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Application of Biological Vascular Grafts in Inferior Vena Cava Reconstruction for Primary Malignant Tumors

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INTRODUCTION

Primary malignant tumors of the large blood vessels are extremely rare. This is supported by available literature, which consists mainly of individual case reports and small retrospective studies. Among malignant vascular neoplasms, venous sarcomas are more commonly observed. The prevalence of primary leiomyosarcoma of the inferior vena cava (IVC) is approximately 1 in 100,000 individuals. To date, around 450 cases have been recorded in the International Registry of Leiomyosarcomas of the IVC, representing no more than 0.5% of all surgically treated soft tissue leiomyosarcomas. Epithelioid hemangioendothelioma (EHE) of the IVC is even rarer, with a prevalence of less than 1 in 1,000,000. Only six confirmed cases have been reported in the international literature.

AIM

To analyze the immediate and long-term outcomes of surgical treatment in patients with primary tumors of the inferior vena cava.

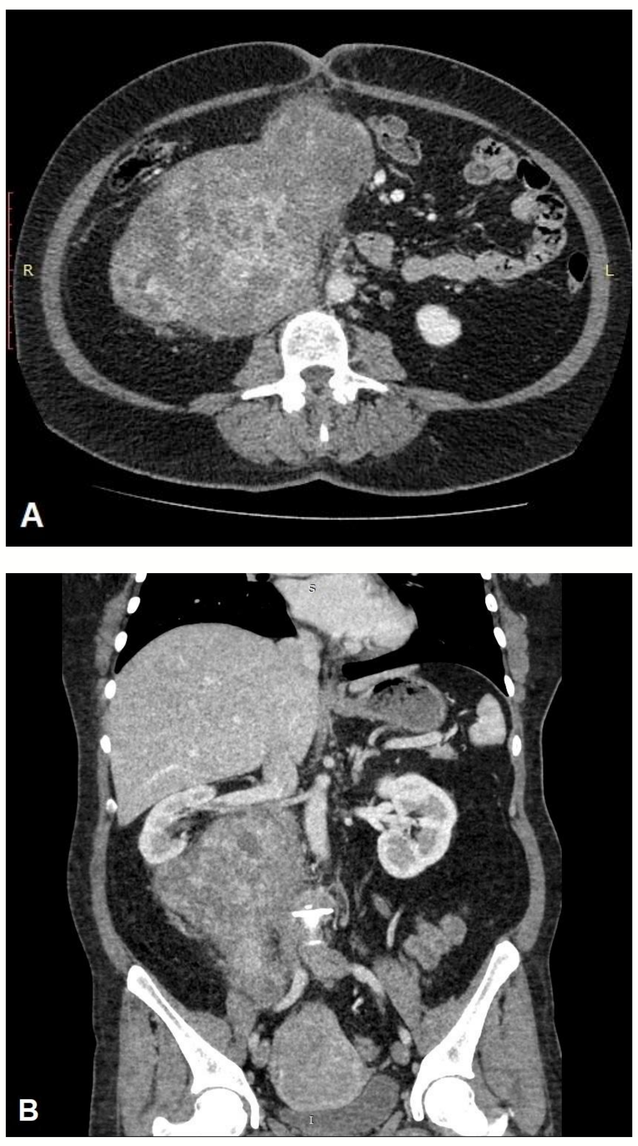

Fig.1. Multispiral computed tomography of the abdominal organs shows a tumor in segments I and II of the inferior vena cava, infiltrating the right renal vein, renal artery, and renal capsule.

METHODS

Between 2019 and 2025, seven patients with primary malignant tumors of the inferior vena cava underwent surgical treatment. The average age of the patients was 54.3 ± 8.7 years. Female patients predominated, with a ratio of 6:1. Among the total cohort, six patients (85.7 %) were diagnosed with primary leiomyosarcoma, while one patient (14.3 %) had epithelioid hemangioendothelioma. Preoperative percutaneous biopsy was performed in 57.1 % of cases. Tumor visualization was achieved using ultrasound duplex scanning, multislice computed tomography angiography, and magnetic resonance angiography. To confirm and refine the diagnosis, preoperative biopsy was conducted under ultrasound guidance. A comprehensive diagnostic workup was used to determine the localization and extent of the pathological process in the IVC, as well as the presence of regional and distant metastases. The extent of planned resection and vascular reconstruction was assessed preoperatively and finalized intraoperatively. In all cases, vascular resection with surrounding tissues was performed with tumor-free margins (R0 resection).

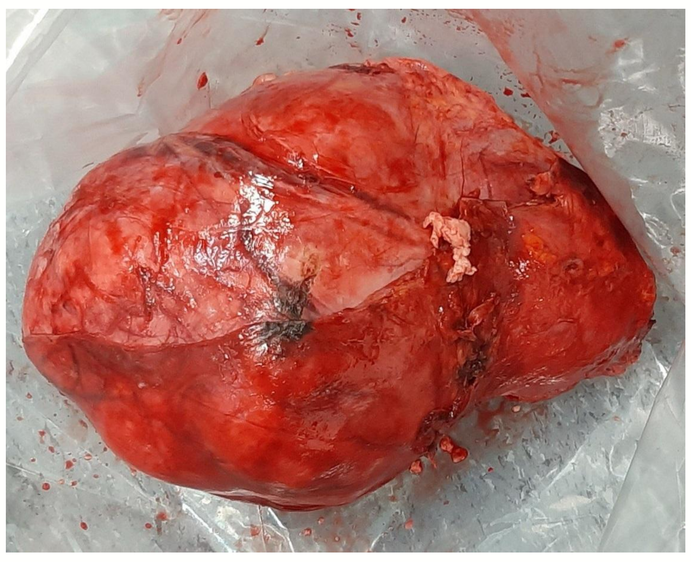

Fig.2. Macro-preparation of the removed primary IVC tumor.

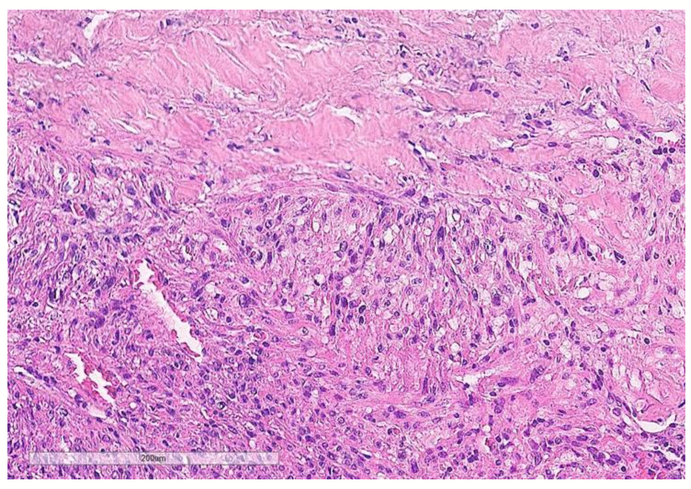

Fig.3. The tumor consists of spindle-shaped cells forming long and short bundles oriented in different directions. Hematoxylin-eosin stain, ×10 magnification.

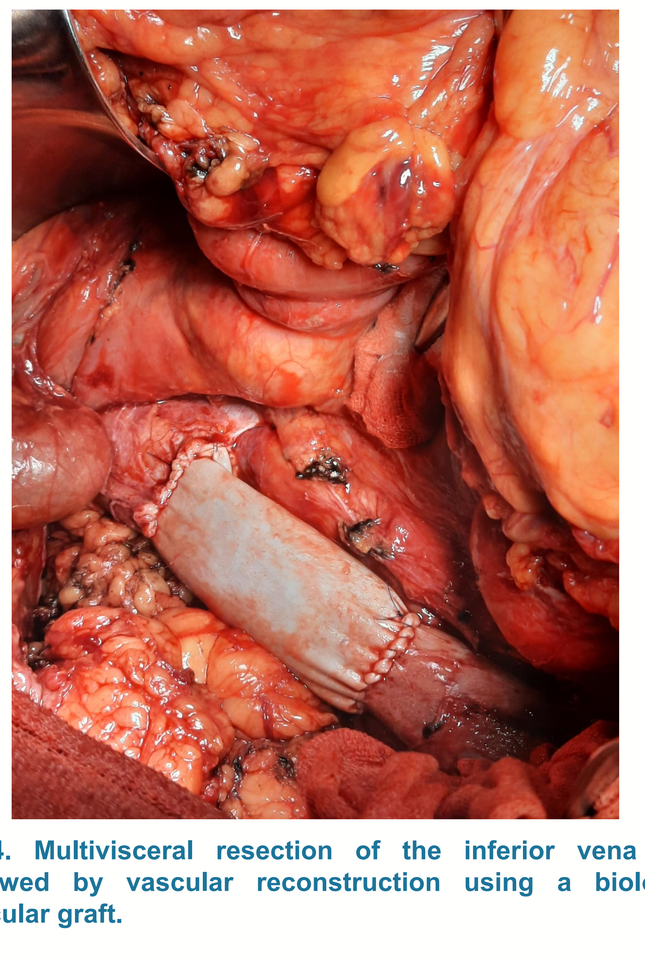

Fig.4. Multivisceral resection of the inferior vena cava followed by vascular reconstruction using a biological vascular graft.

RESULTS

All patients underwent radical surgical treatment. Reconstructive procedures included extended circular resections of the inferior vena cava ranging from 6 to 15 cm in length, performed in five patients. The resected segments were replaced using linear biological vascular grafts constructed from xenopericardial tissue. In three cases (42.8 %), combined resection of the IVC with right-sided nephroadrenalectomy was required. In two cases (28.6 %), the left renal vein (LRV) was implanted into an end-to-side biological vascular graft. In one case (14.3 %), circular resection and reconstruction of both the inferior vena cava and the right renal vein were performed while preserving the right kidney. Parallel artificial blood circulation was employed in three cases (42.8 %). Postoperatively, all patients received anticoagulant therapy. During the first seven days, calcium nadroparin (3800 IU, 0.4 ml) was administered twice daily, followed by rivaroxaban (20 mg once daily) for a minimum of six months. Two patients required reoperation due to retroperitoneal hematoma and bleeding. There was no mortality among the operated patients during either the early or long-term postoperative periods. The average follow-up duration was 38.4 months (range: 2–78 months). No local recurrence was observed throughout the follow-up period. Adjuvant chemotherapy was prescribed for three patients. One patient experienced disease progression, with pulmonary metastases appearing at six months and hepatic metastases at 25 months. This patient underwent videothoracoscopic atypical resection of the S6 segment of the right lung and received adjuvant chemotherapy.

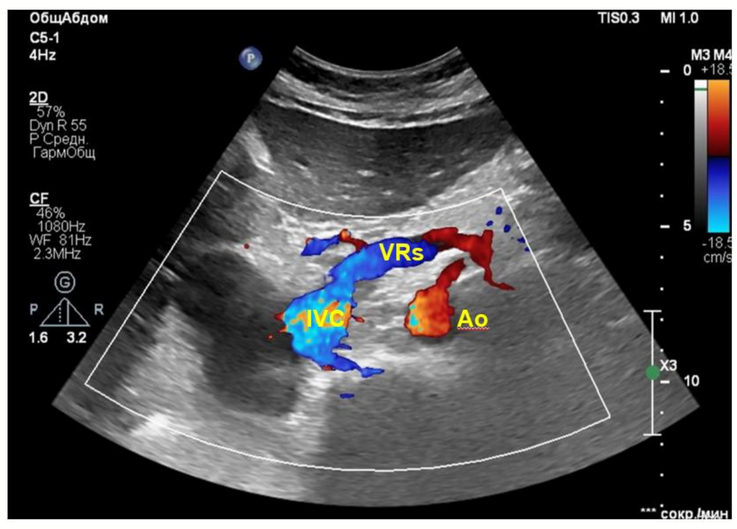

Fig.5. Follow-up imaging of the inferior vena cava and biological vascular graft 12 months post-surgery.

CONCLUSIONS

The treatment of patients with primary malignant vascular tumors of inferior vena cava is a difficult task from the moment of detection to follow-up. Performing combined and sometimes multivisceral resection and vascular reconstruction using a biological vascular graft is an effective and safe treatment method that increases the survival rate of this category of patients.

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