



## Osteomusculocutaneous flap for clavicular reconstruction: a case report

### *Osteomuskülokütanöz flep ile klavikula rekonstrüksiyonu: Olgu sunumu*

Mustafa YEL,<sup>1</sup> M. Nazım KARALEZLİ,<sup>1</sup> Zekeriya TOSUN,<sup>2</sup> Serhan SEZGIN,<sup>1</sup> Nedim SAVACI<sup>2</sup>

Meram Medical School University of Selcuk, <sup>1</sup>Department of Orthopaedic Surgery, <sup>2</sup>Department of Plastic Surgery

Tümör tedavisinde kullanılan radyoterapi yumuşak doku nekrozu, kemik nekrozu ve patolojik kırıklara neden olabilmektedir. On yıl önce meme kanseri nedeniyle geçirdiği radikal mastektomi sonrasında radyoterapi gören 47 yaşındaki kadın hasta sol klavikulada meydana gelen patolojik kırık nedeniyle başvurdu. Hastaya kaburga ve latissimus dorsi ile beraber altıncı kaburğanın 4 cm'lik parçasını içeren osteomuskülokütan flep ile tedavi uygulandı. Kaynama ameliyat sonrası üçüncü ayda sağlandı. Verici saha morbiditesi kozmetik açıdan kabul edilebilir derecedeydi ve omuz fonksiyonlarında ilerleme sağlandı. Hastanın 38 aylık izlemi sonrasında Constant omuz skoru 36'dan 88'e yükseldi.

**Anahtar sözcükler:** Kemik transplantasyonu; klavikula/yaralanma; radyoterapi/yan etki; cerrahi flep.

Radiotherapy for tumors can cause soft tissue necrosis, osteonecrosis, and pathologic fractures. A 47-year-old woman presented with a pathologic fracture of the left clavicle 10 years after radiotherapy following radical mastectomy for breast cancer. She was treated with a compound rib-latissimus dorsi osteomusculocutaneous flap with a 4-cm segment of the sixth rib. Fusion of the bones was achieved in three months. Donor site morbidity was cosmetically acceptable and function of the shoulder was improved. The Constant shoulder score which was 36 preoperatively increased to 88 after 38 months of follow-up.

**Key words:** Bone transplantation; clavicle/injuries; radiotherapy/adverse effects; surgical flaps.

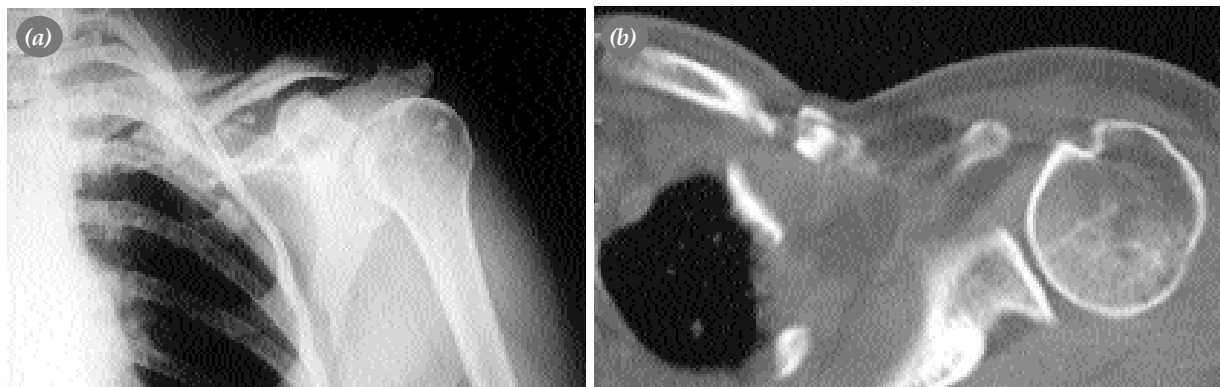
Radiotherapy for tumors can cause soft tissue necrosis, osteonecrosis, and pathologic fractures. The clinical outcome of clavicular fractures associated with radiation therapy are unsatisfactory because of the radiation-induced necrosis of the bone and the soft tissue.<sup>[1,2]</sup>

Clavicular fractures has been treated with various surgical techniques.<sup>[1,3-5]</sup> Clavicular reconstruction using a flap based on the thoracodorsal system with latissimus dorsi and serratus anterior with a rib was first described by Devaraj VS et al.<sup>[3]</sup> Although fascial and humeral reconstruction with vascularized rib grafts is well documented and frequently used, there are few reports for clavicular or upper extremity reconstruction with this grafts.<sup>[3,5]</sup>

In this study a 47-year-old woman who was treated with a compound rib-latissimus dorsi osteomusculocutaneous flap with a 4-cm segment of the sixth rib for a pathologic fracture of the left clavicle 10 years after radiotherapy following radical mastectomy for breast cancer was presented.

### Case report

A 47 year-old female was evaluated for the complaints of persistent pain, swelling and drainage in the left clavicular region, oedema in the left upper limb, and functional disability of the left shoulder for one year. The patient had breast cancer that had been treated with radical mastectomy and subsequent radiation therapy 10 years ago. There was



**Figure 1.** Preoperative radiograph (a) and CT image (b) of the left shoulder showing comminuted pathologic fracture of the left clavicle

wide scar tissue in the left chest. Spontaneous pathologic fracture of the left clavicle occurred one year ago. Eight bandages and shoulder arm immobilizer were applied, but clavicular fracture was remained ununited .

The patient had radiation induced fibrosis and necrosis in the left shoulder and clavicular area. The skin and the soft tissues around the clavicle was very fragile and fibrotic. Abduction, medial rotation, flexion and extension of the left shoulder were restricted. The patient had oedema in the left upper limb. Constant score of the left shoulder was 36 points. Direct radiography and computerized tomography showed comminuted pathologic fracture of the left clavicle (fig.1a,b). Technetium-99 bone scan showed increased uptake of the left clavicular region (fig.2). Incisional biopsy was performed for the differential diagnosis of metastasis of the primary cancer or radiation induced sarcoma and

pathologic examination of the tissue revealed necrotic fibrosis. The bony fragments in the middle third of the clavicle were sequestered. Sequestered fragment of the clavicle was excised with debridement of the necrotic and the fibrotic tissues of the overlying skin. Clavicle was reconstructed with compound rib-latissimus dorsi osteomusculocutaneous flap with a 4cm segment of the sixth rib. The bone graft was stabilized with a K-wire to the clavicle with shish-kebab fashion (fig 3). The shoulder was immobilized for two months with a shoulder arm immobilizer. She had rehabilitated for one month to improve the shoulder and left upper extremity function. K-wire was removed three months postoperatively. The shoulder functions were improved and constant score was increased to 88 and she was painless during the final follow-up 31 months postoperatively (fig 4).



**Figure 2.** Preoperative Technetium-99 bone scan showing increased uptake of the left clavicular region



**Figure 3.** Postoperative radiograph showing stabilization of the flap with a K-wire



**Figure 4.** Postoperative radiograph showing the shoulder function

## Discussion

Radiotherapy can cause soft tissue necrosis or osteonecrosis, pathologic fracture, and postradiation sarcoma in the affected bones.<sup>[1,2]</sup> In cases with infection and soft tissue fibrosis, there is a problem in closure and healing of the skin overlying the clavicle.

Persistent nonunion of the clavicle has been treated with various surgical techniques. Treatments with microvascular transfers with fibula, medial femoral condyle or rib as a composite flap including the serratus anterior and/or latissimus dorsi has reported to be the ideal method for this condition<sup>[1,3-5]</sup>

Free fibula is widely used for reconstruction of bony defects, but a high failure rate has also been reported.<sup>[6,7]</sup> Fuchs has reported the transfer of free vascularized corticoperiosteal bone flaps from the medial femoral condyle for post-radiation-induced fractures or chronic nonunions of the clavicle in three patients.<sup>1</sup> They fixed the clavicle with a plate. Although these two techniques has good results, microvascular expertise is necessary and operation time is longer than pedicled rib transfer.

Fascial and humeral reconstruction with vascularized rib grafts is well documented and frequently used, but there are few reports for clavicular reconstruction with this grafts.<sup>[3,5,8]</sup>

Although the use of vascularized bone grafts alone with or without accompanying composite soft-tissue transplants for bone reconstruction has been recommended for bone defects larger than 6 cm,<sup>7</sup> the chances of healing fractures associated with radiation therapy are low, and consequently, the clinical outcome is unsatisfactory. For this reason in this case, the clavicle was reconstructed with a vascularized graft since the defect was four cm and the defects both in the skin and the clavicle was reconstructed with a osteomusculocutaneous flap based on the thoracodorsal system with latissimus dorsi. Fixation of the bone segment to the clavicle was achieved with shish-kebab fashion with one K-wire as it is easier than plating and infection would be a problem as the patient had necrotic and fibrotic tissues with infection in the operating area.

In conclusion, compound rib-latissimus dorsi osteomusculocutaneous flap for reconstruction of persistent nonunion of the clavicle with fibrosis or necrosis in the overlying skin should be considered. The operation is easy and morbidity is lower.

## References

1. Fuchs B, Steinmann SP, Bishop AT. Free vascularized corticoperiosteal bone graft for the treatment of persistent nonunion of the clavicle. *J Shoulder Elbow Surg* 2005;14:264-8.
2. Markbreiter LA, Pelker RR, Friedlaender GE, Peschel R, Panjabi MM. The effect of radiation on the fracture repair process. A biomechanical evaluation of a closed fracture in a rat model. *J Orthop Res* 1989;7:178-83.
3. Devaraj VS, Kay SP, Batchelor AG. Vascularised reconstruction of the clavicle. *Br J Plast Surg* 1990;43:625-7.
4. Momberger NG, Smith J, Coleman DA. Vascularized fibular grafts for salvage reconstruction of clavicle nonunion. *J Shoulder Elbow Surg* 2000;9:389-94.
5. Unlu RE, Kargi AE, Celebioglu S, Erdogan B, Sensoz O. Reconstruction of the upper extremity with a compound rib-latissimus dorsi osteomusculocutaneous flap. *Scand J Plast Reconstr Surg Hand Surg* 2002;36:34-8.
6. Han CS, Wood MB, Bishop AT, Cooney WP 3rd. Vascularized bone transfer. *J Bone Joint Surg [Am]* 1992;74:1441-9.
7. Wood MB. Upper extremity reconstruction by vascularized bone transfers: results and complications. *J Hand Surg [Am]* 1987;12:422-7.
8. Davison SP, Boehmler JH, Ganz JC, Davidson B. Vascularized rib for facial reconstruction. *Plast Reconstr Surg* 2004;114:15-20.