ORIGINAL CONTRIBUTION

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Lessons learnt from an audit of 95 cases of major nasal reconstruction*

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SUMMARY

Background: *Several texts detail the possible complications of nasal reconstruction but few critically describe a series. We present an audit of the complications of 95 major nasal reconstructions.*

Methods: *This is a retrospective analysis of 95 consecutive major nasal reconstructions (49 male, 46 female, aged between 4 and 92 years) over a 16-year period treated in a tertiary referral centre.*

Results: *Fifty-eight patients in our series required nasal reconstruction after Moh's Micrographic surgery for a morpheiform basal cell or a squamous cell carcinoma. Eight patients had further removal using frozen section to determine the margins, as the disease was very extensive. Minor procedures with local random flaps or full thickness skin grafts were excluded. Ninety-five patients underwent major reconstructive procedures and had an average of 2.8 operations.*

Summary: *The main problem was the suboptimal contouring of the alar margin in 6 of 54 patients who had a full thickness defect repaired. Other complications included telangectasia or hair growth requiring laser ablation (13), stenosis of the nasal valve area (2), ectropion after a cheek advancement flap, donor site haematoma of the pinna, and neuropathic pain.*

Key words: nose, nasal reconstruction, facial plastic surgery, complications, audit

INTRODUCTION

Many different techniques have been use to reconstruct nasal defects. Contemporary nasal reconstruction is based on 3 major principles:

1. providing appropriate skin cover and internal lining [(1)],
2. using adequate structural support [(2)]
3. respect the aesthetic subunits of the nose [(3)].

The principles and operative techniques of nasal reconstruction are very well described in the books by Burget and Menick [(1)] and Baker [(4)].

The main technical challenge in nasal reconstruction is obtaining symmetry of the alar margins and a thin and contoured lower third of the nose. Replacing dorsal skin alone is relatively straightforward. It is replacing a full thickness defect of the alar margin or columella that is a challenge. The paramedian forehead flap (PMFHF) is the main source of donor tissue but it is normally much thicker than the skin of the lower third of the nose. Whilst the PMFHF can be thinned to a large extent, it is difficult to obtain a refined alar margin if it has to extend around a free cartilage graft and replace some of the missing inner lining, particularly in a heavy smoker or someone who is overweight. Whilst an anteriorly based septal flap can provide a vascularised inner lining this is not always available. Posteriorly based septal flaps cannot be advanced near the alar margin to provide an adequate internal lining.

Many other problems have been described from hair growth to flap necrosis [(1)]. Our audit was done to analyse the outcome of the nasal reconstructive procedures undertaken by the senior author (NSJ) and to compare the results and complications with other studies.

METHODS

Ninety-six consecutive patients, who had undergone nasal reconstructive surgery from May 1992 to December 2008, were identified from a database of the senior author (NSJ). The medical records of one patient could not be found. The records and photographic documentation of the remaining 95 patients were reviewed and analysed for demographics, underlying pathology, operative procedures, aesthetic result and any complications.

RESULTS

In the study group 49 patients were female and 46 male. The average age at presentation was 61 years 1 month (median age 63 years, age range 4 -94 years). The type of reconstruction technique is listed in Table 1 with many procedures requiring more than one flap.

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Table 1. The main surgical technique used for the first stage of their nasal reconstruction. Many patients needed more than one technique.

Paramedian forehead flap	Cheek advancement flap	Nasolabial island flap	Conchal cartilage graft	Composite auricular graft	Septal flap	Glabella flap	Dorsal flap
62	26	17	Unilateral 42	unilateral 9	27	1	1
			bilateral 8	bilateral 3			

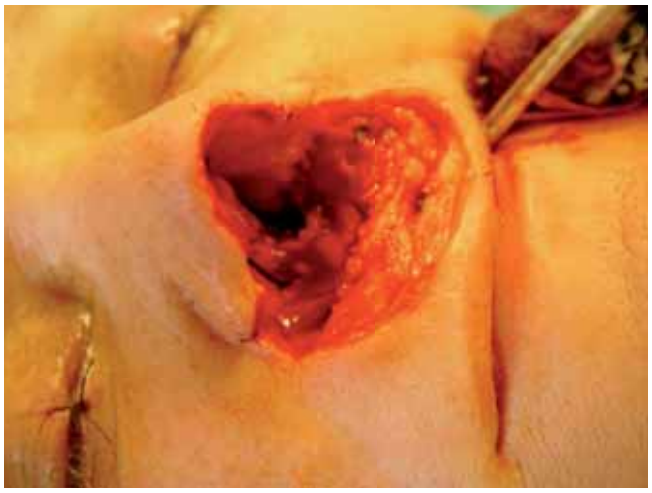

Figure 1. Resection of a recurrent squamous cell carcinoma by frozen section following its recurrence after radiotherapy. Paraffin sections examined later revealed incomplete resection.

Figure 2. Immediate picture after primary reconstruction.

Table 2. A list of complications by pathology and surgical technique.

Complication	Reconstruction technique	Pathology	Treatment
Hair growth on flap (13)	Paramedian forehead flap into hairline +/- septal flaps/ conchal cartilage graft	Basal cell carcinoma	Laser treatment (11) Depiliatory cream/shaving (2)
Notching of alar margin (6)	Composite free graft for internal lining (3 of 9 used) Septal flap for internal lining with baton of conchal cartilage (3 of 27 used)	Basal cell carcinoma (3) Trichoblastoma (1) Human bite (1) Hamartoma (1)	Inserted further cartilage and tried to advance margin but to little effect
Incomplete resection of primary tumour	Septal flaps, free conchal cartilage, paramedian forehead flap with Frozen section – said to be clear	Squamous cell carcinoma; recurrence after radiotherapy	Removed reconstruction and reconstructed with bilateral nasolabial flaps
Ectropion	Cheek advancement, paramedian forehead and septal flap	Basal cell carcinoma	Free full thickness skin graft
Stenosis of the nasal valve	Free conchal composite grafts as lining for paramedian forehead flaps and radiotherapy	Squamous cell carcinoma (2)	Insertion of further composite graft
Haematoma of the pinna	Free conchal cartilage graft as scaffolding for a paramedian forehead and septal flap	Basal cell carcinoma	Drained haematoma
Free conchal cartilage graft infected (2)	Secondary procedures to fill defects after the primary procedure	Basal cell carcinoma (1) Invasive aspergillosis (1)	Given antibiotic prophylaxis on subsequent occasions
Telangectasia of the skin	Paramedian forehead flap with a cartilage graft	Basal cell carcinoma (2)	Laser
Extrusion of split calvarial bone graft (post trauma)	Paramedian forehead flap, contralateral septal flap, cheek advancement and free conchal cartilage	Squamous cell carcinoma and radiotherapy	Second paramedian forehead flap
Necrosis of flap after second stage (heavy smoker and malnourished alcoholic)	Paramedian forehead flap with septal flap and free cartilage graft	Dog bite	Awaits second paramedian foread flap when fit

The majority of the patients requiring nasal reconstruction had an underlying malignancy. Fifty-nine patients presented with a basal cell carcinoma. Most of these (58) underwent Moh's micrographic surgery in the dermatology department. Squamous cell carcinoma was the underlying pathology in 11 patients. A non-neoplastic aetiology for the nasal defect was found in 25 patients (accident 7, human bite 3, dog bite 2, infected implant 1, and invasive aspergilliosis 1). A further 11 patients presented with different pathologies including inverted papilloma with a squamous cell carcinoma in the lacrimal sac [(2)], haemangioma [(2)], trichoblastoma, myofibroma, connective tissue hamartoma, keratoacanthoma, transitional cell carcinoma, sarcoma and post embolism for a haemangioma that was complicated by excessive sclerosant that infracted the nose and cheek.

Fifty-eight patients had Moh's micrographic surgery and went on to have their nose reconstructed up to 48 hours later. One patient in whom excision of a recurrent basal cell carcinoma, initially resected at another unit, could not be cleared by Moh's micrographic surgery required frozen section under general anaesthesia. Reconstruction was then delayed to await the result of paraffin section to ensure that the resection was complete. All 11 patients with a squamous cell carcinoma underwent a combination of Moh's micrographic surgery with or without frozen section if resection of the margins became too painful, usually because bone had to be removed. In 1 patient who had previously failed radiotherapy elsewhere for a squamous cell carcinoma of the columella and premaxilla, the frozen section was deemed to be clear and the patient was reconstructed (Figures 1 and 2). However, after paraffin section this proved not to be the case and the reconstruction had to be removed. A further reconstruction was done with delayed nasolabial flaps, but residual disease appeared high on the nasal dorsum six months later and a radical rhinectomy was done and a prosthesis provided. The patient is disease free after 5 years.

The majority of patients required less than 3 procedures (76%). More stages were required in 23 patients. These procedures were sometimes combined with others including the removal of a foreign body [3], an open septorhinoplasty [2], enucleation of an eye [2], ethmoidectomy and removal of the lateral wall of the nose [2], nasofacial resection, calvarial or iliac bone graft, rib cartilage graft, scalp rotation flap, superficial temporal flap, radial forearm flap, repair of septal perforation or neck dissection.
Patients were discharged home after an average of 2 days following major reconstruction (range 1 to 12 days). In only 8 patients was the discharge from hospital delayed (4 – 12 days) mainly due to medical reasons.
The average time between the 1st and 2nd stage in patients who underwent reconstruction using a PMFHF was 31.3 days (median 32). This excludes the 4 patients that required postoperative radiotherapy (RT). In this group the pedicle was divided after completion of RT. The second stage would typically involve division of pedicle, thinning of the flaps, realignment of eyebrows and division of any septal flap. Other procedures at the second stage included: forming a naso-alar groove, septoplasty or inserting a further cartilage graft to the alar margin.
The third and further stages would usually involve thinning of the flaps, scar revision, forming naso-alar grooves, or placing a further cartilage graft in the alar margin or sidewall of the nose.

Figure 3. Following a paramedian forehead flap dark hair grew on the tip of the nose from the donor skin that came from within the hairline.

Figure 4. The same patient as figure 3 following laser treatment to stop the hair growing.

Complications (see Table 2)
Laser treatment to reduce hair growth on the nose was done in

Figure 5. Notching of the alar margin (frontal view).

Figure 6. Notching of the alar margin (lateral view).

Figure 7. Telangectasia around the reconstruction where the patient had previous radiotherapy and a paramedian forehead flap, a septal flap and a free conchal graft.

Figure 8. The same patient as figure 7 who has had laser treatment for the telangectasia.

Figure 9. Ectropion following a cheek advancement flap done in conjunction with a paramedian forehead flap, septal flap and free conchal cartilage graft.

11 patients (Figures 3 and 4). Two patients could not have laser treatment because of fair or white hair and they shaved the hair and used depiliatory cream. Alar retraction developed in 6 patients following a PMFHF (Figures 5 and 6) in spite of a free cartilage baton graft being placed along the alar margin. These occurred when the paramedian forehead flap was very thick and/or its vascularity was poor and this limited the amount it could be thinned and rolled around the margin. Notching occurred in 3 of the 8 patients where a composite graft was used to replace the internal lining. A vascularised internal lining using an anteriorly based septal flap is preferable.

Two patients developed telangiecetasis that were also treated with laser (Figures 7 and 8). Two patients had unilateral nasal obstruction where cicatrisation had occurred at the nasal valve. These patients had had this area reconstructed with free grafts as vascularised tissue was not available. Two patients had a complication after harvesting of a cartilage graft from the pinna. One patient developed a haematoma of the pinna, and a further patient developed pain around the auricle that persisted for several months but was alleviated after two injections of triamcinolone and marcaine and the passage of time. Two patients developed an infection after insertion of a camouflage cartilage graft at a later stage. These required removal and a course of intravenous antibiotics. In three patients a hypertrophic scar on the nasal dorsum needed to be treated with triamcinolone injections and scar revision. A delay in wound healing occurred after exenteration of the eye and skin grafting in one patient, but this eventually healed by secondary inten-

Figure 10. A large defect following resection of a squamous cell carcinoma was reconstructed with a cheek advancement flap, a contralateral septal flap, a turbinate flap, free cartilage, split calvarial bone and a paramedian forehead flap.

Figure 12. A second paramedian forehead flap and free cartilage graft was used.

Figure 11. After an injury the bone graft became exposed internally, infected, and had to be removed. This resulted in severe cicatrisation.

tion. One patient developed an ectropion after a cheek advancement flap (Figure 9) that was repaired with a full thickness skin graft. A further patient developed a breakdown at one edge of a nasolabial island flap and the defect healed well by secondary intention.

An infection under the PMFHF occurred in a patient who was an intravenous drug abuser and heavy smoker. This patient had lost his nose after a human bite and in spite of regular cleaning with hydrogen peroxide and betadine© and a delayed repair, his free cartilage graft became infected. In this case the cosmetic result was poor due to severe uneven scarring. The tissue was of such poor quality and vascularity further thinning of the flap was not done. One patient with an underlying SCC who had a reconstruction including a PMFHF and calverial bone graft followed by radiotherapy (Figure 10) was hit on the nose and their bone graft became exposed intranasally and developed an infection. His bone graft had to be removed and this resulted in significant cicatrisation (Figure 11). The patient underwent further nasal reconstruction with a second PMFHF (Figure 12). In one patient who had had radiotherapy for a squamous cell carcinoma that caused a septal perforation and alar necrosis (Figure 13) the reconstruction was problematic, as the damaged skin secondary to an endarteritis from the radiotherapy was not removed. This meant that the PMFHF retracted into a small ball when its pedicle was divided (Figure 14A)

Figure 13. Following primary radiotherapy for a squamous cell carcinoma this man developed necrosis of his septum and lateral lower third of the right side of his nose. Note the remaining damaged surrounding skin.

and further surgery was done but some contraction and asymmetry remained (Figure 14B). One paramedian forehead flap necrosed after the second stage in an alcoholic heavy smoker when its lateral attachment came away from its vascular bed at the second stage. The vascularity of the flap was poor but it remained perfused when a trial tourniquet was placed around the pedicle, before it was divided. The patient had had a cerebrovascular event two weeks prior to the second stage and smoked over 50 cigarettes a day. At the second stage the lateral part of the flap detached from the cheek whilst the upper third of the flap was being thinned such was his poor nutrition and healing one month after the first stage.

In one patient a positive margin was found on paraffin section histology after she underwent tumour resection for a SCC (Figures 1 and 2) where there had been clear margins on frozen section. The reconstruction was done at the same time as the frozen sections were clear. The whole repair was excised to remove the area with a positive margin. A further reconstruction was done at this stage using bilateral nasolabial flaps but she developed a recurrence 6 months later and required a radical rhinectomy. She has been tumour free for 4 years and has a prosthesis.

One patient with a SCC developed a neck metastases two years after his nasal reconstruction and this was resected.

Figure 14A and B. The damaged skin was not removed enough and the paramedian forehead flap contracted on the free cartilage graft used to provide a scaffold, particularly after the pedicle had been divided. Local scar revision made some improvement but there was still contracture and a deficit of tissue.

DISCUSSION

Most of our patients undergoing major nasal reconstruction had 3 procedures or less (76%). The PMFHF is a very reliable and robust and is an excellent match in colour and skin texture for reconstruction of large nasal defects. We followed a two-stage technique for the PMFHF, which differs from the 3-stage technique described by Menick [5]. This has allowed us to perform 21 reconstructions with PMFHF in only two stages. We believe that a reduced number of procedures and as little time with a disfiguring pedicle in position is a significant advantage to patients. Thinning the PMFHF at the first stage is critical in obtaining a good cosmetic outcome. This technique led to necrosis in only one patient with severe vascular and nutritional problems. Hair growth at the alar or nasal tip occurs in patients with a low hairline or when the flap had to extend past the nasal tip. Laser treatment for individuals with dark hair is effective and depiliatory cream and trimming the hairs is needed in people with fair or white hair. Telangectasia sometimes develop, particularly if the patient has had radiotherapy. Laser treatment of these vessels works well. A list of complications by pathology and surgical technique is listed in Table 2.

We found that a composite graft for reconstructing the alar margin can lead to alar retraction. The senior author therefore changed his technique and now uses an anteriorly based septal mucoperichondal flap and a free auricular cartilage graft wherever possible to provide the internal lining and structural support for this area.

In contrast to Rohrich et al. [6], we followed the principle of replacing the entire aesthetic subunit if more than 50% is involved and we agree with Burget and Manick [3] that this results in a better cosmetic result. The only exception to this rule was the tip area, where we accept a larger defect than 50% but make it symmetrical. We agree with Singh and Bartlett [7] that for this for this functionally and aesthetically important area preservation of as much tissue is advisable to achieve a good outcome.

One of our cases has demonstrated how important it is not to rely on the frozen section and to wait for definitive histology in patients with a SCC before undertaking any reconstruction.

That the nose has to be dressed for several days is a small price to pay for the increased certainty that reconstruction is taking place on a disease free bed.

In our practise we have observed that patients who did not want to see their nasal defect prior to reconstruction had higher expectations and more difficulty in accepting the postoperative outcome. We would recommend that the reconstructing surgeon is particularly vigilant for any potential psychological issues in this subgroup. Counselling beforehand with pictures that show the stages of reconstruction help the patients to prepare themselves and discussion with a patient who has had nasal reconstruction also appears to be beneficial although we have not quantified this.

CONCLUSION

Reconstructing a full thickness defect of the alar margin remains one of the main challenges, particularly when a vascularised septal flap is not available. In patients in whom the subcutaneous layer of their forehead is thicker and in those with poor vascularity it is more difficult to thin their PMFHF and obtain a refined contour of the alar margin. Vascularised tissue is preferable to cover free grafts wherever they are available. It is important to only reconstruct when the surgeon is sure that the patient is disease free and in squamous cell carcinoma this may mean waiting for the result of paraffin sections. Hair growth and telangectasis are recognised complications and patients need to be warned that these may occur although they can often be dealt with by laser treatment. Patients required a mean of 2.8 operations but several required multiple procedures and patients should be made aware of this possibility.

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