Reconstruction of large sacral defects following tumour resection: a report of two cases

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ABSTRACT

Sacral tumours often present surgical resection and reconstruction challenges. Wide resections result in large sacral defects and neoadjuvant radiotherapy impairs wound healing. The wounds need to be covered with bulky, well-vascularised, healthy tissues. We present 2 cases where large sacral defects were reconstructed following tumour resection. Both defects were reconstructed with inferiorly based, transpelvic, pedicled vertical rectus abdominis myocutaneous flaps. This is a robust flap and carries a well-vascularised muscle bulk and skin paddle. The donor site is distant from the lesion site and is thus unaffected by both the resection and radiotherapy. This is a useful flap for reconstructing large sacral defects.

Key words: chordoma; giant cell tumors; sacrococcygeal region; surgical flaps

INTRODUCTION

Sacral tumours are surgically challenging in both their resection and reconstruction.1 Some of these tumours, such as chordomas and giant cell tumours, tend to infiltrate adjacent tissues although distant metastases are rare.2 Surgical resection remains the mainstay of treatment. Radiotherapy is considered neoadjuvant or adjuvant therapy. Chemotherapy is of no proven value in most cases.3–6

Radical resection leaves large defects that may be complicated by bleeding and infection. Potential neurological deficits and lumbosacral instability may complicate the situation.7 Neoadjuvant radiotherapy can create an unfavourable environment for wound healing and may lead to wound breakdown. The wound needs to be covered with bulky and well-vascularised healthy tissues.

We present 2 cases where large sacral defects were reconstructed with transpelvic pedicled vertical rectus abdominis myocutaneous (VRAM) flaps following resection of primary sacral tumours.
In September 2002, a 52-year-old woman with a sacral chordoma underwent a wide resection with primary closure, followed by radiotherapy. The lesion recurred locally 3 years later. Magnetic resonance imaging showed a mass in the presacral area at the S2 to S3 level, measuring 4.1x4.7x5.0 cm. Infiltration into adjacent sacral bones was noted.

A wide excision was performed using combined anterior and posterior approaches. The right internal iliac vessels were ligated through bilateral inguinal incisions via the anterior approach. The posterior approach involved a wide excision of the tumour with an osteotomy at lower L5. The sacral defect measured 16x8 cm (Fig. a). Due to the prolonged operating time and considerable blood loss, the operation was stopped after the tumour had been resected. The patient was stabilised in the intensive care unit and later in the ward. The sacral wound was managed with regular dressings. Reconstruction was performed 2 weeks later.

The delayed reconstruction was performed with a left VRAM flap based on the left deep inferior epigastric vessels. The skin paddle of the flap measured 22x9 cm. The flap was elevated in the standard fashion and the rectus muscle was divided superiorly. The inferior attachment of the muscle to the pubic ramus was left intact to protect the pedicle from excessive traction upon subsequent manipulation and inset. The vascular pedicle was dissected and mobilised until the origin of the deep inferior epigastric vessels (Fig. b). The length of the vascular pedicle measured 10 cm. The flap was tunnelled through an opening in the left inguinal area, through the extraperitoneal plane across the pelvis to the back (Figs. c and d). Dissection of the extraperitoneal plane in the pelvis had to be meticulous to avoid injury to the ureter and iliac vessels. Scarring from the previous resection was minimal. The muscle bulk of the flap was used to obliterate the dead space in the sacral defect. The wound was closed with the distal part of the skin paddle of the flap (Fig. e). The proximal part of the skin paddle remaining in the defect cavity was de-epithelialised and used to obliterate the dead space. Considering the combined length of the vascular pedicle, the muscle pedicle, and the proximal skin paddle, this flap was rather long and was able to traverse the pelvic cavity without much difficulty. The anterior rectus sheath was closed primarily without using mesh. The patient recovered well and the wound remained intact at the 14-month follow-up (Fig. f). No abdominal wall herniation was detected.
at the donor site.

Case 2

In August 2005, a 33-year-old woman presented with a large giant cell tumour extending from S2 to the coccyx, and measuring 13.4x10.6x25.0 cm on computed tomography, with intrapelvic and intraspinal extensions. A wide excision of the lesion was performed using both anterior and posterior approaches. Both the right and left internal iliac vessels were ligated. The patient had massive blood loss and was haemodynamically unstable. The operation had to be stopped and the wound was partially closed after the tumour was resected. The patient was stabilised in the intensive care unit and later in the ward. The wound was managed with regular dressing. Recovery was prolonged and reconstruction was delayed for one month.

At the time of reconstruction the sacral defect measured 13x7 cm. The reconstruction was performed with a right pedicled VRAM flap based on the right deep inferior epigastric vessels. The flap was elevated with the skin paddle measuring 16x7 cm and the pedicle measuring 9 cm. Flap tunnelling and insetting were performed in the same manner as for the first patient. The anterior rectus sheath was closed primarily. Recovery was uneventful. The patient underwent adjuvant radiotherapy. Wound healing was satisfactory at the one-year follow-up. No abdominal wall herniation was detected at the donor site.

DISCUSSION

Extirpation of sacral tumours often creates large and complex defects with deep cavities (with exposed viscera and no sacrum). The dimensions of the defect make direct closure infeasible. Local flaps (e.g. Limberg flaps, gluteal rotational cutaneous flaps, or posterior thigh flaps) may not be usable due to the poor quality of the irradiated skin and the lack of bulk. Reliable flaps for reconstruction of large sacral defects include bilateral gluteal myocutaneous advancement flaps, transpelvic VRAM flaps, and free flaps. In patients with no preoperative radiotherapy and with intact gluteal musculature and vasculature, bilateral gluteal myocutaneous advancement flaps can be considered. However, these flaps may not be bulky enough to fill large sacral defects. In patients with a history of radiotherapy and damaged gluteal vessels, the use of transpelvic VRAM flaps is advocated. The use of omental flaps may lead to additional morbidity caused by entering the peritoneal cavity. If bilateral gluteal myocutaneous advancement flaps and transpelvic VRAM flaps are not usable, then free flaps (e.g. free latissimus dorsi myocutaneous flaps and free RAM flaps) should be considered.

In both of our patients, the sacral defects were too large for effective use of local flaps. In the first patient, radiotherapy in the sacral region rendered the use of local flaps and even bilateral gluteal advancement flaps unreliable because of damaged local and adjacent tissues. This was compounded by the ligation of the right internal iliac vessels, which further reduced the vascularity of the gluteal and surrounding tissues. In the second case, ligation of bilateral internal iliac vessels reduced the blood supply to the gluteal tissue and skin. It would thus be risky to use bilateral gluteal myocutaneous advancement flaps. Reconstruction with free flaps would be technically more challenging, given the condition of the sacral defects. Due to previous radiotherapy and resection, reliable local vessels may not be readily available for anastomoses. This may necessitate the use of vein grafts to connect the flap vasculature to more distant vessels.

The VRAM flap is a robust and versatile flap suitable for the reconstruction of various defects. It consists of sufficient soft tissue and skin paddle for coverage of large defects with poor vascularity. In the VRAM flap, the skin paddle is designed in a vertical or oblique fashion on the abdominal wall extending to the costal margin to maximise the amount of skin in the flap. Alternatively the skin paddle can be designed in a transverse fashion to form a transverse RAM flap. The donor site of the flap is far away from the lesion site and is unaffected by tumour resection and adjuvant radiotherapy. The well-vascularised muscle bulk is effective for controlling infection and promoting wound healing. The pedicle is usually of sufficient length and size in most circumstances. In both our patients the VRAM flaps could be transposed across the pelvis with few problems, even though the inferior end of the flap remained attached to the pubic bone. This flap is commonly used in various reconstructive procedures and the flap harvesting technique is well established. The incidence of donor-site morbidity is low, especially if the anterior rectus sheath is adequately closed. The use of transabdominal VRAM flaps to reconstruct large sacral defects has been reported. Nonetheless, a transpelvic VRAM flap does not involve entering the abdominal cavity and thus avoids potential intra-abdominal complications.

Contraindications for the use of VRAM flaps include previous injury, ligation of the inferior
epigastric vessels, and extensive scarring of the anterior abdominal wall. Potential donor-site morbidities include bulging and herniation of the abdominal wall as well as weakness of the anterior abdominal musculature.\(^{16-18}\) Herniation of the abdominal wall can be prevented if adequate rectus sheath closure is performed with or without mesh. Abdominal strength is usually regained after 12 months, causing no long-term functional problems.\(^{19}\)

**CONCLUSION**

An inferiorly based pedicled transpelvic VRAM flap is a useful and effective means of achieving satisfactory reconstruction of large sacral defects following tumour extirpation.

**REFERENCES**