

# Tissue expansion in reconstructive surgery

## A case report

A. DE GREEF

### Summary

A case is reported in which serial expansion was used to create scalp and forehead flaps of superior quality skin and subcutaneous tissue to cover a central forehead defect. The background and principles governing this surgery are discussed.

*S Afr Med J* 1986; 69: 705-707.

Numerous plastic surgical techniques have been evolved to provide tissue to areas of need — skin grafting with split or full-thickness skin, local flaps, distant flaps, myocutaneous flaps and, recently, free revascularized microvascular tissue grafting. Tissue expansion can now also play a role in these reconstructive techniques. It is after all a normal process and can be seen in the skin and soft tissues in pregnancy, over a haematoma or enlarging tumour, etc.

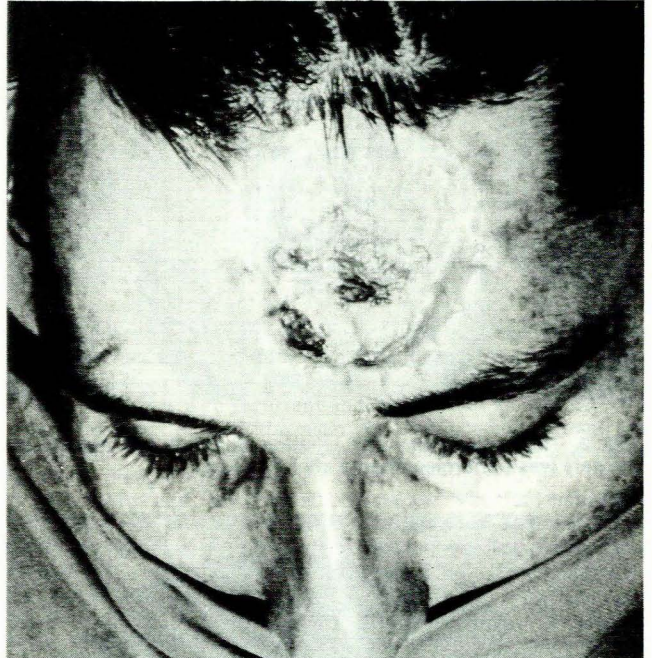
Tissue expansion is the creation and development of donor tissue<sup>1</sup> by using a tissue expander, which is fitted with normal saline by injection through the expander's reservoir dome. Pressure within the expander is transmitted to the skin flap via a valve system.

In the past decade Radovan and Austad,<sup>2</sup> working independently, have evolved the necessary technology for safe, controlled expansion of soft tissue although the ultimate scope and limits of this technique still need to be defined.

### Case report

A 24-year-old white man presented with a 4,5 x 5 cm full-thickness soft-tissue defect of the central forehead. In some areas the periosteum was also destroyed, exposing the frontal bone. He had sustained the injury in a knife fight 3 months earlier (Fig. 1).

A standard split-thickness skin graft (Thiersch's graft) harvested from his right thigh failed to take completely and also gave a very poor aesthetic result. Further surgery was indicated to cover the exposed frontal bone as well as to improve the cosmetic appearance. Available local flaps would have closed the defect with extreme difficulty and distant and tubed flaps would have involved numerous different stages. The patient suffered from severe asthma and bronchospasm and it was not thought wise to expose him to the extremely long anaesthesia that would be required to perform such a free revascularized microvascular tissue transfer. The donor area defect would also be less aesthetically acceptable than with other procedures. (A Chinese forearm flap would have provided a



**Fig. 1.** The 4,5 x 5 cm defect on the patient's forehead is clearly seen. The areas of frontal bone exposure are also evident where the skin graft did not take.

good quality graft with the right amount of bulk, but it leaves an extremely obvious donor defect.)

Tissue expansion was finally decided on to increase the size of the locally available skin flaps. This is a relatively small surgical procedure causing less donor-area defect.

Radovan 250 ml (medium) rectangular tissue expanders were inserted on either side of the defect via parietal incisions 1 month after the graft failure. The reservoir was positioned over the firm mastoid bone for convenient location at the weekly saline inflations.

Over a period of 5 weeks the tissue expanders were fully inflated. The final surgical procedure entailed placing a frontal flap from each side over the defect; each flap was based on the superficial temporal artery and vein. The defect was then closed in a zig-zag fashion to give a better final scar (Figs 2 and 3).

### Discussion

There are at present two basic types of tissue expanders marketed. One consists of a reservoir (inflation bulb) with a connecting tube to the expander, and the other contains a permanently attached reservoir with a self-sealing valve, on the anterior aspect of the expander. There are numerous different sizes and shapes in both groups and custom-made tissue expanders are also available on demand.

The advantages of using this technique are mainly in the mechanical creation of excess soft tissue contiguous to a defect,<sup>3</sup> for use in reconstruction. This extra local tissue is

Department of Plastic and Reconstructive Surgery, University of Stellenbosch and Tygerberg Hospital, Parowvallei, CP

A. DE GREEF, M.B. B.CH., M.MED. (PLAST. AND RECON.), *Part-time Consultant*

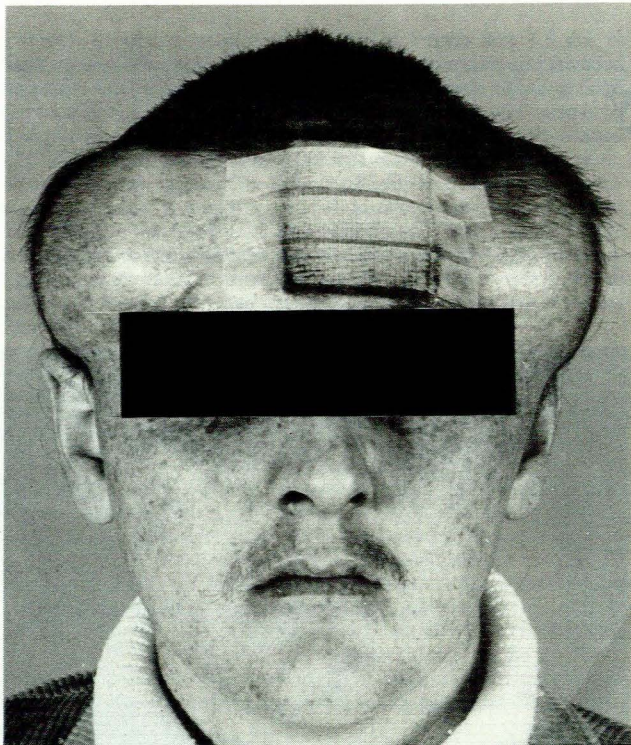


Fig. 2. The patient after full inflation of the tissue expanders. Surgery was performed shortly after this stage.

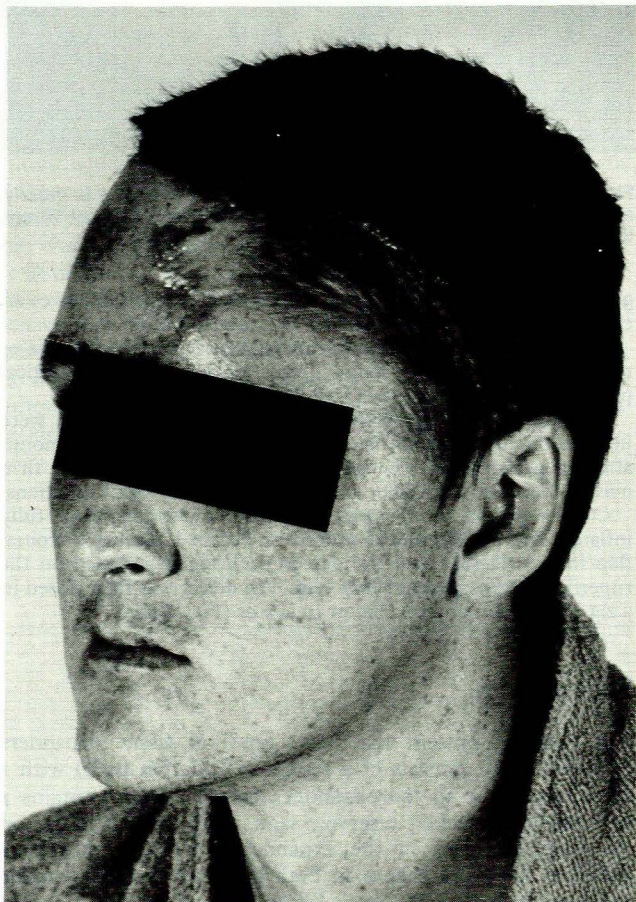


Fig. 3. The satisfactory final results 3 weeks postoperatively. The Z-plasty scar is clearly visible and the supra-orbital and hairline incisions are well healed and well concealed.

optimally matched in texture, colour, sensation, thickness and hair-bearing characteristics to the local skin. It has also been shown that flaps from expanded tissue have a significantly augmented survival time compared with conventionally planned flaps of the same design.<sup>4</sup> In addition there is minimal donor-site morbidity.<sup>5</sup>

Histological changes were noted in the tissue overlying the expander. No dysplastic or metaplastic epidermal changes were seen and the hair follicle morphology remained normal, nor was there thinning of the epidermis,<sup>6</sup> although thinning of the dermis occurs even if muscle overlies the expander. Even though the donor flap is slightly thinned by the procedure, it is supported by an additional capsule layer that develops around the expander. However, the dermal layer slowly recovers its thickness.<sup>4</sup>

According to previous reports<sup>3,5-7</sup> complications of tissue expansion have been relatively few and were mostly related to deflation. Fewer complications have been encountered during expansion of facial tissues than with other tissues,<sup>7</sup> probably due to the better blood supply in this area. It is best to apply the principles of flap surgery and to treat the expanded skin as a random flap.

Several patients have noted mild discomfort due to the expansion process and required sedation at night.<sup>7</sup> This discomfort subsided after removal of the expander. Major complications including infection, haemorrhage and expander exposure were noted in up to 17% of cases in some series. No complications were noted due to the pressure effect on vital structures or neurovascular bundles.<sup>7</sup> Minor complications included pain on expansion, seroma formation after expander deflation and dog ears after advancement surgery but these rarely delayed the reconstructive process.<sup>8,9</sup>

It is useful to instil methylene blue into the tissue expander during its primary placement, in order to see clearly when the needle is properly positioned during the weekly inflation procedure. On slight aspiration the blue fluid will be clearly evident in the syringe and this will confirm that the needle is in the correct position.

Peri-operative antibiotics are occasionally employed,<sup>10</sup> although the use of prophylactic antibiotics is controversial. If there is no clear indication for antibiotics they should probably not be used.

Contraindications to tissue expansion include tissue with a poor blood supply (e.g. irradiated tissue), acute localized infection, and recurrent malignant disease. It should not be used in psychologically unstable patients, or in those who are not prepared to tolerate an implant.

## Conclusion

Tissue expansion is a useful tool in the armamentarium of the plastic surgeon.<sup>11</sup> In properly selected patients this technique provides excellent quality donor tissue, with minimal donor-area morbidity and a low incidence of complications.

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# Choledochopancreatoduodenal fistula caused by duodenal ulceration

## A case report

R. J. AITKEN, P. C. BORNMAN, D. M. DENT

### Summary

A penetrating duodenal ulcer may occasionally erode into the common bile duct and form a choledochoduodenal fistula. Such a fistula occurring simultaneously with a pancreatic duodenal fistula is reported. The presenting features of these fistulas are those of the ulcer and confirmation of the fistula may be difficult, although use of endoscopic retrograde cholangiopancreatography has greatly facilitated their diagnosis. In this case both fistulas could be cannulated through the base of the ulcer. The majority of these fistulas heal spontaneously with intensive medical management. The remainder require surgery, and a conservative approach avoiding direct interference with the fistula should be adopted. Drainage procedures are rarely required and once closed the fistulas usually cause no further problem.

*S Afr Med J* 1986; **69**: 707-708.

Choledochoduodenal fistula formation secondary to duodenal ulceration is well described,<sup>1-3</sup> but the occurrence of such a fistula with simultaneous fistula formation into the pancreatic duct has not previously been reported. The diagnosis, investigation and management of such a case are described.

### Case report

A 48-year-old woman presented with a 15-year history of recurrent dyspepsia. Her first hospital admission 13 years previously had led

to an exploratory laparotomy after extensive investigations, including a barium meal, failed to establish a diagnosis. At laparotomy a diagnosis of chronic pancreatitis was made. Her second admission 2 years later was with recurrent abdominal pain; air was noted in the biliary tract on both the plain abdominal radiograph and the intravenous cholangiogram. A barium meal demonstrated reflux from the first part of the duodenum into the biliary tree.

Her third and most recent admission was for continuing abdominal pain relieved only by copious ingestion of a proprietary drug containing aspirin. In view of the previous findings an endoscopic retrograde cholangiopancreatogram (ERCP) was performed and this revealed a large post-bulbar duodenal ulcer with two slit-like openings in the base. Cannulation of the two openings demonstrated a normal biliary tree and pancreatic duct system. (Fig. 1). The basal acid output was 0,3 mEq/h and maximal acid output 12,2 mEq/h. The serum gastrin was normal. Cimetidine was prescribed for 6 weeks, but the symptoms persisted and the ulcer failed to heal.

The patient was referred for surgery and at laparotomy a large inflammatory mass densely adherent to the undersurface of the liver was found. Gastrotomy confirmed the large post-bulbar duodenal ulcer with the two openings seen at ERCP. In view of the nature and position of the ulcer a vagotomy and Jaboulet gastroduodenostomy was performed. The patient made an uneventful postoperative recovery, and remains symptom-free 22 months later.

### Discussion

The erosion of a posterior penetrating duodenal ulcer into the suprapancreatic common bile duct is rare, but well documented.<sup>1-3</sup> However, we are unaware of any previous reports on the simultaneous involvement of both the common bile duct and the pancreatic duct with duodenal ulceration. Dawson and Allen-Mersh<sup>4</sup> recently studied the intimate relationship between the retropancreatic bile duct and the main pancreatic duct and found that over the distal 4 cm the two ducts lay within 5 mm of each other, separated distally only by their respective linings. On anatomical grounds the complication described here is easily explained, and the lack of previous reports is probably due to ERCP being unavailable in the past.

The presenting features of a choledochoduodenal fistula from duodenal ulceration are those of an ulcer. On investigation over half the patients exhibit pneumobilia on plain abdominal radiographs,<sup>3,5</sup> and the diagnosis is confirmed by reflux of

Department of Surgery and Surgical Gastro-intestinal Clinic, University of Cape Town and Groote Schuur Hospital, Cape Town

R. J. AITKEN, F.R.C.S.

P. C. BORNMAN, M.MED. (SURG.)

D. M. DENT, F.R.C.S.