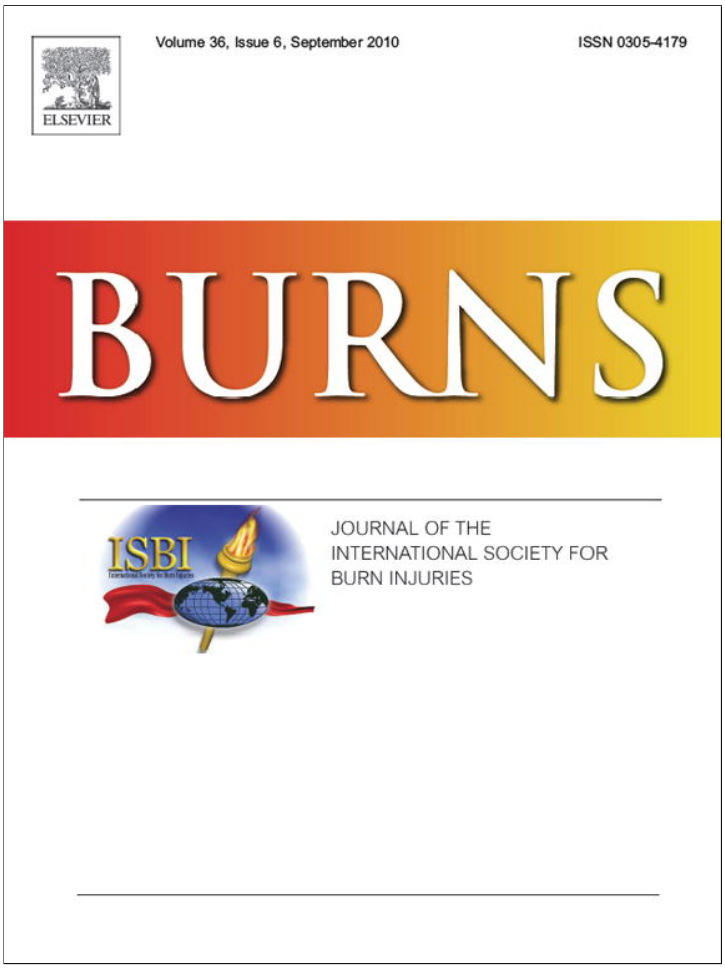

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Case report

Mentosternal contracture treated with a massively expanded supraclavicular flap in a 25-year-old man: A case report

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1. Background

Tissue expansion has become a major reconstructive modality in the past 30 years. Tissue expansion is a major treatment modality in the management of giant congenital nevi and secondary reconstruction of extensive burn scars, allowing sensate tissue of similar color, texture, and thickness to be used to resurface the affected areas. One must be prepared for complications when using tissue expanders, however, because complications are inherent in the process of expanding skin utilizing repeated filling of implanted foreign bodies [1]. Mentosternal contractures are well-known complications after burns, scald injuries, and injuries with acid or lye. The cervical region is functionally and anatomically designed to achieve a maximum range in three-dimensional motion. Furthermore, the cervical area, as does the facial region, functions as a medium to interact with human society. For the unfortunate patients who develop scar contracture, resurfacing with flaps offers an optimal reconstructive outcome. The emphasis, therefore, has been on the use of various flap reconstructions, which have mirrored the historical understanding of the blood supply to the skin [2,3].

Outcomes are dependent on thorough planning, meticulous technique, and close follow-up, and patient compliance. Tissue expansion has revolutionized plastic surgery in the last 30 years. Tissue expansion has permitted the plastic surgeon to achieve the goals of reconstruction with tissue of similar color, texture, and thickness, with minimal donor site morbidity. Preservation of sensation in a durable flap has allowed the surgeon to achieve acceptable functional as well as esthetic goals simultaneously [1].

The cervico-mental area is perhaps the most important esthetic and functional area in burn patients. The natural neck posture places the head in the most optimal alignment for daily interactions. Despite well-planned multidisciplinary support for burn survivors, severe contracture of the neck frequently complicates the early post injury course of the patients who suffer from thermal injuries to the head and neck. Neck reconstruction for cervical scar contracture after burn injuries often takes priority over other areas. Airway access and protection, critical for subsequent surgical intervention, make this zone particularly important and should be addressed early. Adjacent areas such as the face and shoulders are further drawn into the contractual deformity with resultant functional deformation to the mouth and periorbita [4]. Many surgical procedures have been used to correct these contractures, including free skin grafts, local flaps with or without tissue expansion, and free flaps. To achieve good functional and cosmetic results the operative procedure should fulfill the cosmetic and functional criteria of the neck [2,3].

There are essentially three separate categories of neck contracture for which different surgical concepts are advocated [5]. Isolated vertically oriented scar bands can usually be released with Z-plasties. Scar contracture involving burned skin with intervening normal skin can be treated with incisional release and skin grafting or local flaps. Local unburned tissue can be expanded and recruited

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to provide improved color and skin texture. Severe neck contracture involving most of the neck skin generally requires excision and release of the platysma, and the entire esthetic unit of the neck should be addressed to improve the functional and esthetic result. Local island flaps as well as free flaps may also provide well-vascularized tissue to resurface large area defects [2,3,6]. This paper describes the addition of an expansion to the supraclavicular island flap described by Pallua et al., in which we placed a tissue expander under the flap in order to give greater width and length to the flap and to facilitate easy closure of the donor site with new and modified expanding protocol.

2. Case report

A 25-year-old man suffered from severe flame burn injury to neck and chest. Despite early excision and thick skin grafts as well as postoperative splinting, compression, and occupational therapy, he developed severe scar contracture of forehead, brows, lids, perioral and nasal area and a grade [E2 (moderate)] mentosternal contracture, as described by Tsai et al. [2]. Objective measurements noted flexion contractures of (0°/40°/85°), a maximum chest-chin distance of 11 cm, rotation to right and left at 40°, and moderate depression of the right commissure (Fig. 1).

The defect area and requisite flap dimension was at least 30 cm × 15 cm (Fig. 2). Preoperative color Doppler ultrasonography was performed to map out supraclavicular artery territory. Then we inserted 300 cm^3 rectangular TE in subfascial plan in supraclavicular area. Our protocol for massively tissue expansion was for first 10 weeks, 20% expansion of TE volume weekly and for second 10 weeks according to the patient acceptance and close observation, 30% expansion of TE volume weekly was done (Fig. 2). The scar was excised and the neck released with the patient in the supine position. A left-sided massively expanded large supraclavicular island flap (42 cm × 20 cm) was designed to reconstruct the anterior neck for contracture release and resurfacing after 10 weeks (Fig. 3). At 6-month follow-up head reclination testing demonstrated a maximum chin-sternum distance of 20 cm (14 cm at rest), and head rotation was measured at 75° to the left and 70° to the right (Fig. 4).

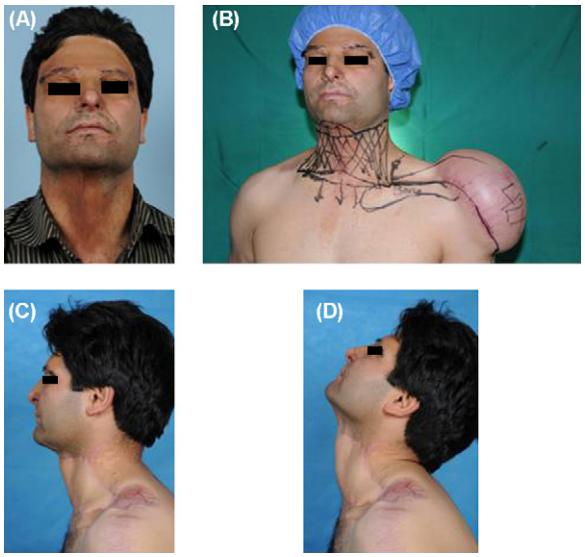

Fig. 1 – (A) Preoperative view; (B) a moderate to severe neck contracture with extrinsic contractures of the face was observed, range of motion was poor. Lateral view; (C) showing moderate neck contracture grade E2 as descroned by Tsai postoperative appearance; (D) range of motion.

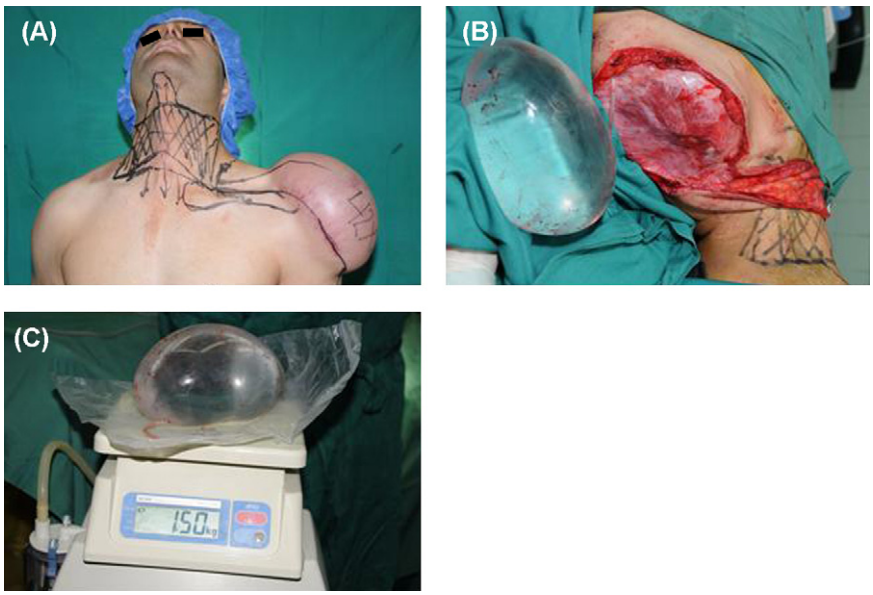

Fig. 2 – (A) Preoperative view. (B) Outline of the flap, supraclavicular artery (SCA), and clavicular bone are marked. (C) Massively expanded TE was shown.

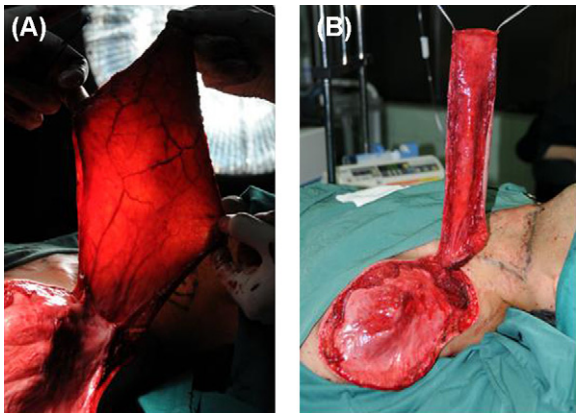

Fig. 3 – (A) Intra-operative view of hyper vascularity due to tissue expansion. (B) Massively expanded large supraclavicular island flap (42 cm × 20 cm) before insetting in neck.

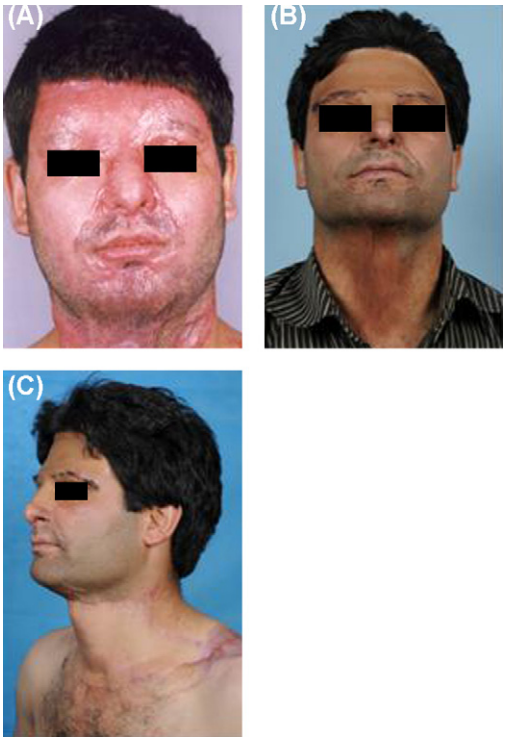

Fig. 4 – Management of the patient step by step: (A) Patient in first day admission; (B) Patient before neck reconstruction; (C) Late postoperative view of the patient 6 months after surgery.

3. Discussion

The goals of treatment for severe neck contracture are to release the contracture, restore the contour of the mentosternal angle, and prevent recontracture. In our case, typical criteria of advanced contracture grading is evident by involvement of both upper cervical and lower cervical areas in the deformity [2]. Activities of daily living, such as work, participation in sport, and social interactions, are impaired and may pose additional psychological stress on the patient. Risk and benefit concerns were discussed with the family who elected to have the functional and esthetic deformities addressed before entry into his work.

We prefer to include full-thickness platysma transection with scar excision to best define the cervico-mental angle and to minimize the risk of recontracture. In some cases, a complete release is not possible because of scarring of underlying tissue such as muscle. In addition, size and length of the obtained flap may not fully match the scarred area. A pleasing cervical profile relies on a well-defined cervico-mental angle, defined in adults as between 105° and 126° [7]. In this case of a young man, we obtained a 105° angle nearly achieving the ideal.

Many methods have been advocated to reconstruct severe neck contracture, including split-thickness and full-thickness skin grafts, dermal substitutes combined with skin grafts, local or pedicle flaps with or without tissue expanders, pedicle or free myocutaneous flaps, and free septocutaneous flaps. Skin grafts alone or in combination with a dermal substitute like Integra have been described with varying success [8]. Tissue expanders can increase skin territory; however, maximum skin gain after tissue expansion is generally about 25% [1,9]. Local or pedicle skin flaps with similar color, thickness, and texture are limited to the territory of uninvolved skin.

The interval and volume of expansion may vary by region and wound type. The rate of inflation of the expanders varies between surgeons but seems to depend on physical findings and patient comfort. Inspection of skin color (blanching), capillary refill, and simple palpation is to be performed when considering additional expansion. When pain is experienced, injection should cease and removal of saline should be considered. Over inflation of tissue expanders beyond the manufacturer's recommended full capacity seems to be the norm in clinical practice [10,11]. In one clinical study, overexpansion has been shown to be associated with a lower complication rate compared with under expansion [12]. In previous reported clinical study, an expander was inflated ''3/5'' times its manufacturer's stated capacity without complication but in our study, an expander was inflated ''5'' times its manufacturer's stated capacity without complication. An ex vivo study of expanders from multiple vendors has shown that mean over inflation of 80 times the manufacturers' stated capacity can be achieved. Over expansion appears safe without risk of implant failure at least to 15 times vendor' stated maximum volume [13].

In our case, right shoulders had significant scarring precluding the use of expanded supraclavicular artery island flap bilaterally.

Initial donor site morbidity with a skin-grafted area at the supraclavicular area has to be mentioned. This can be addressed at a later stage by skin expansion of adjacent uninjured skin should the patient so desire. In the meantime, the donor site is hidden by most clothing.

Functional and esthetic reconstruction of the contracted neck is essential for quality of life. The thinned massively expanded supraclavicular flap is an excellent option for single-

stage reconstruction of severe neck contracture. With appropriate patient selection and preoperative planning, this procedure can be safely employed in these patients.

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