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Extremity soft-tissue sarcomas – reconstructive strategy of the post surgical resection

Mięsaki tkanek miękkich w lokalizacji kończynowej – strategia postępowania rekonstrukcyjnego

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Based on the authors' experience with twenty patients with extremity sarcoma who underwent reconstructive surgery subsequent to tumor resection and the review of current literature, the strategy of reparative approach is discussed. Such topics as the principles of planning, technical alternatives, results and complications of extremity reconstruction are reviewed. The utility of single-stage primary sarcoma resection, soft-tissue reconstruction, and radiotherapy for extremity preservation is presented. In patients who are unable to undergo primary wound closure after a complete resection, pedicled and free tissue flaps provide adequate wound coverage even in the setting of early postoperative brachyterapy.

Key words: sarcoma, reconstruction.

Na podstawie przeglądu literatury światowej i doświadczeń własnych autorów – u 20 pacjentów, którzy przeszli operacje rekonstrukcyjne natychmiast po usunięciu guza – omawiamy strategię postępowania rekonstrukcyjnego. Tematami są zasady planowania, chirurgiczne techniki operacyjne oraz wyniki i powikłania. Prezentujemy radioterapię oraz użycie jednoczasowej operacji z natychmiastową rekonstrukcją w przypadku zachowania kończyny w mięsakach tkanek miękkich. W dwóch przypadkach niemożliwe było pierwotne zeszycie rany i należało użyć płatów uszypułowanych, które zapewniły prawidłowe pokrycie rany nawet w przypadku pooperacyjnej brachyterapii.

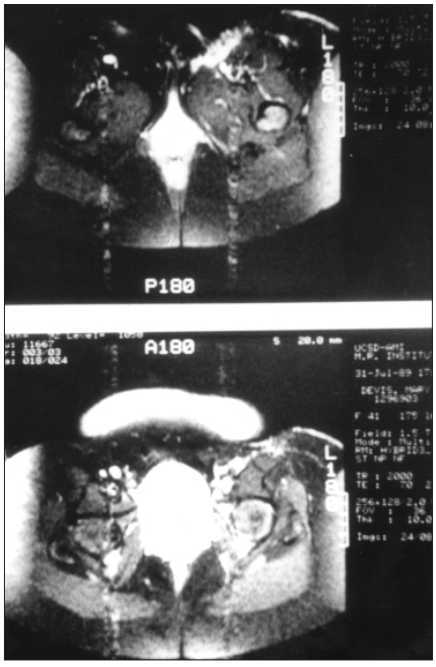
Słowa kluczowe: mięsak, rekonstrukcja.

Amputations have been the main method of treatment for extremity sarcomas until the late 1950s when the concept of radical compartment excision was introduced [1, 4]. However, limb salvage procedures were limited until 1970s, when extremity reconstructive techniques utilizing muscle flaps became popular [1, 6, 11]. With the development of microsurgical techniques in 1980s and further expansion of reconstructive capabilities, limb sparing surgery concepts became even more sophisticated and „aggressive" [1, 8]. On the other hand, advances in adjuvant therapy, the development of brachytherapy and external beam radiation technique, as well as systemic and regional chemotherapy, allowed for a less radical and more selective, surgical approach [6, 9, 10]. Furthermore, improvements in tumor imaging utilizing computed tomography and magnetic resonance imaging techniques increased the selectivity of resections and the successful compromise between adequate margins and preservation of functionally important structures (Photographs 1–4) [1, 4, 10, 12].

Extremity soft-tissue sarcomas have a local recurrence rate of 50% or more when treated with local excision alone [3, 4]. Amputative surgery has a recurrence rate of 5–20% within the stump [6]. With compartmental resections in the area of the thigh, the rate of local recurrence drops to below 10% [4]. Similar rates of disease control are accomplished by limb sparing surgery coupled with adjuvant therapy [1, 6, 7]. The goal of reconstruction of a post-sarcoma resection defect is to obtain stable wound coverage without oncological compromise.

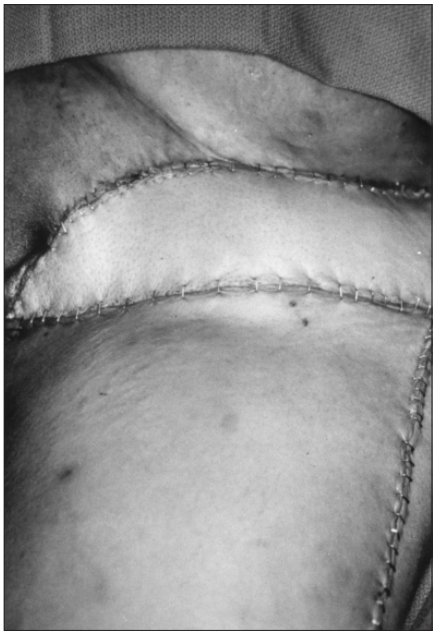
Reconstructive alternatives include: primary and delayed wound closure, skin grafts and flaps. The surgical solution has to be tailored to the specific nature, site,

Photograph 1. Forty-one year old female with dermatofibrosarcoma of the left groin



Photograph 2. Computed tomography scan showing a mass in the proximal part of the anterior compartment of the left thigh

Photograph 3. Intraoperative photo showing preserved medial motor branch of the femoral nerve and femoral artery visible medial to the nerve



Photograph 4. The vastus lateralis musculocutaneous flap was used to cover femoral vessels and nerve, and to repair the defect

Photograph 5. Fibrosarcoma of the knee area

Photograph 6. Extensive „three-dimensional" defect with knee joint exposure was repaired by means of median gastrocnemious muscle flap

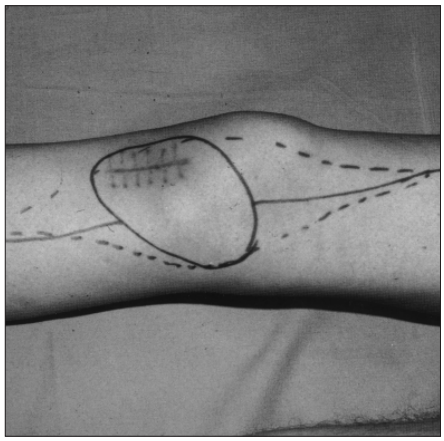
and size of the defect. During the multidisciplinary planning of treatment, such features of expected defect as its size, shape of the wound, vascularity, the exposure of structures requiring immediate coverage (blood vessels, nerves, joints and bones, tendons), and adjuvant treatment plans, all have to be known to the reconstructive surgeon (Photographs 5.–7.). It is rare that a wide, local, soft-tissue extremity sarcoma excision can be accomplished with primary closure. Skin grafts may be suitable for coverage of even extensive, but only two-dimensional defects without the exposure of vital structures and are preferably limited to cases when radiation is not anticipated. In most cases, post-sarcoma resection extremity defects have to be repaired by means of skin, muscle or myocutaneous pedicled or free flaps with their own blood supply. Complex, three dimensional defects can be repaired by means of such vascularized flaps (Photograph 8.–10.) [11]. For the treatment of combined soft-tissue and bone defects, composite, bone containing, flaps are available [13].

It is unfortunate that soft-tissue sarcomas of the hand tend to occur in young patients and are associated with a high incidence of lymphatic spread and regional lymph node metastases as well as a poor prognosis in general [12]. The recommended treatment is radical, frequently amputative, excision in conjunction with adjuvant radio- and/or chemotherapy [12]. Reconstructive surgery may include not only the procedure for immediate coverage but also secondary procedures for improved functional outcome.

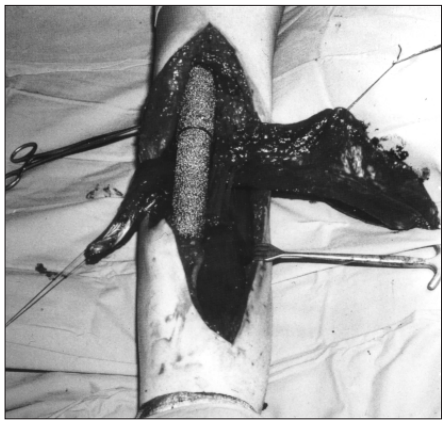
Adjuvant therapies may affect extremity reconstruction. Although there are radiotherapy and chemotherapy related complications, adjuvant therapy improves the results of surgical sarcoma treatment, especially in cases with high grade lesions, and recurrent tumors, and in situations with questionable margins [1, 3, 7, 9]. For example, preoperative radiotherapy, which has a major advantage in marginally resectable lesions, may result in a decrease of the healing potential of local tissue and increase the risk of infections after an otherwise successful tumor resection [1, 2, 7]. Impaired healing of the wound wall may lead to a dehiscence between the flap and the post-sarcoma resection defect.

Chemotherapy, and in particular, selective intra-arterial delivery of chemotherapeutics, may be associated with both intra-arterial catheter or chemical agent related arterial flow problems [3]. Therefore, it is imperative that for more extensive and complex wounds, the tissue for defect repair should be delivered from areas located beyond the post-chemotherapy/radiation irritation zone [3, 7]. Similarly, in case

Photograph 7. The muscle flap surface was subsequently covered with meshed split thickness skin graft



Photograph 8. Recurrent fibrosarcoma of the right medial knee area involving the joint



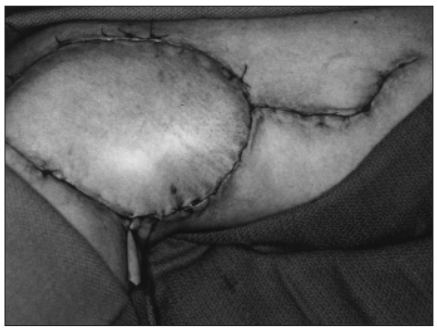
Photograph 9. This twelve year old boy had undergone resection of a soft tissue sarcoma, which included the knee joint, distal femur and proximal tibia. Non functional (no-flexion/extension) prosthesis, spanning femur-tibia defect, was placed. Few years later, when the patient achieved more skeletal maturity and completed his growth, cadaveric composite bone/joint allograft was placed

Photograph 10. Medial and lateral gastrocnemious muscle flaps, covering femur-tibia prosthesis, prior to the coverage by split thickness skin grafts

Photograph 11. Eighteen year old female with wide resection of recurrent liposarcoma of the medial knee area after removal of skin allograft and prior to the coverage with a free flap

of free tissue transfers, it is preferred that microanastomoses between the flap and the recipient site vessels are done in non-inflamed tissue [2, 7]. Reliable post-sarcoma resection defect coverage with well vascularised tissue flap allows aggressive, early, adjuvant therapy. For example, flaps tolerate well brachytherapy with after-loading catheters placed into the wound following resection (Photograph 11.–13.).

Tissue expansion, a frequently used modality in trunk reconstruction, has proven less useful in the extremities because of the high rate of extrusion of implanted devices [5]. Intraoperative methods of tissue expansion in a preradiated or in a field to be radiated postoperatively seem to be too risky



Photograph 12. Closure with a free groin skin flap. Brachytherapy catheters for the treatment with radioactive Eridian 192 were placed in the tumor bed by the radiation oncologist following resection and prior to the free tissue transfer

Photograph 13. Early follow-up after completion of brachytherapy

for consideration in repairs of soft-tissue sarcoma resection defects.

Biological dressings, such as skin allografts, may be useful for a temporary wound closure, for a day or two, as the final histological tests are pending, prior to the definitive „flap" closure (Photograph 11.).

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