Annals of Clinical and Analytical Medicine
Original Research

Long-lasting axillary burn contracture problem in developing countries: underlying reasons and solution suggestions

Outcomes of axillary contractures

Cenk Melikoglu[1] Fikret Eren[2]

[1]Clinic of Plastic and Reconstructive Surgery, Ekol Hospital, İzmir, Türkiye.
[2]Clinic of Plastic and Reconstructive Surgery, Reyyap Hospital, İstanbul, Türkiye.

Abstract

Aim: In this article, we aimed to share our results of axillary contracture release operations and opinions on management protocols to obtain optimal postoperative results.

Methods: Ten patients were operated between September 2004 and June 2013. All patients were male. The age distribution was between 20-24, and all patients had axillary contractures for more than 10 years. In our study, split thickness skin grafts, full- thickness skin grafts, local flaps, perforator flaps and a combination of these techniques were used to release axillary contractures. Following the postoperative period, all patients were included in a program of both passive, and assistive ROM exercises.

Results: In our ten-patient case series, despite each patient had some degree of joint motion gains, we reached suboptimal outcomes. Only 3 of 10 patients reached 180-degree arm abduction. We also reached optimal 180-degree shoulder abduction in our 3 cases that had been operated with pedicled flaps.

Conclusion: All 2nd or 3rd-degree axillary region burns should be hospitalized in a burn unit. Particular attention should be paid to pediatric patients to avoid burn contractures in axillary regions.

Keywords

axillary contractures, burn injury, perforator flaps, pre-expanded flaps

DOI: 10.4328/ACAM.20502 Ann Clin Anal Med 2026;17(9): 979-982
Received: 26.01.2021 Accepted: 06.05.2021 Published Online: 13.01.2026 Printed: 01.09.2026
Corresponding Author: Cenk Melikoglu, Clinic of Plastic and Reconstructive Surgery, Ekol Hospital, İzmir, Türkiye.
E-mail: cenkmelikoglu@gmail.com **P.:** +90 232 386 55 05
Corresponding Author ORCID: https://orcid.org/0000-0002-6944-721X
Other Authors ORCID: Fikret Eren, https://orcid.org/0000-0001-6711-3534

Introduction

Axillary contractures are long- term complications of deep burn injuries in the axillary region. Shoulder abduction is limited to more than 120 degrees, and all upper extremity motions are decreased due to band formation and thickened skin.[1] Daily activities are impaired with axillary contractures, moreover, the psychological status of patients is deteriorated.[2] All kinds of daily activities are impaired with the existence of axillary contractures because the most of hand, forearm and arm movements need regular and proper shoulder movements.[3] Pediatric age group patients comprise the vast majority of burn patients,[4] and children tend to accommodate to therapy regimens poorly.[5] Thus, children tend to have contracture formation more frequently compared to adult age group patients. The frequency of axillary contractures has been reported as high as 27%–38% [6,7] and the patients living in developing countries are more prone to serious contractures.[8]

In the English literature, there is no consensus on the classification of axillary contractures or on the selection of perfect surgical release technique. Split thickness skin grafts, full- thickness skin grafts, local flaps,[9,10] pedicled flaps,[11,12] perforator flaps,[13,14] pre-expanded pedicled,[2,8,13,15] and many pre-expanded,[2] or non-expanded free flaps are reported to be used in axillary contracture releases. In this study, we aimed to share the outcomes of our experiences with axillary contracture release operations and ideas to reach optimal results.

Materials and Methods

This is a multicentral retrospective case series study. All patients were male. Age distribution ranged from 20 to 24 years, and all patients had axillary contractures for more than 10 years. The average age of patients was 21,5 years. The main duration of contractures before surgery was 15,6 years. We have not used classification criteria and chose the surgical technique based on clinical consensus. Split thickness skin grafts, local flaps, local flap + split thickness skin graft, perforator flap, perforator flap + split thickness skin graft were used in our operations as outlined in Table 1. All patients received physiotherapy in the post-operative period and only 2 patients had 10% partial flap loss (Supplementary Figure S1 a, b, c, d).

Pre-operative and post-operative goniometric measurements were recorded. Results were listed as optimal if the patient had reached 180 degrees shoulder abduction. Postoperative shoulder abductions below 180 degrees were listed as suboptimal. Shoulder abduction gain was also considered in each case.

All patients have signed informed constent before submission.

Ethical Approval

This study did not require ethical approval according to the relevant guidelines.

Statistical Analysis

Data were analyzed descriptively. Continuous variables were summarized using means, and categorical variables were presented as numbers. No inferential statistical analyses were performed because of the descriptive case-series design.

Reporting Guidelines

This study was reported in accordance with the STROBE guidelines.

Results

In our ten-patient case series, despite each patient had some degree of joint motion gains, we reached suboptimal outcomes. Only 3 of 10 patients reached 180-degree arm abduction. All our patients have had burn injuries in their pediatric ages, more than 10 years before contracture release surgery. Familiarity to living with such a condition in pediatric, adolescent and adult ages make those patients to be adapted to perform their daily motions in a restricted way. Some degree of soft tissue and joint stiffness can accompany this condition. Such factors are among the causes of suboptimal results (Supplementary Figure S3 a, b).

Discussion

Joint contractures can be avoided with proper burn care, casting and physiotherapy. Those kinds of essential methods are best given in burn care centers. Some patients cannot reach the healthcare system due to possible low social, economic and cultural level in developing countries. Thus, those kinds of patients may remain untreated in case of a burn injury and even unoperated for long periods of time. In our country, every male individual has an obligatory military service task at the age of 20. Thus, patients coming from low socioeconomic and low sociocultural levels may find high-quality health care opportunities in military hospitals. This is why we can reach those long-lasting axillary contracture

Table 1. Patients Data

Patients	Age	Sex	Burn injury and operation, y	Surgical technique	Shoulder abduction degrees		Shoulder abduction gain	
					Pre-operative	Post-operative	Degrees	%
1	21	Male	18	STSG	130	160	30	23.07
2	22	Male	17	LF+STSG	140	165	25	17.8
3	20	Male	13	LF	110	145	35	31.8
4	20	Male	13	PF	160	180	20	12.5
5	24	Male	15	LF	40	110	70	175
6	23	Male	14	LF	90	155	65	72.2
7	20	Male	18	LF	20	90	70	350
8	20	Male	16	LF	70	90	20	28.5
9	22	Male	17	PF+STSG	90	180	90	100
10	23	Male	15	PF	100	180	80	80

STSG, Split thickness skin graft; LF, Local flap; PF, perforator flap

patients who have not been operated for more than 10 years. The surgical approach to axillary contractures resulting from burn injuries is a challenging field for a reconstructive surgeon. Because there is no consensus on the classification system. As Lykoudis et al [15] mentioned, many authors [16-19] had classified have axillary contractures or modified previously defined classifications. Recently Grishkevich published a new classification system based on a large patient series with 346 operations on axillary contracture releases.[12] Due to the lack of a widely accepted and routinely used classification system, the same kind of patients with axillary contractures can be operated in a very large scale of different techniques, changing from simple skin grafts to free flaps (Supplementary Figure S2 a, b). Every technique has its own "pros and cons". The splitthickness skin grafts lose their popularity, in spite of technical convenience, due to cosmetically undesired appearance in longterm and tendency to recontracture.[17] Z-plasty, W-plasty-like techniques remain options for release surgery, but poor skin quality of adjacent tissues in cases of large burn sequel areas can cause complications like partial or total flap loss. In the literature, many pedicled and pre-expanded pedicled flaps have been described for axillary contracture release surgeries. Such options can be more effective than local flaps or split-thickness skin grafts. During axillary contracture release surgery, adjacent axillary neurovascular anatomic structures can be exposed perioperatively, and should be covered by a strong soft tissue. This kind of problem can be better overcome by pedicled flaps like Latissimus dorsi muscle flap or preexpanded latissimus dorsi flap.[15] Local flaps like trapezeflap [9] and double opposing rectangular advancement flap;[10] pedicled flaps like posterior arm flap,[11] quadrangular local scar subcutaneous pedicled flap;[12] perforator flaps like circumflex scapular perforator (CSP) propeller flap,[13] thoracodorsal artery perforator (TDAP) fasciocutaneous flap;[14] pre-expanded pedicled flaps like Latissimus dorsi flap,[15] TDAP flap,[2,8] and many pre-expanded,[2] or non-expanded free flaps are reported. Our results were somehow suboptimal when compared to Kulahci et al.'s paper,[8] in which adult age group axillary contracture cases had been operated with a pre-expanded pedicled thoracodorsal artery perforator flap and Hocaoglu et al.'s paper,[2] in which pediatric age group patients had been operated with pre-expanded perforator flaps of the dorsolateral trunk. This may be due to the inadequacy of split- thickness skin grafts, local flaps and their combined use in severe contractures. We also reached optimal 180-degree shoulder abduction in our 3 cases that had been operated with pedicled flaps. We, as reconstructive surgeons, know that prevention is the best solution in a deformity correction surgery. Children tend to have more burn injuries compared to adults, and complication rates are higher for children. One review with 3146 patients also showed that[6] 82% of follow-up patients who had contracture formation were under 5 years of age.[20,21] In the same paper with 3000 patients, the author also expressed that the axillary region is a very special region because all axillary burn injuries cause contracture formation to any degree. The author also published that the median time for a contracture occurrence is 12.1 months and the maximum time is 13 months. According to this information, all axillary burn injuries, especially children, should be followed a minimum of 13 months for contracture formation. Webbs et al. in their prospective case series with 25 axillary burn patients expressed that approach to shoulder burns with a flowchart would be very useful and patients achieved full range of motions and all functions were preserved by 12 weeks post-discharge using their flowchart.[1] All deep (2nd or 3rd degree) axillary region burns should be hospitalized, especially in a burn unit if available. Particular attention should be paid to avoid contracture formation after acute axillary burn injuries, if the victims are children. Axillary burn patients should be followed regularly for 13 months postdischarge to recognize axillary contracture formation and interfere in with more simple and convenient methods. If an AC patient is operated, especially if there is a long-time interval between the burn injury and contracture release surgery, and if the axillary contracture is severe by any of the classification criteria, we strongly recommend pedicled flaps or pre-expanded pedicled flaps to reach optimal shoulder range of motion and function gain.

Limitations

Since this study is retrospective and single-center, this may limit the generalizability of its results.

Conclusion

All second third degree axillary region burns should be treated in burn units. Particular attention should be paid especially to pediatric patients to avoid burn contractors in axillary an the other joint regions.

Declarations

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed Consent

Written informed consent was obtained from all participants.

Data Availability

The datasets used and/or analyzed during the current study are not publicly available due to patient privacy reasons but are available from the corresponding author on reasonable request.

Conflict of Interest

The authors declare that there is no conflict of interest.

Funding

None.

Author Contributions (CRediT Taxonomy)

Conceptualization: C.M., F.E.
Methodology: C.M., F.E.
Validation: F.E.
Formal Analysis: C.M.
Investigation: C.M., F.E.
Data Curation: C.M.
Writing – Original Draft: C.M.
Writing – Review & Editing: C.M., F.E.
Visualization: C.M.
Supervision: F.E.
Project Administration: C.M.

AI Usage Disclosure

The authors declare that no AI-assisted technologies were used.

Abbreviations

AC: Axillary contracture
CSP: Circumflex scapular perforator
LF: Local flap
PF: Perforator flap
ROM: Range of motion
STSG: Split-thickness skin graft
TDAP: Thoracodorsal artery perforator

References

1. *Webb DC, Byrne M, Kolmus A, Law HY, Holland AE, Cleland H. Outcomes of a shoulder treatment flowchart in patients with axillary burns. J Burn Care Res. 2011;32(2):224-30.*

doi:10.1097/BCR.0b013e31820aaeda

2. *Hocaoğlu E, Aydin H. Preexpanded perforator flaps of the dorsolateral trunk in pediatric patients. Plast Reconstr Surg. 2013;131(5):1077-86. doi:10.1097/ PRS.0b013e3182865dd7*

3. *Sison-Williamson M, Bagley A, Palmieri T. Long-term postoperative outcomes after axillary contracture release in children with burns. J Burn Care Res. 2012;33(2):228-34. doi:10.1097/ BCR.0b013e3182331df4*

4. *Dissanaike S, Rahimi M. Epidemiology of burn injuries: highlighting cultural and socio-demographic aspects. Int Rev Psychiatry. 2009;21(6):505-11. doi:10.3109/09540260903340865*

5. *Passaretti D, Billmire DA. Management of pediatric burns. J Craniofac Surg. 2003;14(5):713-8. doi:10.1097/00001665-200309000-00021*

6. *Kraemer MD, Jones T, Deitch EA. Burn contractures: incidence, predisposing factors, and results of surgical therapy. J Burn Care Rehabil. 1988;9(3):261-5. doi:10.1097/00004630-198805000-00005*

7. *Schneider JC, Holavanahalli R, Helm P, Goldstein R, Kowalske K. Contractures in burn injury: defining the problem. J Burn Care Res. 2006;27(4):508-14. doi:10.1097/01. BCR.0000225994.75744.9D*

8. *Kulahci Y, Sever C, Uygur F, Oksuz S, Sahin C, Duman H. Pre-expanded pedicled thoracodorsal artery perforator flap for postburn axillary contracture reconstruction. Microsurgery. 2011;31(1):26-31. doi:10.1002/micr.20825*

9. *Grishkevich VM. Postburn shoulder medial-adduction contracture: anatomy and treatment with trapeze-flap plasty. Burns. 2013;39(2):341-8. doi:10.1016/j.burns.2012.06.002*

10. *Ertaş N, Borman H. Double opposing rectangular advancement flap is an alternative technique in the treatment of wide linear postburn scar contractures. Burns. 2011;37(8):1449-57. doi:10.1016/j.burns.2011.08.006*

11. *Guha G, Agarwal AK, Gupta S, Gupta S, Murmu MB, Chumbale P, Chattopadhyaya D. Posterior arm flap in management of axillary contracture. Burns. 2013;39(5):972-7. doi:10.1016/j.burns.2012.11.010*

12. *Grishkevich VM. Shoulder adduction contracture after burn: anatomy and treatment with quadrangular local scar subcutaneous pedicled flap. Burns. 2013;39(7):1423-9. doi:10.1016/j. burns.2013.03.014*

13. *Kosutic D, Potter S, Gulic R. Circumflex scapular perforator propeller flap for axillary reconstruction. Microsurgery. 2012;32(3):251-2. doi:10.1002/micr.20981*

14. *Sever C, Uygur F, Kulahci Y, Karagoz H, Sahin C. Thoracodorsal artery perforator fasciocutaneous flap: a versatile alternative for coverage of various soft tissue defects. Indian J Plast Surg. 2012;45(3):478-84. doi:10.4103/0970- 0358.105956*

15. *Lykoudis EG, Seretis K, Ziogas DE. Tissue expansion and latissimus dorsi transfer for arm-thorax synechia reconstruction. J Burn Care Res. 2011;32(2):e15-20. doi:10.1097/ BCR.0b013e31820ab117*

16. *Hanumadass M, Kagan R, Matsuda T, Jayaram B. Classification and surgical correction of postburn axillary contractures. J Trauma. 1986;26(3):236-40. doi:10.1097/00005373-198603000-00004*

17. *Kurtzman LC, Stern PJ. Upper extremity burn contractures. Hand Clin. 1990;6(2):261-79. doi:10.1016/S0749-0712(21)00866-0*

18. *Teot L, Bosse JP. The use of scapular skin island flaps in the treatment of axillary postburn scar contractures. Br J Plast Surg. 1994;47(2):108-11. doi:10.1016/0007-1226(94)90168-6*

19. *Ogawa R, Hyakusoku H, Murakami M, Koike S. Reconstruction of axillary scar contractures: retrospective study of 124 cases over 25 years. Br J Plast Surg. 2003;56(2):100-5. doi:10.1016/ S0007-1226(03)00035-3*

20. *Kidd LR, Nguyen DQ, Lyons SC, Dickson WA. Following up the follow up: long- term complications in paediatric burns. Burns. 2013;39(1):55-60. doi:10.1016/j.burns.2012.05.015*

21. *Partain KP, Fabia R, Thakkar RK. Pediatric burn care: new techniques and outcomes. Curr Opin Pediatr. 2020;32(3):405-10. doi:10.1097/ MOP.0000000000000902*