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Reconstruction of a Post-Burn Contracture of the Elbow Using a Pedicled Latissimus Dorsi Flap

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Abstract

Post-burn scar contractures of the elbow can significantly impair activities of daily living and often require surgical reconstruction. We report a case of elbow reconstruction using a pedicled latissimus dorsi flap. An 81-year-old woman developed a post-burn scar contracture of the right elbow following a scald injury. Preoperative elbow range of motion was 130˚ in flexion and −75˚ in extension. After scar excision and contracture release, a 14 × 9 cm skin defect was reconstructed using a pedicled latissimus dorsi flap. Early rehabilitation was initiated on postoperative day one. The postoperative course was uneventful, and the patient was discharged home one month after surgery. At six months postoperatively, elbow range of motion improved to 140˚ in flexion and −10˚ in extension, allowing independent performance of daily activities. Pedicled latissimus dorsi flap reconstruction provided well-vascularized soft tissue coverage and enabled early rehabilitation, resulting in favorable functional recovery.

Keywords

Post-Burn Scar Contracture, Elbow Contracture, Pedicled Latissimus Dorsi Flap, Burn Reconstruction, Early Rehabilitation

1. Introduction

Post-burn scar contractures are among the sequelae that cause not only aesthetic concerns but also limitation of joint range of motion, significantly impacting ac-

tivities of daily living (ADL). They are most commonly reported in the head and neck and the upper extremities [1].

Because of the substantial functional impairment they cause, post-burn scar contractures often require appropriate therapeutic intervention. Scar contractures affecting the major joints of the upper extremity can impair fine motor function required for activities such as feeding and dressing. Therefore, selecting an appropriate treatment approach is essential.

Herein, we report a case of post-burn elbow contracture in an elderly patient successfully treated with a pedicled latissimus dorsi flap, along with a brief review of the relevant literature.

2. Case Report

Patient: An 81-year-old woman.

Chief complaint: post-burn scar contracture of the right antecubital region.

History of present illness: Nine months prior to presentation, the patient sustained a scald injury to her right upper extremity from hot water at home. The burn was initially assessed as a partial-thickness burn and was treated conservatively with topical ointment therapy at a local dermatology clinic. Details regarding the extent of the initial burn were unavailable.

The burn wounds subsequently epithelialized. However, she developed a contracture of the right elbow and was referred to our department.

Past Medical History: hypertension and type 2 diabetes mellitus.

Social History: right-handed. She used a spoon with her left hand when eating and modified her clothing by cutting the right sleeve to facilitate dressing.

Physical Examination: A burn scar measuring 12 × 7 cm was observed in the right antecubital region. Severe limitation of extension was noted in the right elbow, with a passive range of motion of 130˚ in flexion (**Figure 1**) and −75˚ in extension (**Figure 2**). No limitations were observed in the right shoulder, right wrist, or in the contralateral upper extremity. Preoperative computed tomography showed no evidence of heterotopic ossification around the right elbow.

Figure 1. Preoperative flexion of the right elbow (130˚).

Figure 2. Preoperative extension of the right elbow (−75˚).

Clinical Course: The patient was diagnosed with a post-burn scar contracture of the right elbow. Given the severity of the contracture and its substantial impact on ADL, surgical treatment was selected without additional nonoperative treatment after referral to our department. Eleven months after the injury, she underwent scar excision followed by reconstruction with a pedicled latissimus dorsi flap under general anesthesia. After scar excision and release of the contracture (**Figure 3**), a 14 × 9 cm skin defect was created (**Figure 4**), and right elbow extension improved to −30˚. Partial exposure of the median cubital vein was noted. A pedicled latissimus dorsi flap with a 14 × 9 cm skin island (**Figure 5**) was designed to cover the defect, with the pivot point located at the right axilla (**Figure 6**). The flap was elevated including both the transverse and descending branches of the thoracodorsal artery. Because the flap could be transferred to the defect without tension, division of the latissimus muscle at its origin was not required. The flap was inset and secured to the defect using bolster sutures. An additional skin incision was made along the right upper arm from the axilla to the defect. After the flap pedicle was tunneled through this route, the incision and donor site were closed primarily.

Figure 3. Design of scar excision.

Figure 4. After scar excision and contracture release.

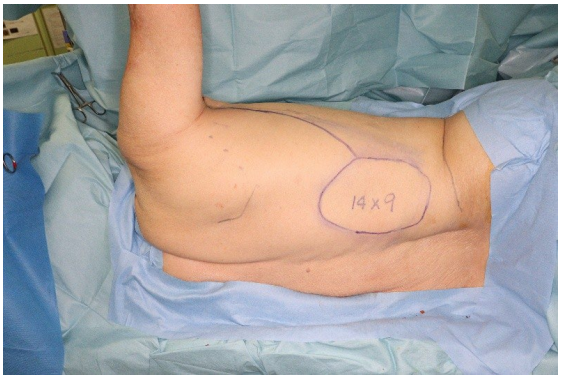

Figure 5. Design of the pedicled latissimus dorsi flap.

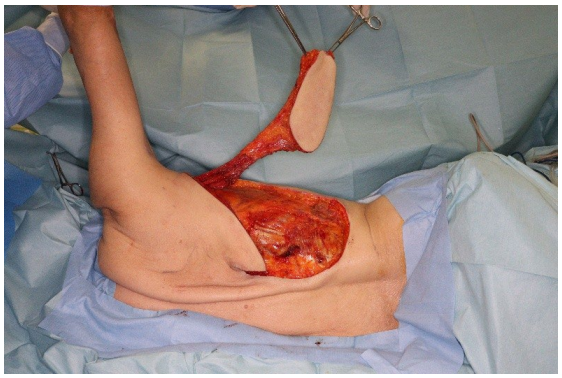

Figure 6. Pedicled latissimus dorsi flap after elevation.

Postoperatively, the right upper extremity was immobilized in a splint extending from the shoulder to the wrist. Beginning on postoperative day 1, the splint was removed during rehabilitation sessions, and passive range-of-motion exercises of the upper extremity as well as general rehabilitation were performed twice daily to the maximum range tolerated by the patient. The splint was maintained outside rehabilitation sessions for one week after surgery. Flap survival was uneventful. After discharge, outpatient rehabilitation was continued twice weekly. At

six months postoperatively, the passive range of the right elbow had improved to 140˚in flexion (Figure 7) and −10˚in extension (Figure 8). No shoulder contracture or loss of shoulder muscle strength was observed. The patient was independent in ADL and was able to perform purposeful tasks, including dressing and eating with the right hand.

Figure 7. Flexion of the right elbow (140˚) at six months postoperatively.

Figure 8. Extension of the right elbow (−10˚) at six months postoperatively.

3. Discussion

Post-burn scar contractures are one of the most common sequelae occurring in the head and neck region and the upper extremities [1]. In addition to aesthetic concerns, contracture-related functional impairment can significantly limit activities of daily living. These impairments often interfere with social reintegration and reduce patients' quality of life. Goverman *et al.* analyzed adult burn patients admitted to burn centers and reported that approximately one third of patients developed joint contractures at hospital discharge despite early therapeutic interventions such as appropriate positioning and splinting following skin grafting [2]. Therefore, post-burn scar contractures remain an important clinical challenge. Among the major joints, the elbow is the second most frequently affected site after the shoulder, with contractures reported in 19.9% of burn patients [2]. Because elbow motion involves not only flexion and extension but also pronation and supination of the forearm, the joint is particularly susceptible to scar contracture and recurrent

limitation [1] [3]. The normal range of motion of the elbow is 0˚ - 145˚, and a functional range of 30˚ - 130˚ is required for activities of daily living [4]. Patients who continue to demonstrate less than 100˚ of flexion-extension capability despite intensive nonoperative treatment should be considered for surgical intervention [3]. In addition, patients who develop antecubital scar irritation or recurrent ulceration caused by repetitive extension forces may also benefit from surgery [3].

Kung *et al*. classified elbow burn scars into mild, moderate, and severe categories based on the degree of contracture and depth of tissue involvement. They emphasized that the choice of surgical treatment should be tailored to the severity of the contracture [3]. Contractures caused by linear scars or superficial scars that do not involve the tendons or joint capsule are classified as mild. These contractures can be reconstructed using local flap techniques such as Z-plasty, V-Y advancement, or X-plasty [3] [5]-[7]. In addition, skin grafting may be an option when excision of the scar results in a defect that cannot be closed primarily. In contrast, scars that extensively involve the entire antecubital fossa or cases requiring ulnar nerve decompression are classified as moderate. Although skin grafting may be used to resurface the defect, the lack of intrinsic vascularity in skin grafts increases the risk of recurrent contracture. Thus, pliable and well-vascularized flaps are preferred to maintain joint mobility [1]. The choice of flap depends on the size of the defect after scar excision and whether neurovascular structures or joint components are exposed. Specifically, reconstructive options include the radial artery flap, the ulnar artery flap and the reverse-flow upper arm flap [8] [9]. In addition, muscle flaps, such as the pedicled latissimus dorsi flap, offer abundant vascularity and may help reduce the risk of recurrence [10]-[12]. However, these flaps can be excessively bulky, potentially limiting elbow flexion after surgery [3].

In severe contractures, scars extend into deep structures such as the fascia, muscle, and joint capsule. These cases are frequently associated with peripheral nerve dysfunction and heterotopic ossification. Management typically involves scar excision and coverage with well-vascularized flaps. Depending on the extent of involvement, additional procedures such as nerve decompression or neurolysis, excision of heterotopic bone, capsulectomy, biceps tendon lengthening, and myotomy may be required. Surgical intervention is usually delayed until at least one year after injury to allow scar and heterotopic bone maturation [3]. When the resulting skin defect is extensive and cannot be adequately covered with local or pedicled flap, free flaps such as the anterolateral thigh flap are indicated [13].

In the present case, hypertrophic scarring extensively involved the entire antecubital fossa, and excision of the scar resulted in exposure of the median cubital vein. According to the severity classification proposed by Kung *et al*., this case was therefore categorized as a moderate contracture. Reconstructive options considered included full-thickness skin grafting, pedicled flaps, and free flaps (**Table 1**).

Table 1. Comparison of reconstructive options in the present case.

	Advantages	Disadvantages
Full-thickness skin grafting	• Technical simplicity • Minimal invasiveness	• Risk of joint contracture due to postoperative immobilization • Not suitable for coverage of exposed tendons or vessels • Risk of recurrent contracture
Pedicled flaps	• Technically simpler than free flaps • Less invasive than free flaps • Allows early mobilization • Low risk of recurrent contracture	• Limited reach of the flap
Free flaps	• High flexibility in flap design • Low risk of recurrent contracture	• Technically complex and time-consuming • Greater surgical invasiveness • Risk of vascular thrombosis • Difficulty in early mobilization

Although skin grafting is technically simple, advanced age raised concerns about joint contracture due to postoperative immobilization and recurrent contracture. Free flap reconstruction offers greater design flexibility and a lower risk of recontracture; however, it is more invasive and requires postoperative immobilization. In contrast, pedicled flaps provide reliable vascularity, carry a lower risk of recontracture, and are less invasive and technically simpler than free flaps, making them more suitable for elderly patients. In the present case, a pedicled latissimus dorsi flap was selected because it could reach the antecubital fossa, provide sufficient tissue volume, and allow primary closure of the donor site. Elbow reconstruction using a pedicled latissimus dorsi flap was first reported by Schottstaedt *et al*. in 1955 [14]. The pedicled latissimus dorsi flap provides abundant vascularity, allowing safe harvest of a long vascular pedicle with a large skin and soft tissue component [14]. Owing to its reliable blood supply and sufficient tissue volume, this flap is associated with a low risk of recurrent contracture [1], and it can reach up to 8 cm distal to the olecranon, making it well suited for elbow reconstruction [15]. Kung *et al*. noted that muscle flaps may become bulky and can result in limitation of elbow flexion [3]. In the present case, the muscle bulk was reduced except around the vascular pedicle, and no postoperative limitation of elbow flexion was observed. Furthermore, the pedicled latissimus dorsi flap provides stable vascularity and sufficient pliability, enabling early mobilization and aggressive rehabilitation, which supports improved elbow extension [1] [3]. In the present case, the splint was removed on postoperative day 1, and range-of-motion exercises of the elbow were initiated, successfully preventing postoperative decline in activities of daily living and secondary joint contracture. Immediately after surgery, the elbow range of motion was 80˚in flexion and −30˚in extension; however, with continuous rehabilitation from the early postoperative period, the patient was able to resume independent living at home as early as one month after surgery. Contin-

ued outpatient rehabilitation after discharge led to further improvement, with elbow range of motion reaching 140˚ in flexion and −10˚ in extension at six months postoperatively.

4. Conclusion

We achieved a functional improvement in elbow range of motion by reconstructing a post-burn contracture in an elderly patient using a pedicled latissimus dorsi flap. As elbow contractures significantly impair daily functioning and carry a high risk of recurrence, surgical planning should be tailored to contracture severity, defect size, and the patient's condition, along with early mobilization and rehabilitation.

Ethical Approval

Ethical approval was not required for this case report in accordance with institutional policy because no identifiable patient information was included.

Consent for Publication

Written informed consent for publication of this case and the accompanying images was obtained from the patient.

Author Contributions

M.H. was responsible for the clinical management of the patient, performed the surgery, and drafted the manuscript. All authors reviewed and approved the final manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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