CASE REPORT

Saving grace: distally pedicled gracilis muscular flap in lower limb salvage

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SUMMARY

During the 1970s, the incidence of limb amputation following surgery for sarcoma excision was as high as 50%. Two important developments have led to modern day limb salvage, namely chemotherapy and precision imaging techniques. We present a case of limb salvage in a patient with osteosarcoma plagued with recurrent infection after prosthetic revision. We discuss the use of the distally based pedicled gracilis muscular flap, which has little mention as a reconstructive option for defects around the knee.

BACKGROUND

The slender gracilis muscle (Latin: slender; graceful) occupying the medial compartment of the thigh was first described as a reconstructive option by Pickrell in 1952 for rectal sphincter reconstruction. Reconstruction with the pedicled gracilis muscle has been documented in perineal and vaginal reconstruction,¹ with the free gracilis muscle described in breast reconstruction.² In addition, it has been popularised for its use in free muscle transfer for facial reanimation and anal incontinence.³ The distally based pedicled gracilis flap, however, has little mention as a reconstructive option for defects around the knee. We describe the use of the gracilis muscle to obliterate dead space for a recurrent infected peri-prosthetic thigh defect many years after excision of osteosarcoma, preventing near amputation of the lower limb.

CASE PRESENTATION

An otherwise well 42-year-old woman underwent excision of a left lower femur osteosarcoma with adjuvant radiotherapy prior to siting of a long stem knee replacement 20 years before this presentation. Radiotherapy was a contributory factor leading to three subsequent distal femoral prosthetic revisions secondary to recurrent wound infection and breakdown. Soft tissue reconstruction necessitated the use of a free flap. One year prior to presentation, a successful free vertical rectus abdomino myocutaneous (VRAM) with split skin graft was undertaken with anastomoses to the femoral vessels. The VRAM flap was selected based on the patient undergoing previous bilateral thoracotomy for secondary lung disease. The latissimus dorsi flap was, therefore, not available as an option in view of the posterolateral thoracotomy approach to gain access to her secondary lesions.

At the second stage of distal femur revision, a post-operative wound infection complicated her recovery with a sinus developing over the lateral aspect of the

distal femur (figure 1). The presence of the sinus resulted in chronic discharge of serous fluid. Because of a combination of irradiated soft tissue and recurrent infections, with limited scope for further complex free flap reconstruction to limit morbidity, lower limb amputation was proposed. However, a final attempt at limb salvage with a distally based pedicled muscular gracilis flap was planned.

The flap was raised via a long medial thigh incision with no cutaneous skin paddle. The muscle was divided at the pubic tubercle proximally and its dominant pedicle from the medial circumflex femoral vessel, therefore relying on the distal minor pedicles to perfuse the flap (figure 2). The proximal secondary pedicle was dissected to the superficial femoral artery to achieve greater mobility. The flap was tunnelled infero-laterally to the defect at 8 cm above the posterior superior patella and sutured into the cavity with primary closure of the overlying skin (figure 3). Negative pressure wound therapy was applied with a portable device at 75 mm Hg for 2 weeks via a portable single use negative pressure wound therapy system.

A peripherally inserted central catheter was inserted to administer 6 weeks of intravenous antibiotics to treat chronic and superadded infection. Nine months later, the wound was healed with no further complications requiring surgery (figure 4).

OUTCOME AND FOLLOW-UP

The patient remains well with no further evidence of recurrence at the excision site.

DISCUSSION

In the mid-1970s, the incidence of limb amputation following surgery for sarcoma excision was in the

Figure 1 Non-healing defect with dead space. Previous vertical rectus abdomino myocutaneous (VRAM) flap can be seen overlying the knee joint.

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Figure 2 Gracilis muscle harvest. The flap was raised via a long medial thigh incision with no cutaneous skin paddle.

region of 40–50%.⁴ Today, wide local excision in combination with neo-adjuvant radiotherapy and chemotherapy at specialised tertiary centres has become the standard of care.⁵ This has necessitated the combined input of the resecting surgeon as well as a reconstructive surgeon. Potential for wound breakdown, haematoma and seroma are greatest when combining surgery with radiotherapy. This is believed to result from the negative effects of radiotherapy on vessel intima, tissue fibrosis and potential dead space formation.⁶

Current evidence suggests the use of local and regional muscle flaps such as the gastrocnemius flap to minimise infection of cavities and wounds.⁷ The gracilis flap is a type II muscle flap (Mathes and Nahai classification),⁸ which describes a single dominant pedicle with a minor supporting pedicle. Anatomical studies of the vascular supply to the gracilis muscle is divided with the main dominant pedicle originating from the deep femoral artery or the medial circumflex vessels and the minor pedicle from the superficial femoral artery. The gracilis flap leaves little donor site morbidity with negligible functional loss, and also offers its use as a muscle or musculocutaneous flap.⁷ When raised as a musculocutaneous flap, the vascular supply to the overlying skin can be variable causing it to be less predictable when raised with a skin paddle.⁹

Figure 3 Muscle flap inset into open defect.

Figure 4 Healed wound.

The gracilis muscle has been used extensively based on this proximal dominant pedicle. Cadaver dissection from 23 thighs reveals the dominant pedicle reliably enters the muscle in the region of 10 cm below the pubic tubercle.¹⁰ Hussey *et al*¹¹ have shown the mean entry point of the dominant pedicle is 9.4 cm from the origin of the muscle, with a mean length of 38.4 cm and a width of 6.2 cm. Little attention has been paid to its use solely on its secondary pedicles. Cavadas examined 20 adult cadavers, locating the number and location of secondary pedicles. In this anatomical study, it was concluded that survival of the muscle was feasible based on a proximal and distal secondary pedicle, suggesting safe pedicled transposition of the muscle by dividing its origin and insertion. Transposition as far as the patella has been suggested. To achieve the transfer, dissection would need to be performed in a retrograde direction. Rouffet *et al* describe two constant secondary distal pedicles, one at the musculotendinous junction and the other more proximal in the middle third of the muscle at 12.4 and 17.5 cm from the knee joint, respectively. In 20% of cadaver specimens, an additional third pedicle entering the tendinous portion was identified. The origin was most often from the superficial femoral artery and the descending popliteal artery. Findings also suggest numerous choke vessels between intramuscular inter-pedicle anastomoses. In another cadaver study, 10 thighs were dissected in correlation with radiographic study. CT angiography for three patients with severe soft tissue complications after total knee arthroplasty was performed. The number of these secondary pedicles originating from the superficial femoral artery or popliteal artery was found to be between one and four, with a calibre of 2 mm from living subjects.¹²

The successful use of the reversed gracilis muscle flap in two patients with defects of the quadriceps tendon has been

described.¹³ A recent description of the reverse gracilis flap for soft tissue necrosis after total knee arthroplasty proved successful using this distally based vascular pedicle.¹⁴ In our particular case, the patient was subjected to significantly fewer overall complications compared with undergoing reconstruction with a free flap. With the increasing expertise and number of trained individuals in microsurgical procedures, reconstructive considerations are often based on complex free flap reconstruction. Free flap reconstruction must be considered carefully with reference to the reconstructive ladder.

This case supports the notion that the versatile distally based pedicled gracilis flap is a reconstructive option for defects of the lower limb. The low morbidity and well-hidden scar make the reversed gracilis pedicled flap worth further trial and investigation with current anatomic studies in support of this. We decided to use the distally based gracilis pedicled flap for simplicity, to decrease operative time and to accommodate the relatively small defect in case of deterioration of the wound and or deep prosthetic infection necessitating future amputation. We reserved the use of a free flap for any further salvage surgery.

Limbs worth saving need acceptable levels of pain, function and cosmesis. The literature attests to the success in the reduced numbers of amputations performed. The true success of these procedures will only be decided on solid patient reported outcomes, which are yet to be confidently shown in the literature.

Learning points

- ▶ Always involve the patient in discussions about limb salvage.
- ▶ Keep reconstructive considerations as simple as possible.
- ▶ Be aware of present anatomical studies to appreciate the success of future reconstructive outcomes.

Competing interests None.

Patient consent Obtained.

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