

TISSUE EXPANSION: KING KHALID UNIVERSITY EXPERIENCE

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Tissue expansion is a means of mechanically generating excess soft tissue adjacent to a defect. The advantage of this technique is that it enables replacement of missing tissue with similar tissue of matching color, texture and other inherent local characteristics. The mechanism of generating skin by this technique and the physiologic changes occurring in the skin during the process of expansion have been well studied in animal models.¹⁻³ However, meticulous attention to detail is required to reduce the incidence of complications associated with the technique and to achieve optimum results.

We present here our experience with 128 tissue expanders in 97 patients in an Arab population. The treatment was carried out at King Khalid University Hospital from 1989-1996. The aim of the study is to evaluate the outcomes of tissue expansion, with a view to identifying the factors that could contribute to minimizing complications.

Patients and Methods

A total of 128 expanders were inserted in 97 patients, comprising 67 females and 30 males. The ages of the patients ranged between 3 and 56 years, with a mean of 21.3 years. Sixty-nine patients had single expanders, and the remaining 28 had multiple expanders inserted simultaneously, or as part of their staged reconstruction. Indications for expansion included postburn scarring (61), post-traumatic scarring or alopecia (26), talipes equinovarus (4), and giant hairy nevi (6).

The expanders were of standard design, with capacities ranging from 50 mL to 1000 mL. All expanders had remote injection ports. General anesthesia was used in all the procedures. Incisions were carefully planned so as not to compromise the healthy tissue intended to be expanded. The pocket for the expander was subgaleal in the scalp, supraplatysmal in the neck and face, and subcutaneous elsewhere. The injection port was placed in the vicinity of the expander in a separate subcutaneous pocket, where it

was easily accessible for subsequent saline injections. In three children, the port was exteriorized. Fifteen to 50 mL of sterile saline were injected into the expander to minimize the dead space in the wound. Drains were not used routinely, except in six cases where there was unusual oozing in spite of meticulous hemostasis. All patients received cephalosporins (first generation) at induction of anesthesia. The antibiotic was continued postoperatively for 48 hours by intravenous infusion. Tissue expansion was started one week after surgery in the outpatient clinic and continued once or twice weekly for 6 to 12 weeks. In four patients, the inflation had to be delayed for 3 to 4 weeks because of problems with wound healing.

In the second stage when the desired expansion had been achieved, the expander was removed through the previous incision. The capsule was incised if necessary, to provide extra mobility to the expanded skin. A defect was created (taking into consideration the amount of skin available after expansion). The expanded skin was then moved into the defect using suitable additional incisions. Drains were used as indicated. The donor sites were closed primarily (Figure 1).

Results

Expanders were used from head to foot in this series. The hospital stay of the patients ranged from 3 to 15 days, with an average duration of 4.7 days. Expansion by site is shown in Table 1. The total period of expansion varied from 5 to 17 weeks, with an average of 9 weeks. The interval between expansions ranged from 4 to 7 days. This depended primarily on the tolerance of the patient and the local skin condition. Overexpansion was done in almost all cases.

Success of the procedure was evaluated by the degree of patient and physician satisfaction. This was rated as excellent, good, fair and poor. Sixty-six (51.5%)

TABLE 1. *Tissue expansion by site.*

Scalp	27 (21%)
Face	9 (7%)
Neck	14 (11%)
Trunk (including breast)	16 (12.5%)
Upper extremity	26 (20.3%)
Lower extremity	36 (28.2%)

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FIGURE 1A. A 20-year-old male with post-traumatic defect of lower leg during expansion.



FIGURE 1B. The same patient at operation showing the tissue expander.

procedures were considered excellent, 38 (29.6%) good, 16 (12.5%) fair, and 8 (6.2%) poor.

The complications encountered were classified as major or minor. Major complications were those which resulted in failure of the procedure. These occurred in 7 (5.5%) of the procedures and consisted of infection (2) and extrusion (5). The expanders had to be removed, but the expansion process was near completion at the time of removal in all but one patient. Minor complications were those that did not result in failure. These accounted for 12.5% of the sample. They were in the form of skin breakdown (7), infusion port extrusion (3), impending exposure (1), scar hypertrophy (3), and unusually wide scars (2). The highest rate of complications occurred in the extremities, below the knee joint (22.2%) and distal to elbow joint (15.3%).

Discussion

Although the concept of tissue expansion is as old as humanity, it was Neuman who initiated its clinical application in the 1950s.⁴ The report of Radovan in 1976 heightened the impact of tissue expansion on reconstructive surgery.⁵ The technique is at present a well-established modality of treatment and a valuable tool for the reconstructive surgeon. The main advantage of this technique is its unique utility in replacing a defect with tissues of similar quality without creating a donor site defect. The increase in vascularity that occurs in the expanded skin helps in developing flaps of greater dimensions without tissue necrosis.

This apparently simple technique of skin expansion is, however, associated with a persistently high complication rate in the order of 20% to 40%. Indiscriminate use of tissue expanders without cognizance of their limitations tends to make matters worse. In our experience with the present series, an in-depth analysis of the needs for reconstruction, proper selection of patients and tissue expanders, careful planning of implantation sites, and proper postoperative care, have contributed to bringing down the incidence of complications.



FIGURE 1C. Postoperative result.

It is important to realize that the increase in surface area gained by skin expansion varies from site to site in the same patient. In our series, the best results were achieved in the scalp, while the poorest results occurred in the extremities. The high vascularity of the scalp and the bony support forming the base underneath the expander may contribute to enhancing the result. The risk of complications was higher in the extremities than elsewhere, the distal part of the lower extremity being the worst affected. The limitation in the extremities appears to be due both to the limited available tissue to expand and to the geometry of flap design and movement. According to Carneiro and Dichiara, careful patient selection with defect not exceeding 30% of the circumference of the limb, use of low profile expanders and slow inflation (because of high intraluminal pressure in the extremities), may help to overcome the problems and optimize the results.¹⁹

Scar hypertrophy involving lower face was seen in three procedures. This hypertrophy may be related to excess mobility, tension of flap inset, and the inherent characteristics of lower facial skin. Significant over-expansion may help to reduce its incidence.

The technique of tissue expansion complements existing reconstructive methods. It provides a valuable surgical alternative for managing various defects, despite

the high incidence of complications. The benefits of tissue expansion far outweigh the risks and, therefore, should be used when anticipated results from other techniques are not acceptable.

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