

COMPLICATION OF TISSUE EXPANDERS IN MAXILLOFACIAL SURGERY

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ABSTRACT

Oral and maxillofacial reconstructive surgery manages and deals with the re-conditioning, re-establishment and restoration of damaged and deformed anatomy of bone, skin, mucosa, muscle and nerves. And many a times, flaps are not sufficient to close the defect with help of local flaps and therefore it might become necessary to incorporate tissue expander to expand the surrounding tissue for restoring a defect. Tissue expansion is multifaceted technique for reconstruction surgeries providing well-vascularised surrounding tissues. This technique requires vigilant selection of patients to execute this process which lasts for approximately 8-12 weeks. Any remiss can lead to unfavourable outcome and complications, some minor & others major. This paper seeks to highlight the complications faced while incorporating a tissue expander. Major complications, might result in a delay in reconstruction but not tissue loss.

Keywords: tissue expanders, complications, reconstruction, reconstructive surgery.

HISTORY

It was surprising to notice that tissue expansion is occurring from thousands of years but has been failed to get acknowledged by the medical profession. As it is a natural process which can be seen in pregnancy, the development of mammary tissue at puberty, and the growth of dermal and sub-cutaneous tissue over cysts and tumors. These all processes will involve expansion of skin in response to underlying physiologic and pathophysiologic changes.

Tissue expansion as a concept of beautification has been used by different tribes as African women of some ethnic group used large plates under their lower lip to enhance the structure, likewise women in Burma used rings around the neck to intensify linear growth of the neck.

In medical field tissue expansion was first notified by Codvilla in 1905, who tried to lengthen the femur. In 1908 Magnuson noted no functional damage occurred after lengthening the bone and soft tissues of leg. Putti in 1921 also attempted for leg

expansion. Neumann in 1957, was first to expand skin using a subcutaneously placed rubber balloon to obtain expanded skin above the ear for reconstruction of a subtotal avulsed auricle, Neumann succeeded but couldn't create a great impact on the medical society. After 19 years, Radovan successfully expanded an arm flap. The expanded flap was further used to reconstruct an adjacent defect of the arm followed by removal of lesion. In 1982 Radovan conducted a study on 68 patients where he carried out breast reconstruction after mastectomy while using a temporary tissue expander. Austad and Rose, in 1979 and 1982 used a sodium chloride osmotic gradient to acquire gradual tissue expansion without the use of injection. In the early stages of expansion, balloon got ruptured, releasing the hypertonic solution stored within, resulting in the necrosis of the overlying tissue. Moreover, the device required a long time to expand, which took about 8 to 14 weeks. Radovan expander took 6 weeks or less thus, Radovan device has become the most accepted tissue expansion implant in current use.

The tissue expanders used prior to bone graft procedures has been reported by Lew et al. (1988), Wittkamp (1989) and Bahat and Handelsman (1991). Study conducted by Pietila (1990) shows low tissue perfusion and hypoxia due to the presence of intraluminal pressure caused due to the irregular filling method. A similar condition occurred in a study done by Wiese (1993), which lead to tissue necrosis, followed by perforation of balloon expander through the mucosa which increased susceptibility to infections due to penetration of the skin by percutaneous valve constructions.

In 1993, K.G. Weise replaced NaCl solution with hydrogel to overcome the complication with the balloon and hypertonic solution. Hydrogels is a hydrophilic polymer solution and is capable of inflating by absorbing body fluid at rate 10-12 times larger than its original size. The hydrogel proved to be beneficial as it is inserted into the self-filling tissue expander easily without the need for external inflation.

Now tissue expansion has a great impact on reconstructive surgery. Tissue expansion is a modernistic approach for the development of additional tissue unescorted by transfer of the tissue flap while providing ample amount of soft tissue.⁵

INTRODUCTION

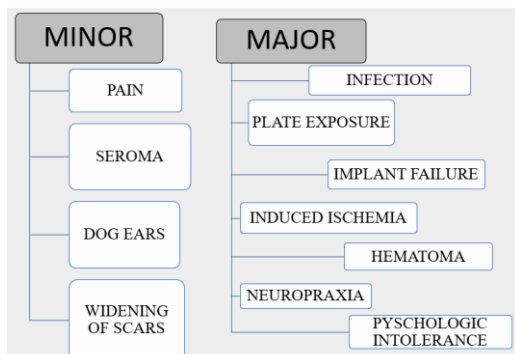
A soft tissue expander is a silicone elastomer, inflatable expander with a remote silicone Elastomer injection dome. The expander is loosely bounded by a silicone envelope, which has an extension for the placement of a fixation screw and pores that allow fluid to reach the osmotic active hydrogel. Due to stretching silicone envelope decreases in thickness. Tissue expanders are implanted below muscles, which is accessible by using a syringe from which sterile isotonic saline is injected until tissue expander achieve desirable dimension.⁵

When a defect couldn't be closed by a local flap alone, there tissue expander comes in picture to expand the surrounding tissues. This process is driven by the concept of biological and mechanical creep. Increased mitotic activity affiliated

with sustained stretch refers to biological creep and mechanical creep is the elongation of skin with a constant load over time after intrinsic extensibility. In this the underlying skin go through epidermal thickening, temporary dermal thinning, and increased blood flow during the period of expansion. Patients with past history of radiation and infection are associated with high complication while using tissue expanders therefore, this TE should be used in stable and nonradiated wounds.⁵

COMPLICATIONS

Intra-operatively and post-operatively surgeons can face number of problems while accommodating TE.



Number of complications are related to tissue expanders and further divided into minor and major complications.

Most of them are minor complications and majority of them can be refined without any long-term treatment.^{1,2,3,4}

MINOR COMPLICATIONS

1. PAIN

Pain is the most common complication related to any surgical procedure. Same is seen during the tissue expansion

process. With the expansion process in scalp and breast pain is minimum. More discomfort can be observed in flank and back expansion but expansion under forehead and extremities cause most discomfort to the patient. Tension in the expanded skin results in severe pain which can be retreat by the withdrawal of few millimeters of saline from TE. Within 4-6 hours discomfort is largely relieved and most of the expanded skin becomes less tense. By 8-12 hours on palpation skin is less tenses than before. By now the patient is comfortable therefore, keeping this in mind injection of tissue expander should be scheduled in the morning, so by the evening patient is comfortable.¹

2. SEROMA

It is a form-fitting capsule that lines the cavity occupied by TE. While injecting saline envelope of expander is forced in opposition to the capsule by the injection of saline however, any fluid lying in exterior surface of the envelope will be under pressure and flow out of the capsule. Presence of needle hole over the injection port provide an outlet for serum, which drain slowly outward and can be easily managed by swabbing away the emerging fluid with a sterilized and clean sponge.¹

3. DOG EARS

Bunching up of an expanded skin along an arc of rotations leads to dog ear. It should be accepted in the beginning, as for many it will die out or become smaller and insignificant. Resection at the time of advancement

makes a larger scar and may de-vascularize tissue.¹

4. WIDENING OF SCARS

Any surgery might lead to widened scars post-operatively. In TE, scar where expanded scalp was tailored and sewn to itself to eliminate a dog-ear demonstrates the importance of not interrupting the advancing edge of an expanded skin flap, especially hair-bearing skin.¹

MAJOR COMPLICATIONS

1. INFECTION

Treatment plan gets affected by the acquired infections. A very large hematoma undergoing a staged reduction of this anomaly presented with a markedly larger expander pocket and the classic signs of infection. At the time of incision and drainage, a large volume of cloudy fluid was found around the expanders. After removing the expanders and packing the wound, the patient was allowed to heal by secondary intention. Antibiotic prophylaxis with incision and drainage should be given in the case of infection.

Irrigation with an antibiotic solution is advised at the time of TE placement. If an expander does become infected drainage, irrigation and antibiotic therapy should be started immediately. If this results to be non-beneficial, right away implant should be removed. Re-insertion is only possible, if infection completely subsides.¹

2. EXPOSURE

Necrosis of the overlying skin or through the original incision line results is implant exposure.

If, an implant pocket created is too small which subsequently places the implant in contact with the suture line is the main reason of exposure therefore, the pocket created by the surgeon should be large enough to prevent the implant from being in immediate contact with the suture line. Too rapid expansion can also lead to excessive thinning, necrosis and subsequent extrusion.

Exposure of TE may follow dehiscence of the incision, erosion of an envelope fold through the skin, erosion through an inadequate tissue cover manipulation by a psychotic patient.

Mostly a two-layer closure with subcutaneous absorbable stitches and nylon sutures in the skin or a closure interrupted nylon mattress sutures and a running nylon skin closure. Nylon sutures were left in place for 3 weeks before removal; this management seemed adequate. Care is taken to see that the incision did not, where possible overlies the expander.^{1,4}

After removal of skin sutures, secure steri strips or dressings should be placed at the suture line. Antibiotic coverage is required after exposure of the implant but expansion at times can be continued with frequent inspection for any on site infection.¹

3. INDUCED ISCHEMIA

Compression to the overlying tissues by the vigorous inflation of an expander to such an extent that it leads to ischemia. Previous radiation therapy may complicate the tissue expansion

by reducing blood supply to the soft tissues to be elevated.¹

4. HEMATOMA

Existence of blood beneath the flap has destructive effects leading to infection and necrosis. Hematoma with compression leads to necrosis. Expander must be removed after the formation of hematoma and hemostasis must be achieved.¹

5. NEUROPRAXIA

It is rare complication¹ of TE. Nerve compression is caused by rapid rates and large volumes of expansion which is secondary to direct mechanical force. The consequences of neuropraxia generally fix rapidly as long as it is treated early enough to prevent the onset of focal demyelination.¹

6. PSYCHOLOGIC INTOLERANCE

Psychologic intolerance is a rare complication that occurs during tissue expansion. Tissue expansion seemed to cause a distortion of body image in most patients, and for some patients it apparently rekindled emotions associated with their previous trauma or surgery for which they were having reconstruction.^{1,4}

7. IMPLANT FAILURE

It can cause due to many factors, TE device is very reliable, with only 1 manufacturing defect that the injection port lacked a solid back to stop the needle from passing out the deep side, thereby missing in injection chamber and creating a leak in the port. Still the greatest source of expander failure remains the physician error which

include faulty assembly, breaking the connector tube linking the expander envelope with the remote port, or leaving connections loose.^{1,4}

CONCLUSION

The use of tissue expanders in the head and neck area is associated with a relatively low risk of complications. Thus, careful patient selection is mandatory to avoid complications in tissue expansion.

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