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Guidelines to Minimize the Complications of Tissue Expansion

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ABSTRACT

This study included 25 patients with soft tissue limitations, treated by means of tissue expansion. The sites of expander insertion were as follow: Scalp (15 cases), neck (2 cases), supraclavicular (1 case), anterior trunk (3 cases), posterior trunk (1 case), upper limb (1 case), and lower limb (2 cases). The overall complication rate was 16% in the form of implant exposure (2 cases) and infection (2 cases). The results were discussed and it is concluded that by careful patient selection, proper preoperative planning, meticulous surgical technique, and development of expertise, tissue expansion can be considered an extremely useful tool in reconstructive surgery with minimal complications.

INTRODUCTION

Tissue expansion is a reconstructive technique that expands tissue to attain an optimal aesthetic and functional result using local tissue when primary closure of a soft tissue defect is not possible. A tissue expander is essentially a silicone balloon that is placed subcutaneously and is slowly filled with saline. Overlying tissues are stretched, resulting in an increased area of tissue [1]. The major tissue response to expansion occurs in the dermis in the form of fibroplasia, increased collagen deposition, a marked increase in vasculature, the skeletal muscle becomes thin, and adipose tissue undergoes atrophy [2]. Complications associated with tissue expanders are infection, haematoma, seroma, skin necrosis, expander exposure, and expander deflation with an overall complication rate between 10% and 30%. It is inadvisable to use tissue expansion in the defects of the central face, hands, feet, neck, near malignancy, under skin graft, near an open leg wound, near haemangioma under an incision, in an irradiated field, or in a psychologically incompetent patients [3].

PATIENTS AND METHODS

25 patients with soft tissue limitations, treated by means of tissue expansion. Sites of expander insertion were scalp (15) - neck (2) - supraclavicular (1) - anterior trunk (3) - posterior trunk (1) - upper limb (1) - lower limb (2).

Patient selection:

The patient must understand that two operations are required, temporary deformity may be inconvenient and hard to disguise.

Choice of expander:

In this study we used the round expander in 20 cases and the rectangular expander in the other 5 patients. We used the largest possible expander size, limited only by the available donor tissue.

Incision placement:

Incisions were usually placed at the edge of the defect in stable tissue that is expected to heal.

Pocket:

Of adequate size for the expander that was placed into it. No protrusion of the expander through the incision and no wrinkles through the overlying tissue.

Injection ports (reservoir):

External reservoirs were used in all cases through small separate stab 6cm from the pocket in a dependant position.

Drain:

Suction drains were used in all cases coming out through the same separate stab of the external reservoir.

Closure:

Must be in three layers. The first layer was 2cm from the incision to separate the pocket from the incision, the second layer was in the subcutaneous tissue, and the third layer was the skin.

Filling of the expander:

In our study we began to fill 3 weeks after surgery if the wound was stable by using butterfly

needle 23. The injection was twice weekly and stopped if the patient feels pain or the tissue overlying showed pallor. Rigorous sterile technique decrease infection.

Second operation:

The patient was ready for advancement when the flap will produce the desired result (the arc over the top of the expander-the width of the expander mass=the possible advancement=the width of the defect). It should not be necessary to excise the capsule formed around the expander. Suction drainage was mandatory in the second operation.

Aftercare:

Antibiotics and pain killers were given to all patients. Patients may shower on the second day after advancement. Drains were removed when the discharge became less than 20c.c. Do not rush to excise the dogears, which usually resolve with time.

RESULTS

The overall complication rate was 16% in the form of expander exposure (2 cases) and infection (2 cases). Hospital stay ranged from 3 to 5 days in every stage. The period between the two stages ranged from 2 to 4 months. We can reach the planned goal of expansion in about 75% (19 patients). In case of supraclavicular expansion, full thickness skin graft was taken from the expanded tissue as the amount of the donor skin was limited (Figs. 1-6).

DISCUSSION

Reconstructive surgical procedures are frequently limited by the availability of adequate soft tissue. Over the past 20 years, mechanical tissue expansion has become a versatile and dependable technique for overcoming soft tissue limitations **[4]**. Living tissues respond to the application of distracting mechanical force with an increase in the rate of mitosis of the overlying tissues, migration of adjacent tissues, and a realignment of collagen. Silicone prosthesis is placed beneath the skin and gradually inflated, thus allowing for the development of new tissue that can be used for reconstructive surgery **[5]**. In addition to expansion of standard rotation or advancement flaps, tissue expansion can be used as an adjunct to myocutaneous and fasciocutaneous flaps, free flaps, and skin grafts. Tissue expansion has also been applied to other tissues of the body including bladder, intestine, ureter, blood vessels, and nerves **[6]**.

The first published clinical case of tissue expansion was by Neumann in 1957 **[7]**. Neumann placed an inflated balloon subcutaneously to facilitate an ear reconstruction. No further development until 1976, when Radovan **[8]** reported using a silicone implant with self-sealing valve that could be placed entirely inside the body without external ports. Following Radovan's presentation, numerous clinical and experimental studies were published, leading to the wide acceptance and use of the technique **[9-12]**.

The primary advantage of tissue expansion is that it provides a source of adjacent donor tissue whose color and texture are usually well matched to the recipient site. In addition, tissue expansion recruits both sensate and hair bearing tissue when needed. Tissue expansion has found widespread application in reconstruction of the breast, head, neck, and the trunk, usually with acceptable morbidity. Use of tissue expansion in the extremities, especially distally, tends to be more problematic **[13]**. Where to place the incision for expander insertion is somewhat controversial.

Some authors argue for a remote incision. Some assert that the incision should be oriented radially to the edge of the expander **[14]**. In this study, we believe that the best incision is usually placed at the edge of the defect as the scar in this position will be removed at the time of advancement. In relation the injection port, some authors put the port beneath normal skin, usually through the same incision to a point distant to the expander **[15]**. In this work, we used external reservoir in all cases with the advantages of painless injection, early detection of reservoir leakage, no dissection of separate pocket for the reservoir, drainage of fluid from around the expander, and no possibility of puncturing the expander **[16]**. The most common reason for the failure of an expansion is the construction of a pocket of inadequate size for the expander that is placed into it. Protrusion of the expander through the incision or projection of wrinkles of envelope through the overlying tissue often results from the surgeon's over estimation of the size of the pocket. The expander must lie flat, and the expander back must not be curled or flexed **[17]**.

In conclusion, careful patient selection, proper preoperative planning, meticulous surgical technique, and development of expertise, tissue expansion can be considered an extremely useful tool in reconstructive surgery with minimal complications.

Fig. (1): Pre and postoperative scalp tissue expansion.

Fig. (2): Pre and postoperative scalp tissue expansion.

Fig. (3): Expansion anterior trunk.

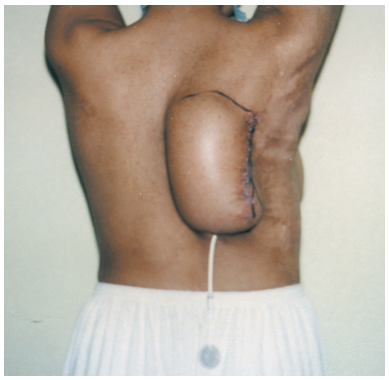

Fig. (4): Expansion posterior trunk.

Fig. (5): Expansion of the supraclavicular area to take a full thickness skin graft.

Fig. (6): Expansion of the left leg.

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