

Case report

Precaval recurrent endometrial cancer treated with en-bloc resection of the inferior vena cava and reconstruction using bovine pericardium. A case report and review of the literature

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1. Introduction

The majority of recurrent endometrial cancer after primary treatment present with both local and distant disease (Legge et al., 2020). While the role of cytoreductive surgery in recurrent endometrial cancer remains controversial, a meta-analysis noted that complete cytoreduction to no gross residual disease improved overall survival in selected subsets of patients (Barlin et al., 2010). Excision of para-aortic nodal disease with a negative margin is complicated by the need for resection of vascular structures to ensure clearance of the tumor with the risk of significant hemorrhage. Previous reports on en-bloc resection of the inferior vena cava (IVC) in oncology have included primary approximation of the vessel wall, ligation of the IVC, vascular reconstruction using autologous and synthetic grafts (Kato et al., 2015; Morris et al., 2019; Nakamura et al., 2014; Uccella et al., 2010). Bovine pericardium (BP), a novel material comprising a collagen matrix in a glutaraldehyde solution, has been used for IVC reconstruction in patients with upper gastrointestinal and renal clear cell cancer (Morris

et al., 2019). This however has not previously been described in patients with gynecologic cancer. We present a case of para-aortic and precaval recurrent endometrial cancer treated with en-bloc resection of the IVC and reconstruction using a tabularized bovine pericardial graft.

2. Case presentation

A 34 years old patient underwent a laparotomy, total abdominal hysterectomy, bilateral salpingo-oophorectomy, bilateral pelvic lymphadenectomy and omental biopsy for a stage 3C1 grade 3 endometrioid adenocarcinoma of the uterus. A single obturator node was found to be positive for metastatic disease on final histopathology examination and she received external beam radiotherapy with extended field including the lower para-aortic area (25 fraction total 45 Gy) and combination chemotherapy with paclitaxel and carboplatin. A surveillance CT 12 months after initial surgery revealed an enlarged para-aortic lymph node causing mass effect on the IVC (Fig. 1). A PET CT scan confirmed two lesions confined to the para-aortic area; a 3 cm mass lateral to the aorta

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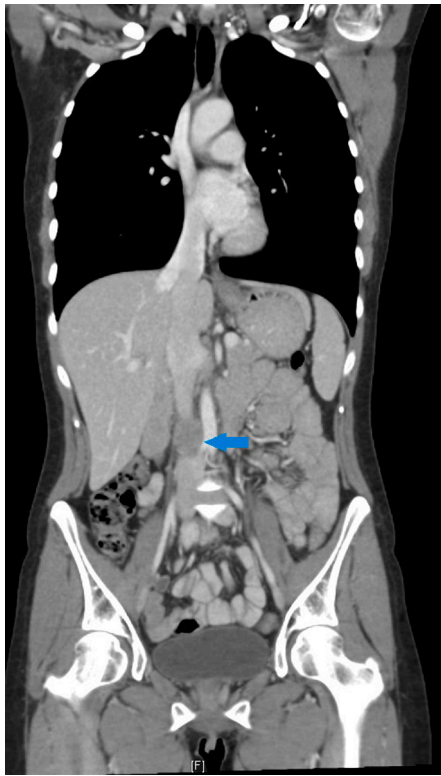


Fig. 1. CT scan demonstrating large precaval node.

below the renal vessels and a further 6 cm nodal mass anterior to the IVC. There were no other sites of disease.

A laparotomy was performed confirming no macroscopic disease other than noted on imaging. The surgical technique included opening of the retroperitoneal space over the aorta and isolation of the aorta, IVC, common iliac vessels, renal vessels and inferior mesenteric artery with vessel loops for vascular control if necessary. The left *para*-aortic lymph node measuring 3 cm was removed at the level of the renal artery, anterior to the psoas muscle. An eight centimeter partially necrotic node was noted densely attached to the IVC caudal to the right renal vein. An intraoperative decision was made to resect the involved IVC with this mass. A prosthesis was necessary to bridge the remaining gap and this was created prior to completing the resection to minimize the time during which the IVC would be clamped. The diameter of the IVC both proximal and distal to the mass was measured. A 10x15cm BP (Edwards Lifesciences Inc., Irvine California) was then used to create a tubular

structure for the graft as described by one of the authors (DY) in a previous series (Morris et al., 2019). A 20 cc syringe was used as a template and the pericardium tabularized using a vascular stapler after rolling the graft over the syringe. The free edges were held together with Allis forceps while two 60 mm vascular staple (Ethicon Johnson and Johnson, New Jersey USA) lines were sequentially deployed along the edge of the syringe, thus forming a cylindrical tube with the pericardium. Following the administration of IV heparin (3000units), the IVC was controlled proximal and distal to the mass using vascular clamps and the mass was resected en-bloc with the IVC. The cranial end of the IVC was then sutured to the graft using a 4.0 prolene double headed suture in a single layer continuous fashion. The graft was then placed in position and cut to length ensuring that there was no redundant graft. The caudal end of the graft was then sutured similarly, and the distal clamp released. The inside of the graft was flushed with heparinized saline to extrude clots prior to the proximal clamp being released. The surgical field was marked with clips (Fig. 2). There was no macroscopic residual disease at the end of the operation. The operative time was 300 min, and the IVC clamping time was 15 min with an estimated blood loss of 300 ml.

The final histopathology confirmed grade 3 endometrioid adenocarcinoma (Fig. 3A) with evidence of tumor invading into the tunica adventitia of the vena cava but not involving the lumen of the vena cava (Fig. 3B). The margins were negative on all resected specimens. The patient was observed in intensive care unit for the first 48 h post-operatively and 40 mg Enoxaparin was given 6 h post-surgery as thromboprophylaxis then continued as a daily dose during hospital stay only. She was discharged on postoperative day 4 and made an

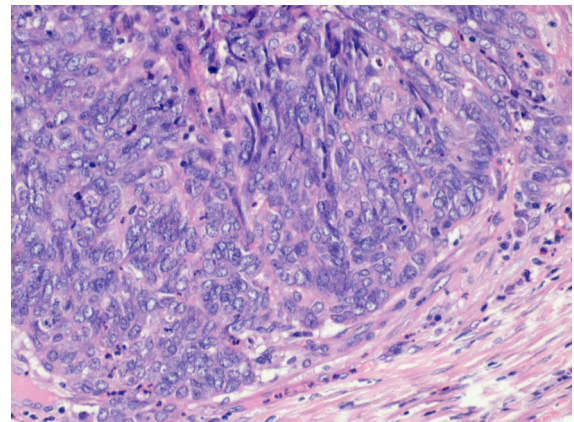


Fig. 3A. Sections of the lymph node showed almost complete effacement by a grade 3 endometrioid adenocarcinoma (H&E \times 200 magnification).

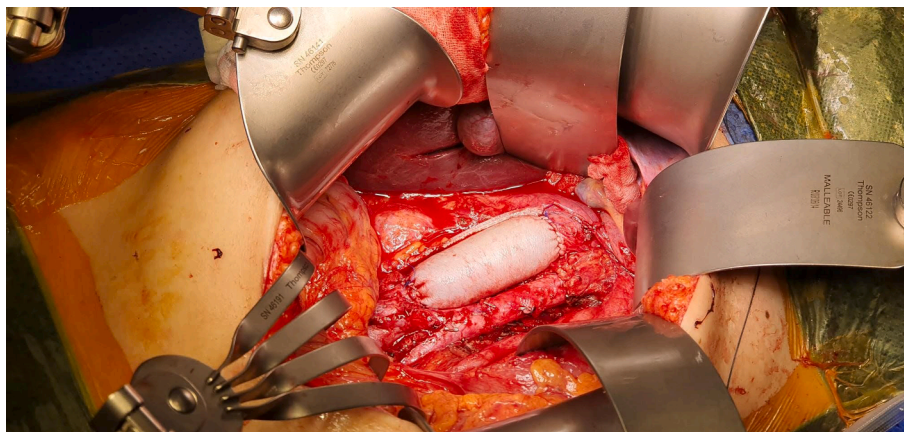


Fig. 2. Post excision with stitched bovine pericardial graft in situ.



Fig. 3B. Para-aortic lymph node with involved segmental IVC resected en-bloc.

uneventful recovery. The patient has since received 25 fractions of volumetric modulated arc therapy (total dose 45 Gy) to the surgical bed as guided by the surgical clips. Patient remained clinically well with no symptoms of IVC obstruction and no new sites of disease was found on PET-CT scan at 10 month post-operative follow up.

3. Discussion:

The patient presented in this report had recurrence in the *para*-aortic area treated with en-bloc surgical resection and subsequent adjuvant therapy. This to our knowledge is the first gynecological oncology case demonstrating the use of BP to reconstruct the IVC after resection of a gynecologic tumor.

Fourteen to eighteen percent of patients with endometrial cancer will present with recurrent disease with a median survival of 21 months. The prognostic factors in patients with recurrent endometrial cancer include: location of recurrence, number of sites of recurrence and ability to surgically resect tumors to no macroscopic residual disease (Legge et al., 2020). Previous reports in patients with recurrent endometrial cancer have demonstrated prolonged survival after surgical resection of disease and radiotherapy in suitable patients (Nakamura et al., 2014). Resection of large *para*-aortic nodal disease may in selected cases lead to prolonged progression free and overall survival but poses surgical challenges relating to hemostasis and maintaining perfusion with vessel resection (Nakamura et al., 2014). Previous reports of en-bloc IVC resection was carried out with ligation of the proximal and distal end of the IVC and maintenance of circulation through collateral vessel formation. Resection without reconstruction while possible leads to extensive collateral formation, unsightly abdominal wall venous dilation and post procedural lower limb thrombosis and edema (Uccella et al., 2010). Kato et al noted in a further case that partial resection of the IVC with approximation may be performed if less than 40% of the vessel wall is involved (Kato et al., 2015). The size and area of involved venous wall in our patient precluded partial wall resection and reconstruction.

Total reconstruction of the IVC after resection may be carried out using autogenous or synthetic grafts. Autogenous venous grafts using either the internal jugular or saphenous veins is limited by the discrepancy in size and the ability to harvest a vessel of significant length. Synthetic polytetrafluoroethylene (PTFE) has previously been used to reconstruct the IVC in patient with cancer. PTFE is associated

with a risk of post procedural infection and thrombosis. PTFE is only available in specified diameters making matching of the caval diameter difficult and these patients need long term post procedural anticoagulation (Chlupac et al., 2009). BP consists of a collagen matrix treated with a glutaraldehyde solution and has been widely used in cardiac and upper gastrointestinal surgery. BP has several advantages when compared to PTFE including, lower risk of infection and thrombosis, no need for long term anticoagulation, ability to tailor to size of patient's IVC, easy to suture, less bleeding at needle points, lower cost and prolonged shelf storage of the graft (Morris et al., 2019; Chlupac et al., 2009). BP has gained clinical popularity over the last 30 years in many surgical fields including carotid endarterectomy, bioprosthetic valve, repair of intracardiac defects, diaphragmatic defects, and portal vein reconstruction (Li et al., 2011). The durability of BP used in aortic valve replacement has been reported to be more than 20 years (Bourguignon et al., 2015). There is limited knowledge apart from case series regarding radiotherapy after vascular reconstruction with BP (Ventura et al., 2017) and the longevity and durability of BP in oncology patients requires further research.

This preliminary report shows that en-bloc surgical resection of *para*-aortic lymphadenectomy with reconstruction of the IVC using BP is feasible and safe when performed in a tertiary center with the involvement of a multi-disciplinary team. This surgical procedure can be considered to allow complete tumor resection for these patients and has advantages in selected patients compared to IVC ligation, autogenous or PTFE grafts.

4. Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

CRedit authorship contribution statement

Huan Xie: Conceptualization, Data curation, Investigation, Resources, Writing - original draft. **Selvan Pather:** Conceptualization, Formal analysis, Project administration, Supervision, Validation, Writing - review & editing. **David Yeo:** Writing - review & editing. **Gaithri Mylvaganam:** Writing - review & editing. **Rasa Venclovas:** Writing - review & editing. **Lyndal Anderson:** Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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