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Management of Defects in the Groin, Thigh, and Pelvic Region with Modified Contralateral TRAM/VRAM Flaps

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Abstract: In patients with sarcomas, or regional recurrence of the disease, radical resection and radiation therapy is indicated to achieve cure or palliation. As a result of radical surgery, extensive radiation, or infection in the pelvic, groin or thigh region, the development of large pelvic / groin / thigh defects present a difficult surgical problem.

Musculocutaneous deep epigastric island-flaps, as a modification of the extended deep inferior epigastric flap, described by Taylor et al. in 1983, are an attractive option for a successful reconstruction for this defect localisation. Two technical modifications of the contralateral extended deep inferior epigastric island-flap permitted an adequate tailoring to a defect in the posterior lateral pelvic or groin-thigh region, and avoided the drawbacks of other loco-regional or microsurgical flaps in previously irradiated fields. The skin island reached the posterior lateral pelvic region, groin or thigh. The muscular portion of this flap was suited to fill the soft tissue defects in these critical areas. These so modified flaps represent an instrument, which in selected cases may be an interesting alternative tool for closure of complex defects. No significant functional impairment secondary to the flap procedures was noted in our patients.

Key words: Deep inferior epigastric flap, TRAM/VRAM, groin / pelvic - soft tissue defect – sarcoma

Introduction

In patients with sarcomas, or regional recurrence of the disease, radical resection, and radiation therapy is indicated to achieve cure or palliation [1]. As a result of radical surgery, and radiation in the pelvic region, the development of large groin-thigh / pelvic defects present a difficult surgical problem [2]. Infection related defects in these localizations present a similar serious clinical problem.

The reconstruction of soft tissue defects at the groin after radical resections, and irradiation with the deep inferior epigastric flap has been reported, and is considered one of the primary choices for the reconstruction of complicated groin-thigh defects [3-7]. There are only limited options in cases, when the defect reaches the posterior lateral pelvic region or thigh, and an ipsilateral deep inferior epigastric flap is not possible, secondary to radical surgery. Two alternatives techniques, utilizing a contralateral deep inferior epigastric designed turn-over island-flap - as a modification of the extended deep inferior epigastric flap - for reconstruction of complicated posterior lateral pelvic, groin-thigh defects will be presented.

Material and Methods

The technique was utilized in three patients. Patient 1 reported was a white male status post radical resection of a Ewing sarcoma in the right iliac crest, pre- and postoperative radiation (64 Gy), and chemotherapy, 12 years ago. The patient presented to an other institution with unspecific symptoms. Staging there revealed 2 solitary pulmonary metastasis at the right lung. Radiographic findings, and biopsy of the right pelvis revealed a radiation related osteogenic sarcoma (Fig. 1). The further course was complicated by wound healing problems of the biopsy site over the irradiated field. After preoperative chemotherapy shrinkage of the pulmonary lesions was observed. The osteogenic sarcoma was resected radically with subtotal hemipelvectomy - sparing the acetabular joint - for salvage of the extremity in an other clinic. During that primary radical surgery an extensive soft tissue resection in the right lower abdomen and groin through a midline laparatomy, and continuous incision to the posterior pelvic region - with separation and partial loss of the rectus abdominis muscle - was necessary. After the secondary resection outside a 30x10x10 cm soft tissue defect in the posterior lateral pelvic region, and a loss of pertrochanteric bony support was evident (Fig. 2-3). After a second look operation in our institution, with further osseous resection, the vitality of the wound was assured (Fig. 4).

In this patient the "boomerang" island-flap - as a modification of the extended deep inferior epigastric flap - for reconstruction of the defect was designed, and carried out. The principle of this flap lies in isolation of the deep inferior epigastric vascular pedicle to the iliac vessels, separation of insertion and origin, and the use of the vertical, and upper transversal overlying

skin in a "boomerang" design - as new soft tissue coverage. While the rectus muscle portion filled the bony defect, the skin paddle resurfaced the soft tissue defect (Fig. 5 + 7). The donor site could be closed primarily (Fig. 6).

After wound closure, the patient was presented to the cardiothoracic department for evaluation of the pulmonary lesions. Because of the solitary nature of the lesions a surgical excision was recommended and subsequently performed [8].

Patients 2, and 3 had defect localization in the groin/thigh region. While after multiple operations, an infection related defect in patient 3 was limited (30 x 15 x 10 cm) - but also having femoral vessels exposed - the defect in patient 3 was extensive (45 x 30 x 10 cm). The defect in patient 2 was in the groin region, after radical resection of a malignant fibrous histiocytoma, and radiation therapy. In the postoperative course, and over months the patient had therapy resistant wound healing problems, ending in a perforation, and massive bleeding episodes of the femoral vessels (Fig. 8). The patient was admitted to our clinic as an emergency. In both patients the same reconstructive principles were applied. After a radical debridement, reconstruction of the femoral vessels with a saphenous vein graft (patient 2), and a modified contralateral TRAM Flap was performed (patient 2-3, Fig. 9). The defect size was extensive in patient 2, and a major part of the superficial abdominal wall with the umbilicus was harvested here on the contralateral pedicle, and the defect closed. A primary wound healing at the defect, and donor site was seen, without complications (Fig. 10-11). Lymphatic flow studies after one year showed lymphatic transport from the irradiated groin. and affected leg to the opposite side by using the intramuscular lymphatic bundles in the rectus abdominis muscle (Fig. 12), and no lymphedema was observed after reconstruction.

Planning of the required skin-island to reconstruct the posterior lateral pelvic region was done first. A combined transversal, and or high vertical skin paddle is designed. After skin incision the flap is dissected down to the anterior rectus sheath fascia. The anterior sheath is included in the flap, except a 1 cm lateral and medial slip. The rectus muscle is elevated medially, and the vascular pedicle identified. After the deep inferior epigastric vessels are identified and isolated up to the iliac vessels, the muscle is separated from the costal margins, and raised based on this pedicle. After mobilisation of the musculocutaneous flap and isolation of the vascular pedicle, the flap is turned over into the defect. The muscle origin is cut, and secured distally with 2/0 nonresorbable suture material, controlling adequate perfusion. The muscle edges, and subcutaneous layers are secured distally with resorbable 2/0 suture material. Wound closure of the skin edges to the residual skin of the irradiated area is done with interrupted 3/0 nonresorbable suture material. Two suction drains were inserted at the donor site, and the recipient site respectively. The donor site, after meticulous reunification of the anterior rectus sheath with 1/0 nonresorbable suture material, was closed primarily in layers. The patients were mobilized immediately after surgery, except patient 1, being mobilized on a walking handle three weeks after reconstruction. All patients did well at follow up 12 months later.

Discussion

The improved prognosis following radical, but limb salvaging surgery, adjuvant chemotherapy, and irradiation for primary and secondary osteosarcomas, has resulted in increasing concern for post-therapy quality of life [9, 10].

The reported patients had recurrent life threatening wound healings problems. Limb salvage surgically was possible, despite radical resection with histological free margins. Without the additional soft tissue of an amputated extremity, wound closure is difficult. After multiple attempts in other institutions for wound closure of the defects, by means of vacuum assisted closure devices, were unsuccessful, and resulted in dehiscence and chronic wound infection.

A microsurgical procedure is an option, despite the irradiated field. While a higher rate of thrombosis is found in the experimental setting, when irradiated recipient vessels were used in end-to-end anastomoses, clinical results did not show any marked difference in the healing or flap loss pattern [11, 12]. The need for dissection through a previously operated and radiated area, and consequently longer operating time, is a drawback of a microsurgical procedure in this setting.

The ipsilateral deep inferior epigastric based musculocutaneous rectus abdominis flap is an option in defects of the posterior lateral pelvic region [13]. The ipsilateral epigastric flap can be used as a large flap with sufficient arc of rotation to the posterior lateral pelvic region. However in our patient the deep inferior epigastric system was separated during the previous radical tumor resections. A major disadvantage of the ipsilateral flap - even when technically possible in these patients - is the need for dissection through a previously operated and radiated area.

The use of a large flap - from the lower extremity involved in the disease process, as the anteror thigh flap or in combination with the tensor fasciae latae flap, has also been reported for corresponding indications [14-15]. A major drawback of flaps harvested nearer the knee is the significant donor site morbidity, which is especially increased when the flap includes the vastus lateralis muscle or is wider, and requires additional skin grafting at the donor site [16]. In a case as ours of subtotal hemipelvectomy this may hinder ambulation, which is limited to walking handles, until in a second setting after wound closure an elective reconstruction of bony support for the trochanteric region is performed. In addition, perfusion of local flaps after radical surgery may be critical, and integration of a plastic surgeon in the resection is advisable.

The contralateral deep inferior epigastric flap is a well accepted procedure for defects of the groin and upper thigh regions [3-7]. However, while the contralateral deep inferior epigastric myocutaneous flap in a vertical design does not reach the posterior lateral pelvic region, the high transversal design alone may have a limited perfusion, due to few perforators.12 The combination of both designs creates a "boomerang" type design, and assures adequate perfu-

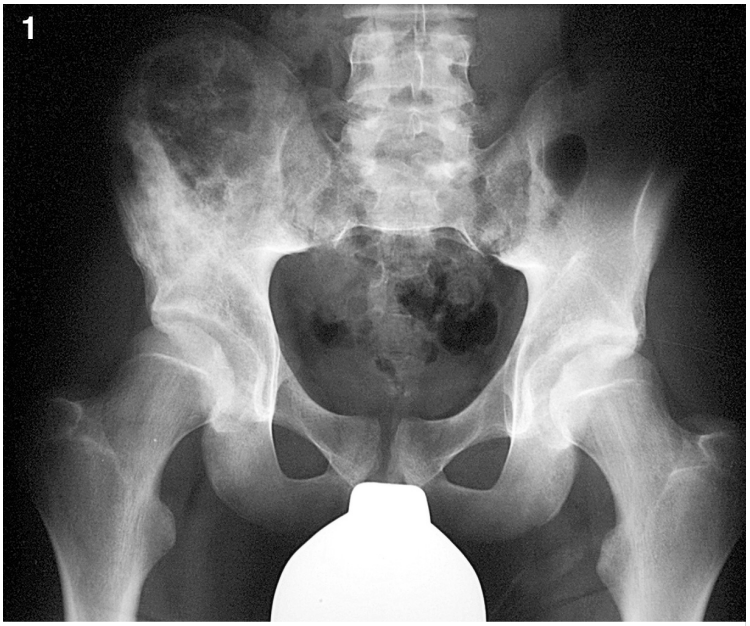

Fig. 1. Ewing sarcoma of the right iliac crest 12 years earlier.

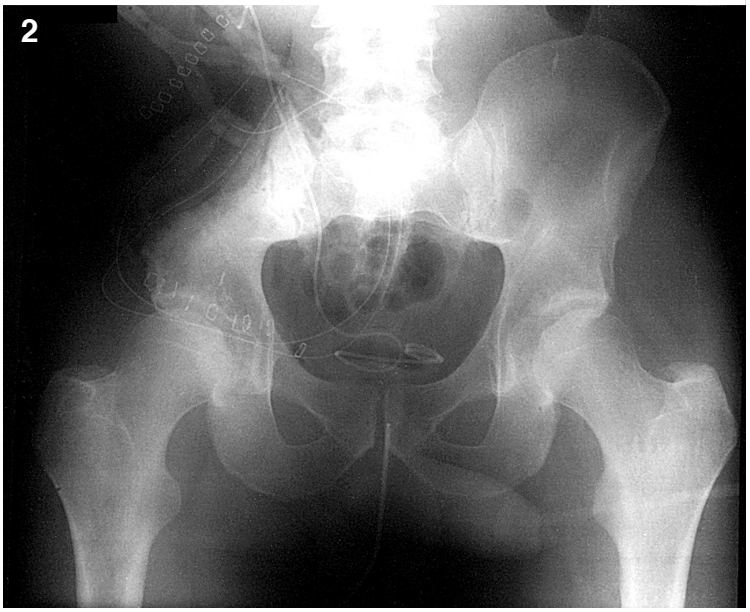

Fig. 2. Biopsy proven radiation related osteosarcoma x-ray 12 years after resection of the Ewing sarcoma.

sion of the skin paddle. In addition to the enhanced arc of rotation, a combined coverage of groin and posterior lateral pelvic region is enabled. In patient 1, this would not have been obligatory, but allowed improved soft-tissue coverage here, and partial restoration of the contour.

Musculocutaneous deep epigastric island-flap, as a modification of the extended deep inferior epigastric flap, described by Taylor et al. in 1983, eventually enabled wound closure and successful reconstruction of the posterior lateral pelvic region. These technical modifications of the contralateral extended deep inferior epigastric "boomerang" island-flap permitted an adequate tailoring to a defect in the posterior lateral pelvic or groin region, and avoid the drawbacks of other loco-regional or microsurgical flaps in previously irradiated fields. The skin island reached the posterior lateral pelvic region or thigh. The muscular portion of this flap was suited to fill the pelvic soft tissue defect in this critical area. This so modified flap represents an instrument, which in selected cases may be an interesting alternative tool for closure of complex defects. No significant functional impairment secondary to the flap procedures was noted in our patients.

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Fig. 3a-b. Clinical picture of chronic wound in the irradiated posterior lateral pelvic region after biopsy of recurrent osteosarcoma.

Fig. 4. Situation on x-ray status post supratrochanteric illium resection, debridement and deep implantation of a gentamycin chain.

Fig. 5. Turn over (90°) of the "boomerang" island-flap into the defect at the posterior lateral pelvic region.

Fig. 6. Primary closure of donor site with uneventful healing.

Fig. 7. Successful reconstruction of posterior lateral pelvic defect, restoration of adequate skin, and soft-tissue coverage over bony defect at follow up 6 months later.

Fig. 8. Irradiated defect of the groin-thigh region with exposition of the femoral vessels, temporary shunt after perforation, and bleeding.

Fig. 9. Intraoperative situation after resection of the irradiated field, and reconstruction of the femoral vessels with saphenous vein.

Fig. 10. Reconstructive result of the groin-thigh region after 6 months.

Fig. 11. Primary healing of donor site without herniation after 6 months.

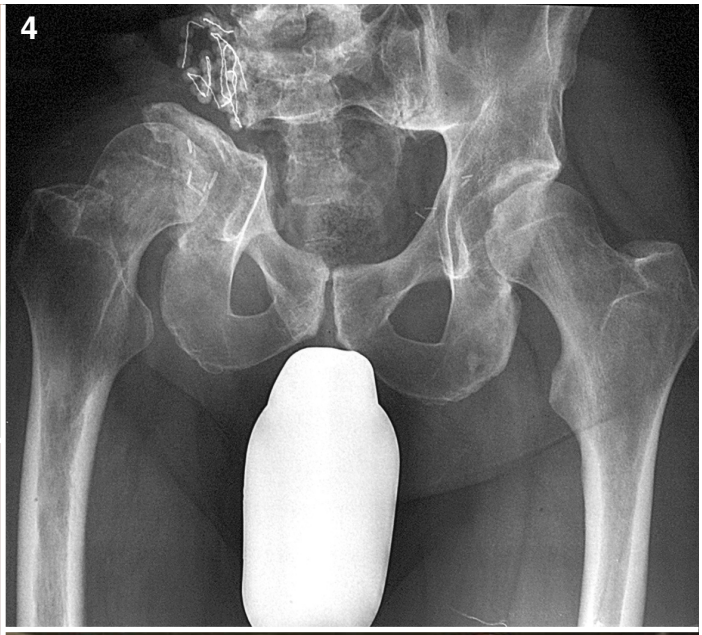

Fig. 12. Sequential lymphatic flow studies 1 year later, showing lymphatic transport from the irradiated groin, and affected leg to the opposite side by using the intramuscular lymphatic bundles in the rectus abdominis muscle to the contralateral inguinal lymph nodes.


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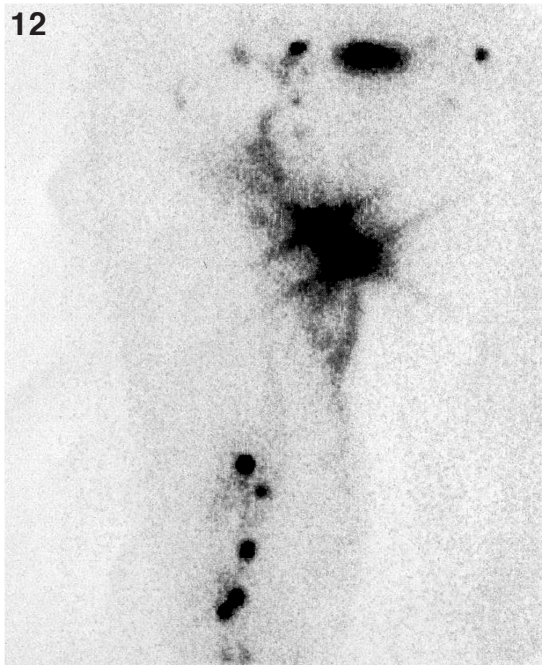
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