Advancement Versus Transposition Expanded Flaps for Management of Cicatricial Contracture of the Neck

MOHAMED NASR, M.D.; ADEL M. TOLBA, M.D.; MAHFOUZ SHEHATA IBRAHIM, M.D., M.R.C.S. and MAHMOUD ABD-ELNABY, M.D.

The Department of General Surgery, Plastic Surgery Unit, Faculty of Medicine, Zagazig University, Egypt

ABSTRACT

Introduction: Resurfacing of the anterior neck with suitable, well-matched skin from the upper trunk is usually difficult because the neck connects the head and body with multidirectional and complex motility. Tissue expanders have been used primarily to construct local advancement flaps of tissue immediately adjacent to a tissue defect or deformity. These flaps often lack adequate mobility to allow coverage of large area even when complete capsulotomies were done. Later studies described expanded large transposition flaps for neck reconstruction.

Aim of the work: Is to compare advancement versus transposition expanded flaps for total or subtotal resurfacing of the neck.

Patients and Methods: Thirty six expanded advancement and transposition flaps have been performed for neck resurfacing in 20 patients suffering cicatricial post burn contractures in whom the expansion were completed without significant complication.

Results: The expanded advancement flap is safe and reliable method for neck resurfacing in spite of its small coverage area and inadequate mobility that could be overcome by overfilling the expander or sequential expansion of the same flap. The expanded transposition flap proved remarkably reliable and reproducible in neck resurfacing. The donor site scar of the flap and the failure of re expansion limit its use.

Conclusion: The expanded advancement is the 1st choice in neck resurfacing when available.

INTRODUCTION

Neck contractures are well-known complications after burns, have great physical and psychological impact on the patient. The neck resurfacing has a special challenge for the surgeon in giving an aesthetically satisfactory result because of its high visibility and its design to achieve a maximum range of motion. Skin grafts, local or free flaps are various reconstructive options available for resurfacing of this region. Local flaps are the best due to a better matching with the recipient site with no tendency to shrink [1].

Neumann was the first in publishing clinical report of tissue expansion in 1957 [2] using a subcutaneous rubber to achieve the expansion of an area of the scalp for ear reconstruction. Later Radovan [3] used a silicone implant for reconstruction of the breast. After many clinical and experimental studies tissue expansion has become a useful adjuvant procedure in reconstructive surgery [4]. Tissue expanders have been used primarily to reconstruct local advancement flaps of tissue immediately adjacent to a tissue defect or deformity [5].

Extended survival length of expanded random flaps was first described by Cherry and Sasaki [6,7] independently who also described the rich vascularity of the capsules of tissue-expanded skin. Basing on their work, Spence [1] was the first to use expanded tissues as transposition flaps in 1986 to reliably cover large areas of the face and neck.

The expanded skin is usually derived from the shoulders and upper torso that provides a well color match, increased area of skin for transfer, and allows primary closure of donor site [8].

The aim of this work is to compare the expanded advanced and transposition flaps in the treatment of cicatricial contracture deformity of neck, and to improve the method for the repair of soft tissue defect of neck.

PATIENTS AND METHODS

This study was conducted on 20 patients who came to the Plastic Surgery Clinic of Zagazig University Hospitals complaining of neck scarring after burn during the period from May 2013 till March 2014. Patients who did not complete the expansion due to infection, exposure or inability to withstand the expansion were excluded from this study. All patients were subjected to detailed
medical history taking, meticulous physical exam-
ination, photographed and consented for approval
of surgery and possible outcome and complications.

The protocol of the study was approved by the
ethical comitte of Zagazig University Hospitals.

During preoperative visits, the donor site avail-
able for expansion was determined by evaluating
those areas close to scarred neck with unscarred,
well-matched skin. The area available for a tissue
expander pocket was measured and an appropriate-
sizedtissue expander was obtained. In cases of
advancement flap, we used the largest expander
dimensions as the donor area allows. However, in
patients with transposition flap, we used the rect-
angular expanders with dimensions most common-
lly ranged from 11x6 to 15x8 as donor area allows.

Technique:

All procedures were performed under general
anesthesia with endotracheal intubation and inter-
avenous antibiotic (third generation cephalosporin)
was given. In all cases, expanders were inserted
in subcutaneous plane either in the neck, the chest,
the shoulder or the upper back according to avail-
able unscarred area. The back was used only for
3 patients who had burned shoulders and chest.

In cases of advancement flap, the expanders
were inserted through small incisions (4cm) parallel
to the scared edges (Figs. 1,3).

However in cases of transposition flap, most
often an incision approximately 4cm long was
made, the orientation of this incision is important
as it will be included in the incision when the
transposition flap is raised after expansion and
should not interfere with proposed pedicles. The
incision was made down to the muscle fascia, and
the skin and subcutaneous tissue were undermined
using the coagulation cautery on the fascia. The
undermining was carried out to the extent of the
previously marked dimensions. After irrigating
with saline, obtaining meticulous hemostasis, the
tissue expander was placed and the wound was
closed in two layers.

All valves were external except in 1st 3 cases.
Some inflation was done at the end of operation
to close dead space and no suction drains were
inserted.

In all cases the inflations started 3 weeks after
der expander insertion, then at twice weekly intervals
according to patient’s tolerance and were stopped
2 weeks before reconstructions in transposition
flaps.

Again under general anesthesia, the recipient
site on the neck and the expanded flap donor site
were prepared.

In all cases, the scared areas were not excised
before harvesting the transposition flaps and ex-
amining their vascularity and determining the
available skin for transfer.

In advanced flap, the capsule was removed in
all cases. However in transposition flap the capsule
was left at the pedicles and undersurface of the
flap except in the 1st 3 cases; it was removed from
undersurface of the distal part of the flap.

The transposition flaps were designed to be
centered on the vascular axis after localization of
the vessel using trans-illumination. The flap was
then harvested on its fascial pedicle in all cases
and all donor sites could be closed primarily (Fig.
2).

Three to six weeks postoperative under general
anesthesia, the pedicle was divided and the wound
base closed. The residual, unscarred skin from the
pedicle was then unfurled and redraped or used as
full-thickness skin graft to resurface neighbor
scarred area if needed or distal parts of the flap if
necrosis occurred as in the earliest 3 patients.

The patients were nursed with a pillow under
their shoulders to maintain the neck extension.
Drains were removed about 3 day’s post-operative.
Soft neck Collars were applied after the 1st week
post-operative.

RESULTS

Thirty six expanded flaps (23 advancement in
13 patients, 13 transposition in 7 patients) have
been used for neck resurfacing in 20 patients in
whom the expansion were completed. There were
17 patients with total neck scaring (with or without
shoulders and chest scaring) and 3 patients with
subtotal neck scaring. There were 6 male and 14
female patients ranging in age from 6 to 36 years and
the average age was 16 years. The extent of injury
and method of reconstruction illustrated in Tables (1,2).
Twenty three advancement flaps were done in 13 patients. Ten patients had total neck scaring and 3 patients had subtotal neck scaring, however, all 13 patients had no scaring in the chest or shoulder skin. Over inflation were done in all patients and sequential expansion were done in 3 patients. The average duration for expansion was 3 months. Advancement ranged from 7cm. up to 15cm. All advancement flaps did well. The scars were good but 2 patients showed hypertrophied scar (already they were showed hypertrophied post-burn scars) and were treated well by silicon sheets and pressure garment and 3 patients showed broadening of the scar. The mean operative time for advancement flap reconstruction was 2.25 hours (Table 3).

Thirteen transposition flaps were done in 7 patients. All patients had total neck scaring, 2 of them had burnt chest with normal shoulder skin and 3 patients had scaring in the chest and shoulder skin. Over inflation was not needed as it was not add tissue for reconstruction and the expansion was needed for delay the flap and to allow 1ry closure. Sequential expansion was not possible to be done. The average duration for expansion was 2 months. Transposition flaps dimensions ranged from 9cmx3cm up to 30cmx8cm. Distal flap necrosis of 2-3cm was developed postoperatively in the earliest 3 patients and was treated by full thickness skin grafting from the pedicles during their division. Donor sites scar was hidden underneath clothing. Neck scars were good but 1 patient showed straight mid-line contracted scar which need further z-plasty. The mean operative time for transposition flap reconstruction was 2.5 hours (Table 4).

Our patients were mostly happy with their final appearance. The color and texture match was good and none of the patients had any re contracture during the follow-up period.

Fig. (1-A,B,C): Expansion of nearby skin.

Fig. (1-D,E,F): Post operative after usage of expanded advancement flap.
Fig. (2-A,B): Preoperative.

Fig. (2-C,D): Expansion of shoulder skin.

Fig. (2-E,F): Expanded transposition flap intra operative.
Fig. (2-G,H): Early postoperative.

Fig. (2-L,M): Late postoperative.

Fig. (3-A): Preoperative.
Fig. (3-B): Skin expansion.
Fig. (3-C): Postoperative after usage of expanded advancement flap.
Table (1): Complexity of injuries.

<table>
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<th>Methods of reconstruction</th>
<th>No. of patients</th>
<th>Extent of neck injuries</th>
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<tr>
<td>Advancement transposition flap</td>
<td>17</td>
<td>Total (± shoulder/ chest scaring)</td>
</tr>
<tr>
<td>Advancement flap</td>
<td>3</td>
<td>Subtotal</td>
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Table (2): Methods of reconstruction.

<table>
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<th>Methods of reconstruction</th>
<th>Extent of injuries</th>
<th>No. of patients</th>
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</thead>
<tbody>
<tr>
<td>Advancement expanded flaps</td>
<td>Total, subtotal</td>
<td>10</td>
</tr>
<tr>
<td>Sequential expanded</td>
<td>Total</td>
<td>3</td>
</tr>
<tr>
<td>advancement flaps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transposition expanded</td>
<td>Total</td>
<td>7</td>
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Table (3): 23 advancement flaps-related data.

<table>
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<tr>
<th>Extent of injury</th>
<th>Uni/bilateral-once/ sequential (twice)</th>
<th>Duration of expansion</th>
<th>No. of patients</th>
</tr>
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<tr>
<td>Subtotal</td>
<td>Unilateral &amp; once</td>
<td>3 months</td>
<td>3</td>
</tr>
<tr>
<td>Total (no shoulder nor chest scaring)</td>
<td>Bilateral &amp; once (7) unilaterial &amp; sequential (3)</td>
<td>3 months</td>
<td>10</td>
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Table (4): 13 Transposition flaps-related data.

<table>
<thead>
<tr>
<th>Extent of injury</th>
<th>Uni/bilateral-once/ sequential</th>
<th>Duration of expansion</th>
<th>No. of patients</th>
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<tbody>
<tr>
<td>Total with burnt chest &amp; shoulder</td>
<td>Bilateral &amp; once</td>
<td>2 months</td>
<td>3</td>
</tr>
<tr>
<td>Total with burnt chest</td>
<td>Bilateral &amp; once</td>
<td>2 months</td>
<td>2</td>
</tr>
<tr>
<td>Total neck only</td>
<td>Unilateral (1) &amp; once bilateral (1) &amp; once</td>
<td>2 months</td>
<td>2</td>
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</table>

**DISCUSSION**

Reconstructive ladder in burn reconstruction includes direct closure, adjacent tissue transfer, skin grafts, flaps, and tissue expansion [9-11]. Tissue expansion besides all other remedies facilitates burn reconstruction. The expansion of the skin peripheral to the scar can provide sufficient skin of ideal color, texture, thickness, and sensation with very low donor site morbidity [12-13]. The main disadvantage of the technique is the necessity to have at least two surgical procedures. The complications are exposure or infection of the tissue expander, pain, and long time needed for the total expansion.

The ideal reconstructive system is elusive. It should first provide sufficient well-matched skin that can be used reproducibly and reliably to return excellent function and appearance. In addition, the donor site morbidity should be minimized and economy of tissue usage optimized to reduce further destruction of the patient’s body [8]. Of course, the ideal system must eliminate scars and deformity entirely. All of this should be within the skill and patience of most reconstructive surgeons.

Tissue expanders have been used primarily to reconstruct local advancement flaps of tissues immediately adjacent to a tissue defect or deformity [8]. These flaps satisfy many of these requirements; they provide a well matched skin for reconstruction of neck soft tissue deformities with no donor site morbidity or additional scars. However the amount of skin generated during the reconstruction is usually limited and the flaps often lack adequate mobility to allow coverage of large areas. This problem can be overcome by overexpansion which can usually achieve the desired flap dimensions. Over inflation of the implant well beyond the manufacturer’s stated maximum volume is proved to be successful and allowing for better coverage of the defects [14]. That can also be achieved by sequential expansion of the same flap.

The tissue expander enhanced transposition flaps appeared to provide ample of suitable tissue for reconstruction of the neck. These flaps are very mobile thin hearty flaps that provided excellently matched skin cover for the neck. The expanded transposition flap appears to have the reliability of an axial flap, the primary vessel on which the flap is based is immediately superficial to the expander capsule [1]. We have distal flap necrosis in the 1st three cases after excision of the capsule of the distal part of the flap and so we stress the importance of maintaining the continuity of the capsule in the base of the pedicle as the flap is being elevated.

Another great advantage is the ability to close reliably the flap donor site. This is accomplished routinely be expansion until enough skin is available to achieve this. The newly formed scar is usually hidden by the clothes of the patient. The expanded skin is allowed to grow fully by stopping expansion 2 weeks before transposition of the flap.

The availability of the residual expanded skin that the pedicle provides after division and insetting of the flap has proven to be valuable when used
as full thickness skin graft in resurfacing the necrosed distal part of the flap in the 1st three patients or the central portion of the face where preservation of the fine facial features is paramount.

The expanded transposition flap appears to be reliable and versatile for the reconstruction of major soft tissue defects of the neck. It provides economy of tissue and versatility and is well within the skill, patience, and courage of most reconstructive surgeons, but, the donor site scar and the unavailability of sequential expansion limit its uses.

Conclusion:

Instead of increasing interest about transposition expanded flap, the old technique of the advancement expanded flap is generally better as it allows over inflation and sequential expansion and it is more safe and easier. However the transposition flap may be the only solution when there is no available neighbor tissue to be expanded and advanced to the scared area.

REFERENCES


