Reconstruction of extensive posterior mid-thoracic soft-tissue defects after spinal surgery on irradiated skin

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Summary A 56-year-old patient presented with neurological disorders resulting from an extrinsic medullary compression extending from T3 to T5 associated with a T4 corporeal invasion by a high-grade non-Hodgkin’s malignant lymphoma. Treatment consisted in a laminectomy without spinal stabilization followed immediately by chemotherapy (VCAD) and locoregional radiotherapy (20 cycles of 50 Gy between T3 and T7 followed by nine sequences of 18 Gy). The evolution revealed unfavourable with reappearance of a compressive syndrome thus requiring surgical decompression combined with spinal stabilization. The immediate postoperative period was simple but a secondary wound dehiscence was observed surrounded by an inflammatory area of 15 cm on 12 cm. The authors describe the reconstruction by means of a trapezius musculocutaneous island flap. The results were satisfactory and corroborated those previously reported by various authors after use of this flap in similar situations.

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Introduction
Cutaneomuscular defects of the posterior mid-thoracic region are quite common after instrumented spinal fusion surgery, either due to postoperative wound infections thus complicating the surgical gesture or secondary to early surgery performed on irradiated skin. Therefore, reconstruction is the surgeon or plastic surgeon’s main objective to achieve proper coverage of the exposed orthopaedic hardware with a well-vascularized tissue harvested from a distant donor site which represents a long-term reliable solution [1—4]. A precise topographical evaluation of the defect, the patient’s physiological data and the extent of the area to be covered will guide the clinician in choosing the best reconstruction option [4] (Fig. 1).

Because of its anatomical features, the trapezius musculocutaneous island flap appears to appropriately meet these requirements as illustrated in this case report.

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Figure 1  Available reconstruction methods for posterior mid-thoracic soft-tissue defects depending upon topographical findings. On the right: A. Trapezius muscle. B. Latissimus dorsi muscle. In the middle: A. Trapezius muscle. B. Latissimus dorsi muscle. C. Para-vertebrae muscles. On the left: A Latissimus dorsi muscle free flap. B. Latissimus dorsi muscle. C. Gluteus maximus.

Figure 2  Clinical case. A. Tumour syndrome with extrinsic medullary compression. B. Laminectomy without spinal stabilization.

Material and methods

We report the case of a 56-year-old patient with no significant medical history, who presented in 1988 with a progressive extrinsic medullary compression extending from T3 to T5 associated with a T4 corporeal invasion by a high-grade non-Hodgkin’s malignant lymphoma (Fig. 2). The extension assessment was negative. Initial surgical treatment consisted of a laminectomy from T3 to T5 without spinal stabilization. The surgical treatment was completed by three sequential polychemotherapeutic regimens (according to VCAD protocol) associated with a 50 Gy locoregional radiotherapy. The evolution was unfavourable demonstrating a deep neurological worsening: right lower limb paralysis in August 1988 due to a T4 vertebral compression associated with posterior vertebral wall backing thus threatening the spinal cord. A surgical decompression was performed through a posterior approach combined with a T2 to T4 stabilization by means of a Cotrel—Dubousset type instrumentation (Fig. 3) followed by radiotherapy. Immediate postoperative period was simple but patient presented with a progressive partial dehiscence of the upper section of the median wound with hardware exposure. After 1 month of local postoperative care, a 6 cm height and 2 cm width median soft-tissue defect was observed perpendicular to T3 and T5, thus exposing the hardware. The wound had sclerotic borders, showed signs of very fragile clinical granulation tissue and was surrounded by a large 15 cm height and 12 cm width inflammatory area (Fig. 4). This large cutaneomuscular soft-tissue defect required the need for reconstruction. The trapezius musculocutaneous island flap

Figure 3  Clinical case. Spinal stabilization using a Cotrel—Dubousset type hardware during revision surgery for neurologic degradation.
was considered as being the best available reconstructive method.

**Trapezius musculocutaneous island flap reconstruction**

**Outlines of the flap**

The outlines of the flap were drawn the day before the operation with the patient in the standing position, arms at the sides. The 12th dorsal vertebra, the scapular tip and scapular spine were located. The spinous line, then a line running from T12 (that is 3- to 4-finger width under the scapular tip) towards the scapular spine, passing 2 to 3 cm inside the scapular tip were drawn as well as the vascular axis of the trapezius muscle which is the trapezius artery, a branch of the dorsal scapular artery supplying the inferior portion of the muscle. The axis was drawn from its point of emergence, 8 cm from the median line slightly above and inside the supero-internal scapular angle towards the T12 vertebra. A skin paddle was drawn depending upon the size of the defect to be reconstructed (Fig. 5).

**Resection of the inflammatory area**

Once the patient was placed in the prone position with the homolateral arm in abduction-internal rotation to free the area between the scapula and the spine, surgery started with the excision of the inflammatory area which surrounded the soft-tissue defect and the exposed osteosynthesis hardware. The real size of the soft-tissue defect was measured to be 15 cm over 12 cm with a vertical long axis.

**Flap elevation**

Once the skin paddle was incised down to the fascia and dissection at the distal part of the island was performed by separating the inferior border of the trapezius from the...
latissimus dorsi muscle which insertions were preserved, a second vertical skin incision was made between the island and the neck base in order to raise a skin flap on both sides thus removing the superficial face of the trapezius. The flap was raised through blunt dissection under the trapezius muscle plane while retaining the underlying deep vascularized fascia. The vascular pedicle visualized under the fascia thus permitted the lateral section of the muscular paddle under visual control. Dissection should not be carried out under the rhomboid muscle plane since this muscle will help compensate for the functional deficit induced by the trapezius harvest [5].

Flap transfer

The flap was secured to the recipient site with a double-layer suture avoiding kinking of the pedicle; a tension-free wound closure was performed at the donor site over two suction drains.

Postoperative management

Postoperative period was simple with removal of the suction drain after 6 days and of the suture after 15 days. Chemotherapy could be carried on and did not appear to have a significant influence on the flap (Fig. 6).

Discussion

A 4- to 6-week minimum period should be respected prior to undertaking any surgical procedure when following preoperative radiotherapy [6,7]. The latissimus dorsi muscle due to its large surface (35 cm long axis, 20 cm width) and its good vascular pattern (Fig. 7) [2] and the trapezius muscle due to its high versatility have proven to be the most reliable treatment options in the reconstruction of extensive posterior mid-thoracic musculocutaneous defects. The trapezius musculocutaneous flap appeared to be a valuable and reliable tool for reconstruction of dorsal mid-thoracic, head and neck defects since it allows for greater rotation distances whereas for anatomical reasons, the use of the latissimus dorsi muscle flap is limited to the reconstruction of thoracolumbar and lumbar defects with the exception of free tissue transfers [4,8] (Fig. 8).

Klink et al. [8] demonstrated in a series of five patients that the use of trapezius (two out of five), latissimus dorsi (two out of five) and combined trapezius-latissimus dorsi

Figure 6  Clinical case. A. Resection of the inflammatory area. B. Flap transfer. C. Result at 15 days. D. Result at 6 months.

Figure 7  Vascularization of the trapezius muscle. This angiogram of latissimus dorsi muscle in a 72-year-old man (cadaver) displays the different arteries especially the thoracodorsal artery (TA), the septocutaneous branch (white arrow) and musculocutaneous perforators (black arrows). TA-1 and TA-2 represent primary and secondary intramuscular territories; PIC: posterior intercostal artery territory; DBPIC is the vascular territory supplied by the dorsal branches of posterior intercostal arteries; LA, artery territory supplied by lumbar artery; DBL vascular territory supplied by dorsal branches of lumbar artery.
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Figure 8  Comparison between trapezius and latissimus dorsi axis of rotation. On the left: trapezius (A) and latissimus dorsi (B) axis of rotation, the ellipse represents the island pattern of trapezius flap. On the right: extent of trapezius (A) and latissimus dorsi (B) turnover flap coverage.

Muscleocutaneous flaps resulted in poor outcomes (hardware removal secondary to persistent wound infection). Dumanian et al. in 2003 [3] report their experience with the application of trapezius flaps in the reconstruction of upper back soft-tissue defects in a series of 22 patients. The authors of that series advocate the use of the lower trapezius muscle flap in the coverage of mid- and high-thoracic defects since the latissimus dorsi muscle offers a limited axis of rotation due to the axillary origin of its pedicle and to the frequent need for a thin skin graft at the donor site because of the difficulty to achieve a tension-free wound closure during the management of extensive defects. Latissimus dorsi muscle flap is a valuable option in the repair of thoraco-lumbar and lumbar region defects and remains the most popular method when applied as a free flap. Disa et al. in 2001 [9] reported satisfactory results in a series of six patients treated with trapezius flap coverage.

Meiners et al. in 2003 [10] reviewed 14 cases all treated with a reverse latissimus dorsi muscle flap associated or not with a gluteus maximus muscle flap and reported encouraging results. Primary wound closure could not be performed in five out of 14 patients and a skin graft was required for coverage of the donor site whereas two patients, in whom primary wound closure had been achieved, developed necrosis of the skin. Chun et al. [2] performed reconstruction in five patients using a trapezius musculocutaneous island flap associated or not with a paravertebral muscle turnover flap and achieves a tension-free primary wound closure in all cases. In a retrospective series published in 2005, including 17 patients treated with the same type of flap, Papadopoulos et al. [11] report similar good results. The peninsular pattern trapezius muscle flap was first described in 1979 by Mathes and Nahai [12]. Baek et al. in 1980 [13] then Yoshimura et al. in 1981 [14] improved this method by using this flap in an island version thus offering better aesthetic aspect and a grade 5 vascularization according to Mathes and Nahai (Fig. 9).

Figure 9  Vascularization of the trapezius muscle. A. View of the superficial scapular artery (SCA) and dorsal scapular artery (DSA) from the anterior aspect of the elevated muscle. B. Angiogram of global vascularization of the trapezius muscle.

Conclusion

The lower trapezius musculocutaneous island flap is a significantly advantageous tool if properly harvested. This one-stage surgical procedure is rapid and easy-to-perform and ensures reliable reconstruction by using a healthy and well-vascularized tissue of perfectly adapted size for best aesthetic results. It offers a good axis of rotation for proper coverage of very distant recipient sites up to the cervico-occipital region and allows a tension-free primary wound closure. It provides highly satisfactory functional results provided that the rhomboid muscle fibres are spared in order to compensate for the functional deficit induced by the trapezius harvest.

Conflict of interests

None.

References


