

Peritoneal Conduit for Superior Mesenteric Vein Injury During Colon Cancer Surgery for Krukenberg Tumor: A Case Report

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Abstract

Venous resection and reconstruction are typical during pancreaticoduodenectomy due to pancreatic adenocarcinoma. Multiple treatment options have been offered for venous injury repair. The present study used the peritoneum as a conduit for the superior mesenteric vein (SMV) reconstruction during colon cancer surgery. The case was a 55-year-old woman with colon adenocarcinoma. The SMV damage was six cm in length. The defect was replaced with a peritoneal conduit derived from the parietal peritoneum of the abdominal wall. Coalition and flow of the SMV were confirmed by contrast-enhanced computed tomography examinations. Peritoneal conduit may be a promising choice for SMV defects in emergent situations due to its availability and lower overall costs.

Keywords: Peritoneal conduit; Superior mesenteric vein; Colon cancer; Krukenberg tumor.

Introduction

Vascular reconstructions have been recognized in many venous injuries caused by cancer or trauma-related defects¹. In case of tumor invasion or adhesion, en bloc venous resection might be performed for completely extracting the tumor². Venous resection can be regarded as the most effective treatment during pancreaticoduodenectomy in malignant periampullary tumors³.

Venous can be repaired primarily by the end-to-end anastomosis or through synthetic grafts, autologous veins, and cryopreserved homologous vascular grafts used as interposition

grafts. Miscellaneous grafts include a saphenous vein, femoral vein, external iliac vein, left renal vein, parietal peritoneum, allogenic vein, and polytetrafluoroethylene (PTFE)^{2,3}. Selection of various options should be individualized considering the surgeons' experiences, accessible grafts, and patients' conditions². The present study reports a novel method through which conduit was derived from the parietal peritoneum of the abdominal wall.

Case Report

A 55-year-old woman with pelvic mass was referred to our center, Tehran, Iran. She had no ascites but had abdominal lumps, pain, and 10 kg weight loss over two months. Total abdominal hysterectomy and left salpingo-oophorectomy (TAH + LSO) had been performed 20 years ago due to a myomatous uterus and a left benign ovarian cyst.

When referring to the hospital, the reports of abdominal ultrasound indicated one 11×9 cm solid cystic mass in the right ovary with an increased vascular pattern detected using Doppler sonography that was confirmed by a computed tomography (CT) scan. In addition, a contrast-enhanced CT scan revealed a bulky para-aortic mass. In Positron Emission Tomography (PET) CT scan, a hypermetabolic mass with a diameter of 32×27 mm and SUV = 24 mm was found in the para-aortic region or renal veins. There was also a *Bowel Wall Thickening (BWT)* of the transverse colon adjacent to the mass. There was an ovarian mass with a diameter of 15 cm, SUV = 4/8, and mild ascites (Fig. 1).

Tumor markers included CEA = 220 ng/ml (NL < 5), CA 19-9 = 86 u/ml (NL < 37), and CA125 = 51 u/ml (NC < 35).

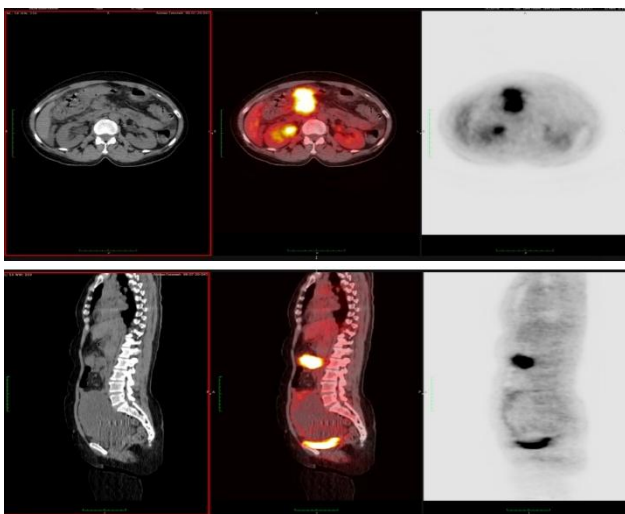


Figure 1: Ovarian mass and a large para-aortic mass

Upper gastrointestinal endoscopy and colonoscopy were performed. The patient had a normal upper endoscopy. Due to the partial obstruction of the transverse colon, it was not possible to perform a complete colonoscopy, and only a cold forceps biopsy of the obstruction site in the transverse colon was done. High-grade dysplasia was reported in pathology. Therefore, debulking surgery was planned due to the diagnosis of ovarian cancer.

The surgery started with a midline incision. Right salpingo-oophorectomy and transverse colectomy were performed. The report of the frozen section indicated a high-grade adenocarcinoma in both sides of the right ovary and colon (Figs. 2,3). This report was also confirmed by permanent pathology, and adenocarcinoma of both ovarian and transverse colon was positive for CK20 and CEA on IHC in the pathology report.

Despite the mass presence that was detected by the PET CT scan, no para-aortic mass was observed during the surgery, and it was the same transverse colon mass extended to the retroperitoneum. No distinct mass was detected in the para-aortic lymph nodes.

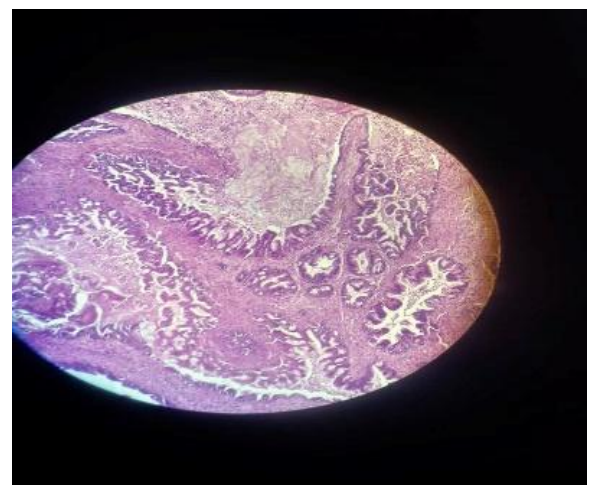


Figure 2: A high-grade adenocarcinoma in ovary

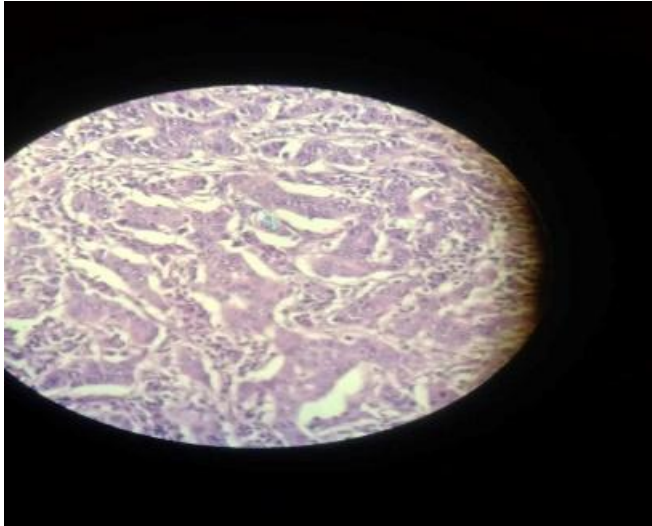


Figure 3: A high-grade adenocarcinoma in transvers colon

Unexpected small bowel congestion was observed due to SMV damage while we did not have active bleeding. The Superior Mesenteric Artery (SMA) was intact, and only the SMV was damaged simultaneously in removing the transverse colon mass. SMV damage with a length of 6 cm and a diameter of 18 mm was located at the base of SMV, juxtaposition to the neck of the pancreas. Therefore, a 5 × 15 cm section of the parietal peritoneum was removed from the left abdominal wall and used for repairing the damaged site. An inter-position graft as a conduit made from an 8 × 4 cm parietal peritoneum was rolled into a cylindrical shape over a suction tube with a running 6/0 polypropylene suture (Fig. 4). Ultimately, the peritoneal conduit was anastomosed to both stumps of the damaged site in an end-to-end fashion (Fig. 5). Synchronous anticoagulant therapy was started during the vessel reconstruction surgery. At first, 5000 units of heparin were injected intravenously. Then, 1000 units per hour were continued for 48 h. After that, 48h after the surgery, heparin along with Axabin was administered simultaneously for 48 hours. Subsequently, Axabin 20 mg was administered daily for three months. The beginning of the congestion to the end of the SMV repair lasted 2 hours.

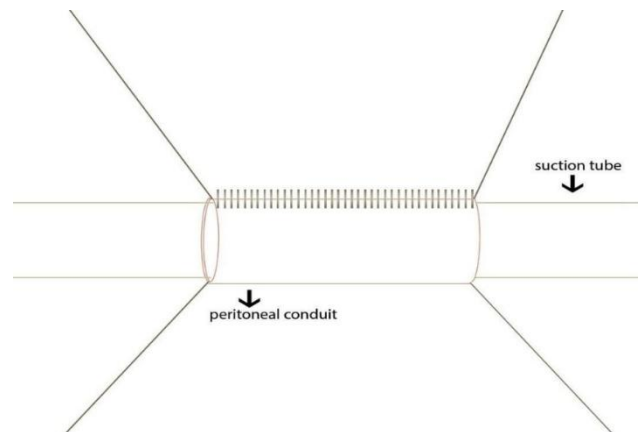


Figure 4: Peritoneal conduit.

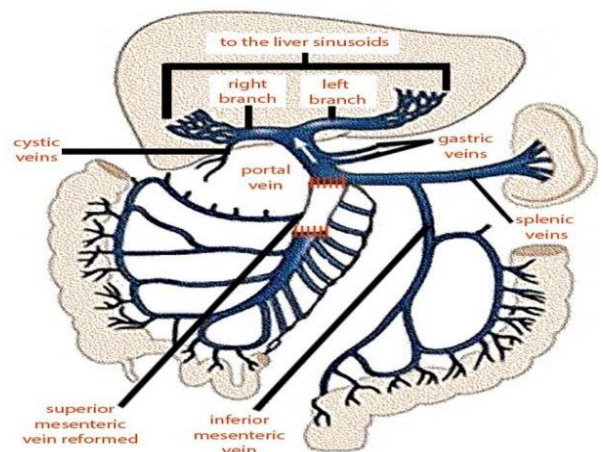


Figure 5: Reformation image of the superior mesenteric vein.

Blood flow into the conduit was without any leakage under direct vision during the surgery, and small bowel congestion was improved at once. Ultimately, the arrangement of colostomy was performed in the right colon. Conduit flow was good, and patency was observed in the Doppler ultrasound examination in the short-term follow-up after two weeks. Subsequently, the CT scan image indicated a narrow flow with normal SMV patency after three months (Fig. 6).



Figure 6: The image of the follow-up CT scan for SMV.

Discussion

Various conditions such as malignancy or trauma lead to a requirement for vascular repair. The surgeon should arrange a surgical plan considering multiple factors containing medical conditions besides institutional, patient-, and surgeon-related factors. Subsequently, the best decision for surgical planning should be made based on the advantages and disadvantages of the selected choices^{1,2}.

Restoring patency of SMV is a vital issue that can be achieved through an end-to-end anastomosis in most patients^{2,3}.

Various interposition grafts with their advantages and disadvantages are available. Autogenic vessels such as great saphenous veins can be too small in diameter and size for SMV flow drainage, especially in cancer cases. The femoral vein might lead to leg swelling after surgery. The internal jugular vein can be appropriate in terms of capacity, diameter, and length; however, donor-site morbidity resembles that of other allogenic vessels. However, autologous grafts might suffer endothelial dysfunction due to fibrosis, varicosity, and atherosclerosis^{1,2}. Previously, the right great saphenous vein might have been used occasionally in coronary bypass surgery. In addition, preparing autologous grafts may prolong the main surgery and lead to the morbidity of the donation site¹⁻⁶.

Cold-stored allogeneic vessels are at high risk for infection and rejection. Moreover, as all centers do not possess a cryopreserved vascular graft bank, this option is impossible for all surgeons²⁻⁴.

Synthetic grafts such as polytetrafluoroethylene (PTFE) grafts are more at risk of infection and thrombosis¹⁻⁴. Suturing PTFE implants is a challenging surgery due to the narrow and pliable walls of PTFE grafts as well as the high cost of this surgery³.

For the first time, the successful peritoneal repair of the vascular defect was performed by a French surgeon, Alexis Carrel, in 1910³. Later, Yoshioka described the use of peritoneum grafts for reconstructing portomesenteric vein defects in a porcine model in 2001³.

Peritoneum grafts are safe, effective, available under emergency conditions, cost-effective, and indicate a lower risk for infection, thrombosis, and blood loss. Besides, the use of peritoneum grafts, as compared to other methods, can shorten the time of surgery¹⁻³.

Furthermore, some studies have reported no additional risks for thrombosis in peritoneal grafts despite not receiving antithrombotic agents. It should also be noted that the peritoneal mesothelium is capable of operating in compliance with native vasculatures and cells¹⁻⁵. In our case, SMV was enlarged and dilated due to the presence of a tumor. Therefore, there was a size mismatch between saphenous veins with 3.4 mm and SMV vein with 18 mm of caliber.

With due attention to multiple procedures including colectomy, salpingo-oophorectomy, and arrangement of colostomy, we had to shorten the time of surgery. In addition, synthetic grafts were contraindicated due to the presence of full-blown colon cancer. As no cryopreserved vascular graft bank was available in our center, peritoneal conduit was the best choice for our case.

In a long-term follow-up performed after three months, bowel condition was good despite a narrow flow observed in the CT scan. The

mentioned point could be the reason for the formation of collateral circulation.

One of the limitations of the present study was the patient's refusal to perform CT angiographic imaging during the follow-up period, which is why only the image presented in Figure 5 was available.

Conclusion

In conclusion, peritoneal conduit would be an effective option in SMV reconstruction; however, further studies are required in this regard.

Abbreviations

SMV: superior mesenteric vein, PTFE: polytetrafluoroethylene, TAH: total abdominal hysterectomy, LSO: left salpingo-oophorectomy, CT: computed tomography, PET: positron emission tomography, BWT: *bowel wall thickening*, SMA: superior mesenteric artery.

Acknowledgments

None to declare.

Conflict of Interest Disclosures

The authors declare that they have no conflict of interest.

Authors' Contributions

MM and MR designed the study. SRH, AE, SR, and HM collected the data. MM, AE, and MR drafted the manuscript. HM reviewed the image of the CT scan. All authors read and approved the final version of the manuscript.

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Ethical Statement

The purpose of this report was completely explained to the patient, and written informed consent was obtained from the patient. A written informed consent for publication of the

patient's clinical details was obtained from the patient.

References

1. Oruz MT, Zakir T, Aslaner A, et al. Peritoneal Patch Used for Vascular Reconstruction of the Superior Mesenteric Vein Invaded by Locally Advanced Pancreatic Tumour. *Surg Gastroenterol* 2017;22(3):132-35.
2. Zhiying Y, Haidong T, Xiaolei L, et al. The falciform ligament as a graft for portal-superior mesenteric vein reconstruction in pancreatectomy. *Journal of Surgical Research* 2017; 218:226-31.
3. Kayaalp C, Sumer F, Polat Y, et al. Autologous peritoneum graft repair of a superior mesenteric vein defect during pancreaticoduodenectomy. *Cureus* 2015;7(10)
4. Smoot RL, Christein JD, Farnell MB. An innovative option for venous reconstruction after pancreaticoduodenectomy: the left renal vein. *Journal of Gastrointestinal Surgery* 2007;11(4):425-31.
5. Dua MM, Tran TB, Klausner J, et al. Pancreatectomy with vein reconstruction: technique matters. *HPB* 2015;17(9):824-31.
6. Kim SM, Min S-K, Park D, et al. Reconstruction of portal vein and superior mesenteric vein after extensive resection for pancreatic cancer. *Journal of the Korean Surgical Society* 2013;84(6):346-52.