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Case report

A surgical multi-layer technique for pelvic reconstruction after total exenteration using a combination of pedicled omental flap, human acellular dermal matrix and autologous adipose derived cells

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1. Introduction

Women affected by relapsed gynecological cancer are often treated with pelvic exenteration (PE); this aggressive surgical procedure implies a large hard-to-fill pelvic defect. Moreover patients submitted to PE for gynecologic malignancies present severe postoperative local complications (including abdominal infections, intestinal fistulas, small bowel perforation, terminal colostomy complications, vaginal stump dehiscence, pelvic organ prolapse and even perineal evisceration) in about 21% of cases and a 3% mortality within 30 days (Chiantera et al., 2014).

Because of young age and survival greater than 50% at 5-year in patients with no residual tumor after surgery, a new approach with better clinical results to pelvic reconstruction is needed.

Different reconstruction techniques were proposed to improve abdominal organ support and reduce complications, with conflicting results (Kolehmainen et al., 2013). Synthetic mesh used for pelvic reconstruction, despite increased mechanical support, attempts to adhesions and other relevant complications (Dinsmore et al., 2000). Primary reconstructive myocutaneous flap (MF) from abdomen or thigh is invasive and sometimes it cannot be performed because of previous incisions, hernia or insufficient flap tissue volume that compromise the donor site. Pedicled greater omental flap (PGOF) represents the standard procedure used for pelvic dead space filling, but it cannot provide the required support alone.

As a result of the disadvantages of these techniques, the use of bioprosthetic materials, such as human acellular dermal matrix (HADM) has been explored (Bondioli et al., 2014). Post-operative abdominal adhesion reduction and well tolerability in compromised tissues are its major advantages (Silverman, 2011).

The association of a thigh-based MF with HADM has been proposed by Said H.K. et al. for the pelvic floor reconstruction in recurrent vulvar cancer (Said et al., 2007). More recently, a two-layer reconstruction with a combination of HADM and PGOF has been performed by Momoh A.O. et al. after an anterior PE for bladder cancer (Momoh et al., 2010).

Moreover, some reports have suggested that the mechanical performance of HADM could be enhanced by cell seeding and some Authors have already created matrix seeded with adipose-derived stem cells (ASCs). The structural framework of the HADM is favourable for cell incorporation and this procedure improves the mechanical support of the matrix (Altman et al., 2008). Moreover ASCs combined with HADM were also successfully used to accelerate wound healing because of induced angiogenesis. To obtain these multipotent stem cells and progenitor cells, autologous adipose tissue is harvested from the patient (Komatsu et al., 2013).

We report a surgical multi-layer technique of pelvic reconstruction using a combination of pedicled omental flap and HADM filled with

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microinjection of adipose-derived Stromal Vascular Fraction (SVF) following total pelvic exenteration (TPE) for the treatment of recurrent cervical cancer.

2. Case presentation

A 41-years-old Caucasian woman from Eastern Europe presented to Gynaecologic Unit in January 2014 for a high-grade squamous cell cervical carcinoma (FIGO stage IIIB) and enlarged bilateral common iliac lymph nodes (maximum diameter of 17 mm) suspected for metastasis. The patient underwent right nephrostomy before treatment for right hydronephrosis.

One month later the patient started a combined external beam radiotherapy (46 Gy) on tumor and pelvic lymph nodes and Cisplatin based systemic chemotherapy. The curative treatment was completed by 28 Gy high dose-rate brachytherapy boost.

In order to explore the response to treatment, the patient was submitted to pelvic MRI (4 months after therapy) and 18F FDG-PET/CT (6 months after therapy). MRI showed a complete radiologic response with fibrotic tissue but the 18F FDG-PET/CT showed a focal metabolic uptake ($SUV_{max} = 13.4$) located in the cervical region suspicious for cancer persistence, without nodal uptake. A cold biopsy of the cervix confirmed the persistence of disease.

Therefore, we proposed surgical intervention modulated on the results of intraoperative frozen sections with the possibility of TPE if bowel and bladder were involved. In case of PE, plastic reconstruction with PGOF and HADM filled with adipose tissue would be performed.

After a longitudinal laparotomy we performed peritoneal washing for cytology and a complete exploration of abdominal cavity that showed a local involvement of uterus, bladder and rectum without lymph nodes involvement confirmed by the frozen section biopsies. Indeed the patient underwent to supraelevatoric TPE (type I) according to the classification by Magrina et al. (1997), with lymph nodes dissection extended to common iliac vessels and para-aortic and para-caval lymph nodes. Pelvic peritoneum, fatty tissue among vessels and part of the right levator ani muscle were removed without residual disease based on frozen section results (Fig. 1A). Fecal divertion was obtained with a terminal para-rectal sigmoidostomy on the left side and urinary divertion with an ileo-colonic heterotopic urinary continent pouch (Indiana technique) (Rowland et al., 1987).

Immediate reconstruction of the pelvic floor was achieved using a multi-layer technique. Firstly, the pelvic dead space was partially filled with PGOF on the left gastro-epiploic artery (Fig. 1B). Then, the omentum was covered by a 20×20×2 mm inlay of HADM inserted circumferentially into the pelvic defect with interrupted monofilament resorbable sutures onto the residual pelvic muscle and fascia and their insertions onto the pelvic bone and periosteum (Fig. 1C). Finally, PGOF was filled with adipose tissue to increase its thickness and to create a sort of natural hammock for supporting the intestinal loops and avoiding inter-organs adhesions and pelvic prolapse. Adipose tissue was obtained with the lipoaspiration in abdominal subcutaneous fat tissue (Fig. 2A); the low pressure of aspiration was preferred to minimize damage to the graft. At the end of the procedure, 200–300 cm^3 of adipose tissue was aspirated and centrifugated (by Coleman Technique) to obtain 100–150 cm^3 of processed fat (Coleman, 1995). Finally microinjections of processed fat in the PGOF were performed (Fig. 2B) to increase volume. At the end of the procedure three abdominal tubular drains were inserted.

The final pathology confirmed the persistence of a high grade cervical squamous cell carcinoma with infiltration of uterus, right ovary, right ureter and bilateral proximal parametrium with negative surgical margins and positive peritoneal washing; none of nineteen lymph nodes removed revealed cancer metastasis.

The patient's post-operative course was uneventful and uncomplicated according to Clavien-Dindo classification of surgical complications (Dindo et al., 2004).

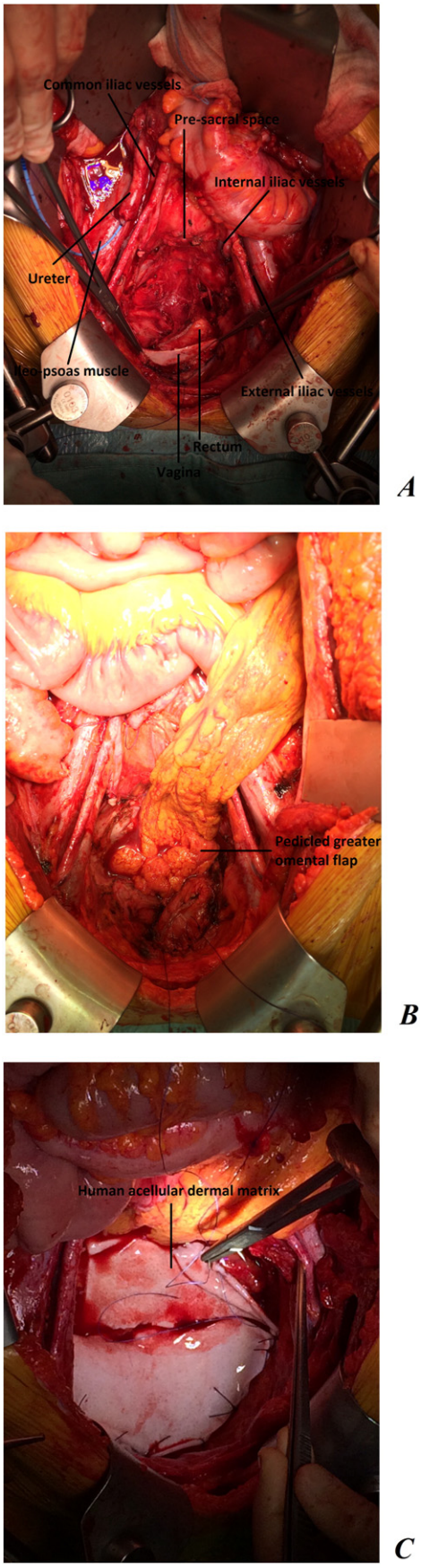

Fig. 1. Demolitive surgery and first step of reconstructive surgery **1A** Pelvic defect after TPE. **1B** Pelvic defect filled with PGOF. **1C** HADM positioned at the pelvic brim and fixed to pelvic fascia.