

Clinical analysis of 45 cases of surgical treatment for inner thigh primary soft tissue sarcoma

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Abstract *Objective:* We aimed to study the relationship between clinical effect and surgical methods of inner thigh primary soft tissue sarcomas. *Methods:* Wide or radical resection were performed in 45 cases of soft tissue sarcomas, including 20 cases of postoperative recurrence after radiation therapy, 7 cases of first treatment. Thirty-six cases received 4–6 cycles of postoperative chemotherapy. *Results:* Thirty-eight of 45 cases were followed up for 1–5 years, with 5 case of recurrence and 6 cases of distant metastasis. *Conclusion:* The inner thigh primary soft tissue sarcoma can be effectively treated with wide or radical resection.

Key words soft tissue sarcoma; comprehensive therapy

Soft tissue sarcoma is a malignant tumor occurs in mesenchymal tissues, it is a rare tumor which accounts for only 1%–2% of adult malignancies, inner thighs and groin area are high incidence areas of sarcoma. 45 cases of inner thigh primary soft tissue sarcomas were treated in our hospital from 2005 to 2010, which are reported as follows.

Patients and methods

General information

There were 25 males and 20 females among the 45 cases, with a mean age of 49 years (11 to 85 years). The clinical surgical stages were [1]: 5 cases of period IA, 2 cases of IB, 26 cases of IIA, 12 cases of IIB. And in this group, there were 9 cases of malignant fibrous histiocytoma, 8 cases of synovial sarcoma, 7 cases of liposarcoma, 7 cases of dermatofibrosarcoma protuberans, 4 cases of fibrosarcoma, 4 cases of rhabdomyosarcoma, 3 cases of acinar soft tissue sarcoma, 2 cases of leiomyosarcoma, and 1 case of malignant schwannoma. Fifteen in the 45 cases involved single compartment, 30 involved double compartment; with 2 cases of femur involvement, 8 cases with neurovascular involvement. Tumor size was 3 to 28 cm.

Routine preoperative testing

X-ray, ultrasound, CT and MRI examination, angiography was taken to check the relationship between tu-

mor and blood vessels in 6 cases when ultrasound and MRI detected tumor involvement in femoral vessels, 5 underwent PET-CT examination. Thirty-four cases of recurrence were pathologically confirmed outside the hospital, 4 cases of recurrence received needle biopsy when pathological sections were not available, 4 of the initially diagnosed patients received preoperative needle biopsy with ultrasound localization, 3 received no preoperative testing as tumor was small and shallow, surgical planning was made according to the preoperative examination.

Treatment

Surgical incision was based on tumor traits, radical excision or wide excision was conducted at safe distance (tumor margin \geq 5 cm).

The skin around the original surgical scar and subcutaneous tissues should be removed in the surgery, and the needle biopsy channel be incised.

As for localized tumor at the inner thigh, when the tumor was located at the deep pectineal muscles, namely, at the junction of interior, rear compartment and lower part of the buttocks, block resection was performed for femoral muscles, part of the iliopsoas muscles and pectineal muscles.

For the tumor that located above the terminal point of long adductor muscle and below the obturator, if not grown directly on the adductor magnus, the adductor magnus muscle could be reserved while all the tissues on the adductor magnus muscles be removed. If it had broken the long adductor muscle fascia, combined radical

surgery might in need.

For tumors at the lower 1/3 area of interfemur, since the shallow layer of adductor magnus was near to the terminal point, and the deep layer transferred to tendon, so the tumor in this area should be considered as tumor in vascular space, which also belonged to the type of cross-chamber tumor. The relationship between tumor and the blood vessels in front, and the popliteal fossa behind should be analyzed in detail. The first vascular surgeries were mostly able to separate the blood vessels completely, such as the infiltration of blood vessel walls, in which vascular replacement surgery should be done.

Deep femoral artery and vein was another group of major blood vessels penetrating the medial compartment. It had several branches, especially the four arteries, which were quite close to the femur shaft. It's difficult to handle when sarcoma was large and closely tied with the blood vessels above, and it was best to dissect the periosteum to relax the blood vessels at first, went on then with ligation, the deep femoral arteries could be ligated together.

Periosteum could be removed when it's involved, the normal surrounding periosteum was incised first and then the periosteum involved was detached with a periosteum detacher.

For the femurs involved, if CT or X-ray shown bone destruction, partial roughing could be done for the light ones, meanwhile the thin layer of cortical bone could be incised in the surgery. When the tumor broke into the canal, it was best to resect the segment of bone with tumor, and conduct interlocking intramedullary nailing or perform the prosthesis replacement.

For the tumor of full compartment involvement, when sarcoma in the medial region of thigh involved the entire compartment, but had not yet broken the compartment walls, medial compartment resection could be performed.

Obturator nerves and blood vessels ran above the upper medial region of thigh and regulate the adductors. In the compartment removal, or the upper barrier removal, they could be removed along with the tumor. As the adductor muscle had a relatively minor function, neither nerve resection nor muscle resection had a large functional impact, no repair was in need;

When the tumor broke myolemma, especially for patients undergone repeated surgeries, it was inadvisable to rigidly adhere to a certain range of surgical procedures or dispose a lot of normal tissues to get an edge removal. Full consideration should be given to the multidimensional contact surfaces of sarcoma, so as to design an ideal cutting edge.

When sarcoma broke into the groin area, sarcoma at the primary site should get an edge-cutting, basing on the principle of extensive sarcoma resection in safe distance. Meanwhile, inguinal lymph node dissection should be

conducted, when sarcoma involved the skin, skin safe edge should be designed to conduct en bloc resection, including the skin. Turned to direct suture or transposable repair of pedunculated tissues after surgery.

Among 8 in this case group, the accretion between tumor and femoral nerve vascular was intrathecally freed at first and then inactivated for 30 min with ethanol; 2 cases of periosteal involvement underwent periosteal and partial cortical resection; 2 cases of obvious femoral artery involvement underwent artificial vascular grafting; 1 case of femoral vein involvement underwent the partial femoral vein resection; 2 cases of skin defects underwent skin flap grafting.

Routine postoperative pressure bandaging for wound surface, and local pressure bandage for skin grafting area. Routinely placed suction drainage tube for 3–7d, extubation was considered when drainage amount was less than 20 mL. Postoperative radiation therapy was added for patients who were found to have important blood vessels in the tumor compartment in operation (who had never undergone radiotherapy). 4 cases in this group underwent postoperative radiation therapy, with a conventional fractionated radiation dose of 2.0 Gy, 5 times a week, total dose was 60GY. They were followed up after radiation therapy, 36 cases underwent a postoperative chemotherapy of 4–6 cycles.

Results

Forty-five cases got complete resection, 2 cases of wound infection, in which 1 case was a poor skin graft healing, but were both healed after dressing. Wound lymphatic leakage was found in 5 cases, in which 2 cases were healed after local pressure, 1 case of postoperative bleeding healed after surgical suturing of lymphatic leak, 2 cases healed automatically. No neurological complications of vascular injury were found in this group. 38 cases were followed up for 1 to 5 years, 7 cases failed to be followed up. Five cases of reoperation after recurrence (both cases were recurrence after postoperative radiotherapy outside the hospital), 2 cases of recurrence died of lung metastasis; another 3 cases underwent re-excision, with no recurrence.

Discussion

Surgical resection and radiotherapy are basic models for the modern treatment of soft tissue sarcoma^[1], but surgery still takes dominance^[2], adjuvant radiotherapy may improve the local control rate for high-grade malignant soft tissue sarcomas, adjuvant chemotherapy may also be able to improve the survival rate for patients with high-grade malignant soft tissue sarcomas, resisting local recurrence^[3].

Surgical treatment is the primary means for local control of soft tissue sarcoma, treatment strategy depends on the tumor stage and tumor location^[4]. The desirable treatment is R0 resection, which retains the normal function. Amputation is taken into consideration unless all treatments failed^[5]. Except for the shallow tumors, which are less than 3 cm in diameter, do not cause injury, and are able to achieve extended resection in the initial surgery, the other tumors must get histological confirmation before surgery. R0 resection must be done to achieve radical treatment, regardless of the removal method, biopsy and drainage channels should be incised at the same time^[6]. For soft tissue sarcoma in apartment, compartment resection can be taken, and functional compartment resection is taken in more cases. There is a safe muscular incision edge, when implementing functional compartment resection, if the tumor is small, the involved muscle compartment do not need to be incised from starting point to the ending point, so as to get better functions and retain part of the muscle or muscle stump. It is generally believed that the incision of the marginal 5 cm of tumor tissue includes peripheral zone and most of the salient tumor focus. Compartment resection is the resection of starting and ending point at muscles or muscle groups, and it is only necessary when tumor invades the whole apartment. For soft tissue sarcoma outside apartment, the surgical treatment would be expanded incision^[7]. R0 resection usually requires resection of surrounding normal tissues (eg, fascia, periosteum, osteone, epineurium or adventitia), additional adjuvant therapy is needed sometimes. As far as clinical practice is concerned, whether the tumor locates in or outside the apartment, R classification is helpful for comparison of surgical efficacy, and it is the most practical method^[8]. Edge resection (along the tumor pseudocapsule), even intracapsular removal is inadequate, and often can't be compensated by other adjuvant therapy. R0 resection is suitable for most of the adult primary tumors without distant metastasis, and a certain limb function can be reserved. If R0 resection can not be done for the primary tumor, or R0 resection can only be achieved through amputation, then new adjuvant therapy (radiotherapy, chemotherapy, isolated limb perfusion therapy) is needed to shrink the local tumor and retain the limbs. If R0 resection can't be achieved even with the application of adjuvant treatments, amputation should be done for treatment or palliative^[5]. The possible reason behind might be tumor invasion of the joints, multiple compartments, nerves, etc, and only the non-functional limb or limb segment can be retained after R0 resection. Amputation should be considered if there are severe ulcers of tumor, intractable pain, uncontrollable bleeding, ichoremia, or for better care and improved quality of life^[9].

Since the small tumor gets plenty muscular soft tissues,

with a hidden location, being hard to cause pain, and is less likely to cause dysfunction when involved, it's difficult to detect the tumor when it is small. Patients in this group are mostly cases of recurrence, so regular check after surgery is very important, enhanced MRI is regularly done every 3-6 months to detect cases of early recurrence, so as to get radical resection if it's detected earlier.

Due to the loose tissues of inner thigh, tumor growth could be expanding or spreading along the tissue spaces, and always invading the groin area, which is especially clear in the cases of repeated recurrence after surgery. MRI is relatively sensitive to the soft tissue lesions, as a necessary examination, it could determine the edge and scope of tumor and reveal the relationship between tumor and blood vessel nerves, thus determines the apartment involved and the area to be cut in the surgery.

There are different views on the incision area of the upper part of medial compartment. Some scholars believe that, during the resection of medial compartment, the upper entry should include the obturator surroundings, as well as ramus pubicus, ischiadic ramus and so on. As the location is deep and a surgery is difficult to perform, we believe that with the involvement of other treatments and a better understanding of the characteristics of local anatomy, surgical scope should be appropriately reduced. The external obturator muscle is an enclosed structure with well obturator foramen, starting from the obturator annulus in the front lower area, the external obturator muscle runs horizontally behind the scleroma and ends in the trochanteric fossa behind the femur. The whole inner apartment looks like an inverted container and the external obturator muscle looks like the bottom. When the sarcoma has not yet reached or being close to the external obturator muscle, cutting edge, including the removal of external obturator muscle is theoretically acceptable. Such method is still adoptable when sarcoma is relatively closer with the obturator annulus, and postoperative radiotherapy or after-loading therapy should be added. It is only when the obturator annulus is involved that the incision of ramus pubicus and ischiadic ramus should be taken into consideration.^[3]

When the soft tissue sarcoma locates in the inner compartment and in particular involves the groin area, lymphatic return is frequent in this area, so enough attention should be given to the postoperative lymphatic leakage. Lymphatic leakage has been found in 5 cases in this group, considering that electric knife is often taken in the surgery, some tissues undergone blunt separation and the failure of lymphatic ligation, it is thus suggested here that during the tissue separation, especially the separation of tissue space around the blood vessels, suture ligation should be taken to reduce the occurrence of complications. When the much inner thigh muscle has been incised, the inner thigh is sunken and it would be

difficult for the skin to stick on the residual muscles, the skin is likely to be lifted when extending the limbs and leading to the skin necrosis after the surgery. Therefore, the muscles in the front and rear compartment should be sutured with the residual muscle, without gap, then bandage after surgery, and fix the thigh joint if necessary.

Controversies still remain over the clinical effect of postoperative radiotherapy or chemotherapy for soft tissue sarcoma [10]. Soft tissue sarcoma is not sensitive to radiotherapy. Since this type of tumor gets no real envelope, microscopic tumor foci may exist in the normal tissues surrounding the fake envelope, even in the distant parts, so the local recurrence rate after surgery can be as high as 48%–77%, the relapse rate could still remain at 30% after local wide resection. Therefore, in order to achieve optimal local control, operation scope needs to be expanded, and remove all the tissues that may get microscopic tumor foci, which often leads to the amputation and severely affects the patients' life quality. In recent years, the treatment of soft tissue sarcomas has undergone significant changes, and it has already shifted from a single surgical treatment to a combined treatment of surgery and radiotherapy [5]. Since the comprehensive treatment gets a high local control rate, and has a similar long-term survival rate as that of amputation, and most patients could keep a good function after radiotherapy thereafter, therefore, the comprehensive method has become the main treatment for soft tissue sarcoma [11]. As for the low-grade malignancy whose location allows for wide excision without causing significant dysfunction, a single surgery can be taken, and it would not make a significant difference of the local control and survival rate if radiotherapy is taken after the reoperation on recurred tumor [12]. As for the localized high-grade malignant soft tissue sarcoma, the treatments include surgical resection, radiotherapy and chemotherapy. If the tumor can not be completely removed, a variety of new adjuvant therapies should be taken, including ILP (isolated limb perfusion therapy), radiation therapy, or a systemic chemotherapy with or without local thermotherapy, which fully embodies the concept of multidisciplinary treatment [13]. In order to reduce unplanned surgical resection, at least one imaging needs to be done each time before tumor resection [14]. The independent prognostic factors of soft tissue sarcomas are tumor size, histological grade, location, with or without distant metastasis and local recurrence. Further clinical research is still in need to prove whether systemic chemotherapy can improve the overall prognosis of patients with localized lesion. Of course, systemic chemotherapy is required for the treatment of patients at stage IV.

Conflicts of interest

The authors indicated no potential conflicts of interest.

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