disease-free 6 months after surgery with patency of the IVC and renal vein.

Key words: 1. Homograft
2. Sarcoma
3. Surgical operation

CASE REPORT

A 52-year-old man who had postprandial abdominal distension and right upper quadrant abdominal pain visited the gastroenterology department. He had liver cirrhosis caused by hepatitis B virus. On the abdominal computed tomography (CT) angiogram, a 4.5×2.8 cm heterogeneous enhancing mass with intraluminal obstruction was observed in the infrahepatic and the suprarenal inferior vena cava (IVC) (Fig. 1). An F-18 fluorodeoxyglucose positron emission tomography-CT scan did not show distant metastases.

In an operation via inverted L-shaped incision laparotomy, the right hepatic lobe was dissected for IVC mobilization and was rotated and elevated to the left side. Retrohepatic IVC was fully dissected to secure sufficient space for a proximal clamp and venous cannulation. To prevent venous hyper-

tension during tumor removal and vascular reconstruction, a veno-venous bypass was performed via the left femoral vein to the proximal retrohepatic IVC by using a centrifugal bio-pump (Medtronic Biomedicus Inc., Minneapolis, MN, USA). After the proximal and distal clamp, the tumor and the involved IVC were completely removed from the infrahepatic IVC to just above the right renal vein. The left renal vein ostium was also resected because of tumor involvement. A frozen section showed that all resection margins were cleared. The tumor characteristics were as follows: a hard yellowish lobulating mass with extraluminal extension (Fig. 2B). However, tumor invasion into the perivascular tissue was not observed. The vascular defect was reconstructed with a banked cryopreserved vena caval homograft. The graft was obtained from a cadaveric multi-organ 51-year-old male donor, deceased because of intracerebral hemorrhage with brain-

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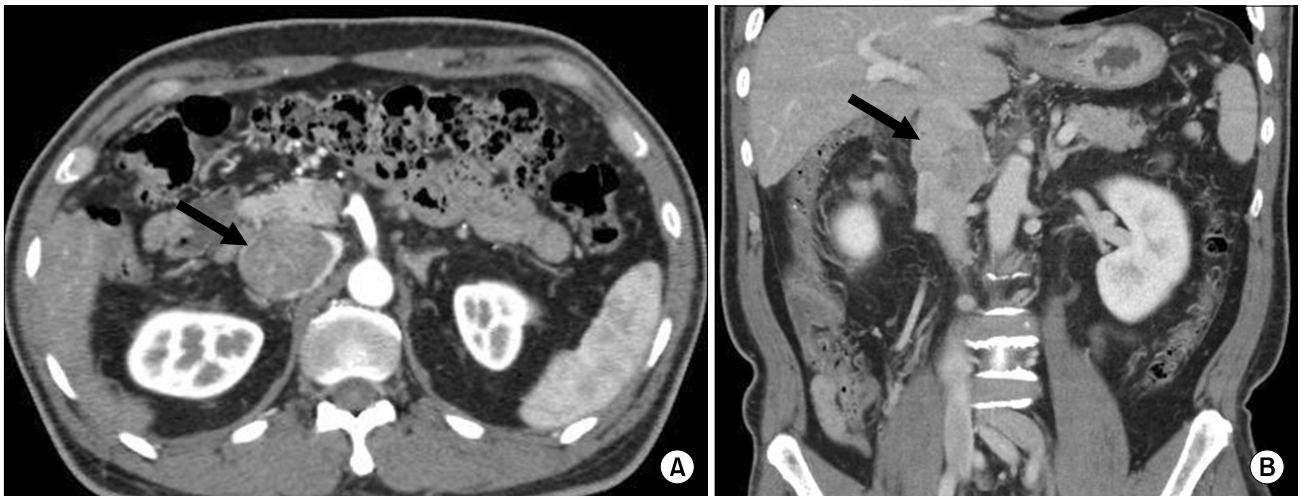


Fig. 1. Preoperative computed tomography shows a mass in the inferior vena cava. (A) Axial view. (B) Coronal view.

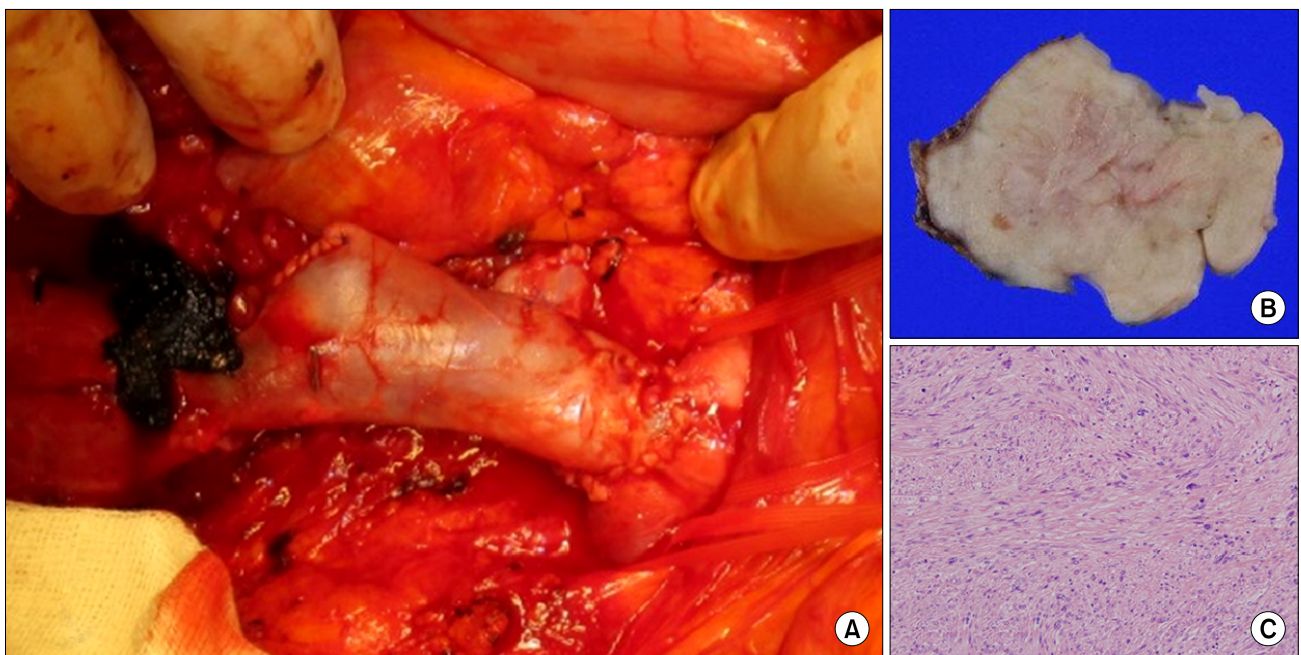


Fig. 2. (A) Intra-operative findings: final result of inferior vena cava replacement. (B) The cut surface of the tumor reveals homogenous grayish white appearance. (C) Microscopic finding shows spindle cells with some mitosis (H&E, $\times 200$).

stem edema that had occurred 3 years before. It consisted of a 70-mm-long distal IVC with both common iliac veins, and the diameters of the proximal and the distal ends were 19 mm and 14 mm, respectively. After the distal and proximal anastomoses were performed with single, end-to-end continuous sutures between the native IVC and the homograft, the resected proximal portion of the left renal vein was re-

constructed with the interposition of the short segment (length: 1 cm) of the iliac vein homograft (Fig. 2A).

The patient was discharged on postoperative day 10 with normal kidney function and without the clinical signs of graft obstruction or infection. A postoperative CT angiogram showed a patent IVC and left renal vein homograft (Fig. 3). Oral anticoagulation therapy with warfarin was maintained for



Fig. 3. Postoperative computed tomography. (A) Axial view. (B) Coronal view.

3 months after surgery (target international normalized ratio, 1.5 to 2.0). Postoperative adjuvant therapies including chemotherapy and/or radiation therapy were not performed according to the oncologist's recommendation in our center because the benefit from adjuvant therapy in patients who underwent curative resection (R0 resection) has not been clearly reported.

Pathology confirmed a grade II leiomyosarcoma, having a maximum diameter of 5 cm, arising from the IVC wall. The surgical resection margins were microscopically clear (Fig. 2C). Our patient showed 6 months of disease-free survival without graft complications after surgery, and good patency of the reconstructed IVC and the renal vein homograft.

DISCUSSION

Primary leiomyosarcoma of the IVC is a rare malignant tumor (2% of all leiomyosarcomas) but can be a fatal disease [1]. The 5- and 10-year malignancy-free survival rates after a wide surgical resection by using the Mingoli register were 31.4% and 7.4%, respectively [2]. The clinical diagnosis is usually delayed because the malignancy is often asymptomatic until an advanced stage, and the manifestations are variable and nonspecific [3]. Clinical symptoms vary depending on the size and location of the tumor. Abdominal pain is a frequent presenting symptom, and edema of the lower ex-

tremities, Budd-Chiari syndrome, and intracardiac extension are possible. The preoperative diagnostic modalities included an abdominal ultrasound, a CT angiogram, and magnetic resonance imaging. On the basis of the findings of these examinations, tumor involvement was classified into three groups according to the level in the IVC: segment I, infrarenal; segment II, inter- and supra-renal up to but not including the main suprahepatic veins; and segment III, suprahepatic with possible intracardiac extension [4]. In our case, a CT angiogram was used for the diagnosis, and the extent of the tumor showed segment II involvement (infrahepatic to suprarenal IVC).

Survival of the patients with IVC leiomyosarcoma depends on curative tumor resection, its anatomic site, histological grade, invasion of the adjacent structures, and histologic subtype [3]. It has been observed that en bloc surgical resection with negative margins of more than 1 cm is the only treatment that improves survival [3,5]. However, surgical procedures can be complex due to the tumor involvement in the renal vein confluence and at the retrohepatic location. Therefore, nephrectomy, kidney auto-transplantation, or re-attachment of the tumor-free renal vein stump to the reconstructed IVC is often required for complete tumor resection. Moreover, the use of cardiopulmonary bypass or total circulatory arrest with deep hypothermia under median sternotomy is necessary in patients with a high level of retro-

hepatic IVC or segment III tumor involvement. In the present case, the proximal portion of the left renal vein was resected due to the tumor involvement, and then, the short segment of the homograft interposition between the reconstructed IVC homograft and the tumor-free renal vein stump was performed. Furthermore, we only used the veno-venous bypass by using a centrifugal biopump under partial heparinization without the additional incision for total cardiopulmonary bypass.

The efficacy of adjuvant therapy such as chemotherapy or radiation therapy for primary leiomyosarcoma of IVC has not been established yet because of the insufficient response [1,5]. Therefore, there have been several previous reports that the adjuvant chemo-radiotherapy might not have any benefits in patients with complete tumor resection [2,4,6]. We consulted a chemo-oncologist and a radiation oncologist about the adjuvant therapy after discharge, but they did not recommend either chemotherapy or radiotherapy to our patient because of the lack of evidence and the toxicity to other major organs.

Usually, when the IVC needs to be replaced, reinforced polytetrafluoroethylene (PTFE) prosthetic grafts of various sizes have been commonly used [4,7]. However, the limits of this well-established graft are mainly the risk of prosthetic graft occlusion and/or infection [7]. Therefore, creation of an arteriovenous fistula and long-term anticoagulation therapy are often recommended to ensure graft patency [4,7].

A banked venous homograft can be an alternative option. It has been used for limb salvage surgery or peripheral vein resection in sarcomas of the extremities as a bypass graft and for neo-aortic reconstruction [7]. However, few reports on the restoration of caval continuity have been published; specifically, only two previous cases have been reported in which a banked venous homograft was used for the reconstruction of a resected IVC [3,7]. Vena caval replacement with a homograft has several advantages when compared to replacement with PTFE grafts. Cross-sectional luminal narrowing in PTFE grafts, ranging from 16% to 40%, has been reported during follow-up. However, the venous homograft showed a relatively mild degree of graft stenosis and lower rates of luminal narrowing, ranging from 2% to 9%. These findings may be associated with the lack of immune response to the ve-

nous homograft. Several studies have shown that the homograft has virtually no cellular or humoral immune responses because the homograft was repopulated by endothelial lining of the recipient, and a subendothelial region recellularized by myofibroblasts [3]. Furthermore, the slow progression of luminal obstruction by the adaptive remodeling process in the homograft may provide more time for the collateral vessels to develop [7,8]. Therefore, the need for anticoagulation therapy after surgery might be mitigated. Graft availability is the only limiting factor of the use of a homograft.

In our case, we planned the reconstruction of the IVC with a 19-mm reinforced PTFE prosthetic graft first, but grafts of this size are not available nowadays in Korea. For this reason, we changed our graft strategy to the cryopreserved homograft (Cell and Gene Biotechnology Co. Ltd., Seoul, Korea), and an adequate size of the vena caval homograft could be donated free of charge. This is the first reported case in Korea in which the circumferential resection of the primary IVC leiomyosarcoma has been replaced by a banked vena caval homograft. Our patient showed good clinical outcomes including 6 months of disease-free survival, and the patency of the reconstructed IVC and the renal vein homograft was also maintained until now without graft complications. Long-term follow-up is necessary to verify the graft patency.

In this report, the feasibility and safety of the cryopreserved vena caval homograft replacement is documented. Therefore, it can be considered a good alternative graft to the reconstruction of IVC in the case of a rare primary leiomyosarcoma.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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