Forequarter amputation for malignant tumours of the upper extremity: Case report, techniques and indications

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Forequarter (interscapulothoracic) amputation is a major ablative surgical procedure that was originally described to manage traumatic injuries of the upper extremity. Currently, it is most commonly used in the treatment of malignant tumours of the arm. With the advent of limb-sparing techniques, primary forequarter amputation is performed less frequently, but remains a powerful surgical option in managing malignant tumours of the upper extremity; therefore, surgeons should be familiar with this procedure. A classic case report of forequarter amputation, with emphasis on indications and surgical techniques, is presented.

Key Words: Forequarter amputation; Interscapulothoracic; Sarcoma; Shoulder girdle; Upper limb

Forequarter (interscapulothoracic) amputation was first performed by Ralph Cuming in 1808. The first oncological forequarter amputation was reportedly performed by Dixie Crosby in 1836 for a case of osteosarcoma. In 1887, Paul Berger published a classic description of an anterior approach to forequarter amputation (1). The posterior approach was described by Littlewood in 1922 (1). Since then, numerous modified techniques, involving concomitant chest wall resection with reconstruction, have been described (2).

A forequarter amputation is a radical ablative surgical procedure that includes the entire upper extremity with its shoulder girdle (2). This procedure was originally described in the early 19th century to manage severe, traumatic injuries of the upper extremity (3,4). Currently, the most frequent indications are the presence of malignant tumours of the arm, axilla, shoulder and scapula (2).

Limb-sparing surgery, preceded and followed by effective chemotherapy with or without radiation therapy, has replaced the radical surgical approach for treating limb sarcomas in most cases (5). Amputation of the affected extremity was considered for many years to be the standard of care for treating and curing patients with bone and soft tissue sarcomas of the limbs. Recent advances in limb-sparing techniques have reduced the number of major amputations performed for tumours of the upper extremity (1). The purpose of the present article is to familiarize surgeons with the indications for surgical technique of this uncommon but valuable surgical procedure through presentation of a classic case report of forequarter amputation for a malignant tumour of the upper extremity.

CASE PRESENTATION

A 57-year-old man was referred for a large, indurated and painful left upper extremity mass that had been increasing in size for five months (Figure 1). He had limited function of his arm due to mass effect and persistent, intractable pain. A complete metastatic evaluation, including magnetic resonance imaging and computed tomography, only revealed a large left upper extremity soft tissue mass surrounding the axillary vessels (Figure 2). Needle-core biopsy of the mass was suggestive of malignant fibrous histiocytoma (Figure 3). After...
a multidisciplinary discussion involving medical and radiation oncology, it was decided that the patient required surgical resection before radiation. He underwent forequarter amputation via an anterior approach (Figure 4). Surgical pathology confirmed the specimen to be malignant fibrous histiocytoma with negative nodes and clear margins. The patient's postoperative course, including six weeks of radiation, was uneventful. He experienced only occasional phantom limb pain, which is a common sequela of forequarter amputation.

OPERATIVE TECHNIQUE
The surgical technique for the present case of forequarter amputation was originally described by Berger in 1887 (1). The patient was placed in a right lateral decubitus position to expose the thorax, with the left upper extremity freely able to rotate. An anterior approach was used for this forequarter amputation. A modified elliptical incision was made with the superior apex over the clavicle on one end and continued inferiolaterally. The inferior apex was made at the midaxillary line and continued posteriormost over the entire length of the scapula to join the superior apical incision. Soft tissue dissection was at the fascial level over the pectoralis major. The clavicle was exposed and divided at the proximal third; care was taken not to tear the underlying vein. The clavicle was carefully elevated to expose the subclavian artery, vein and brachial plexus. The subclavian artery was ligated and cut first, then the subclavian vein was tied and cut to prevent bleeding from the collateral blood supply of the shoulder. Branches of the brachial plexus were ligated and divided proximally (Figure 5). Next, the chest wall attachments of the pectoralis major and minor were divided. Posteriorly, fasciocutaneous skin flaps were developed and all periscapular muscles were released (Figure 6). This allowed the shoulder girdle to be freed and the whole extremity to fall away from the trunk. The anterior and posterior skin flaps were used to close the defect primarily. Any excess dog-ear skin was excised and closed primarily, and drains were placed.

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**DISCUSSION**

The goal of forequarter amputation (also known as shoulder girdle amputation) is to radically remove the bones and soft tissue of the upper extremities, including the scapula (1). Amputation of the affected extremity was considered, for many years, to be the standard of care for treating and curing patients with bone and soft tissue sarcomas of the limbs (5). Amputation surgery is not an abandoned idea today, but its application tends to be limited to cases of advanced disease that are unmanageable by a less radical approach or in patients with recurrent tumours after conservative treatment in whom limb salvage is not feasible anymore (6). Amputation has also been advocated as a palliative procedure for symptomatic, locally advanced disease that has already failed to respond to radiation therapy, chemotherapy and limited surgery (7). Forequarter amputation is usually performed when a limb-sparing operation is not possible, either following a severe injury to the upper limb or in managing primary soft tissue or bone tumours of the upper extremities. The indications include but are not limited to:

- There are no metastases to any other organs.
- Prognosis for treatment with chemotherapy or radiation therapy are considered extremely poor.
- Wide local excision is technically not feasible.
- The age and health of patient allows for a major surgical procedure, but not a series of reconstructive procedures.

**REFERENCES**