Good results after endonasal cartilage closure of nasal septal perforations

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ABSTRACT

INTRODUCTION: Surgical closure of nasal septal perforations is a challenging procedure. Several approaches and techniques have been described with different levels of success. We report our experience in nasal septal perforation surgery.

MATERIAL AND METHODS: We reviewed a sample of 19 patients who underwent surgical closure of nasal septal perforations. The perforations varied in size from 3 mm to 25 mm (mean 13 mm). Outcome was assessed on the basis of a comparison of the preoperative and final follow-up assessment of perforation size and symptoms. The surgical technique is based on an endonasal approach with dissection of bilateral bipedicled mucoperichondrial/-periosteal advancement flaps and interposition of a septal or conchal cartilage graft.

RESULTS: Symptomatic resolution was documented for 18 of the 19 patients (95%). Complete closure was accomplished in 16 patients (84%) without major complications. We observed no graft donor site morbidity.

CONCLUSION: The technique described uses recognized surgical principles to reconstruct the original nasal architecture and physiology. The results achieved sustain that the method offers both durability and strength. The endonasal approach leaves no scars, reduces risk of tip-rotation and offers sufficient view and space for instrumentation. We conclude that this method is suitable for treatment of perforations up to a vertical height of at least 25 mm.

The nasal septum is an important physiologic and supportive structure of the nose. Nasal septal perforations are defects of the nasal septum with complete interruption of mucosal and cartilaginous tissue.

The aetiology is multitudinous (**Table 1**) with iatrogenic injury accounting for the majority of recognized septal perforations [1-7]. Proper exposure of medical history and a thorough physical examination are imperative, while failure to diagnose and manage any underlying pathologic condition may compromise successful repair of the perforation and delay proper treatment of any severe underlying disease [3, 5, 8-10].

Once established, septal perforations do not close spontaneously [9]. The perforations create a turbulent airflow and therefore disturb the normal humidification process [3, 11, 12], which leads to a wide variety of symptoms including crusting and dryness, recurrent epistaxis, nasal obstruction, malodorous discharge, paranasal pain, headache and whistling [3, 4, 8, 10, 13]. Larger perforations may compromise the structural support of the nose, causing external nose deformities [2, 3, 11, 14]. The more anterior located and to some degree the larger a perforation is, the more likely it is to cause symptoms [8, 10, 11, 13, 15].

Treatment is only indicated in the presence of symptoms [1-3] and can be either conservative or surgical. Conservative treatment is limited to the use of saline and ointments to moist the mucosal surfaces, or close the perforation with a silastic septal button. Crust formation or even enlargement of the perforation often limits the quality of such treatment and both methods have a number of shortcomings [3, 6, 11, 15]. Nevertheless, these modalities are the treatment of choice when the patient suffers from ongoing systemic diseases or is committed to continued drug abuse [3, 8].

Surgery remains the most efficient treatment of septal perforations, since successful closure completely eradicates symptoms and the need for further treat-

TABLE 1

Aetiology of septal perforations.

Nasal septal surgery
Cautery
Cryosurgery
Nasal packing after surgery or epistaxis
Digital manipulation
Trauma/septal hematoma or abscess
Decongestants
Idiopathic
Cocaine abuse
Wegener's granulomatosis
Lupus erythematosis
Sarcoidosis
Tuberculosis
Neoplasm (e.g. midline lethal granuloma)
Nasotracheal intubation
Nasal steroids
Congenital perforations

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TABLE 2

Patient details.

Case no.	Age[a] years	Sex	Aetiology	Size[b] mm
1	17	m	Septoplasty	25
2	20	f	Septoplasty	10
3	22	f	Septoplasty	20
4	25	f	Septoplasty	3
5	26	m	Nose-picking	20
6	30	m	Nasal packing (epistaxis)	15
7	36	m	Septoplasty	7
8	38	m	Decongestant abuse	8
9	41	f	Idiopathic	20
10	42	m	Septoplasty	15
11	44	m	Septoplasty	5
12	45	m	Septoplasty	15
13	45	f	Idiopathic	15
14	50	m	Decongestant abuse	20
15	52	m	Radiotherapy	5
16	54	m	Nasal packing (epistaxis)	14
17	64	m	Nasal packing (epistaxis)	10
18	67	m	Nasal packing (epistaxis)	10
19	74	m	Nasal packing (epistaxis)	10

a) Mean: 41.7 years. b) Mean: 13 mm.

ment. Successful surgical closure of septal perforations is a challenge. Numerous approaches and techniques have been described and historical closure rates range from 20% to 100% [2, 8]. No single technique has been established as the best choice for closure of all perforations [1, 2, 5, 6, 8, 10]. The trend goes toward multilayered tension-free closure, using uni- or bilateral local mucoperichondrial and -periosteal flaps with interposition of autogenous grafts [1, 3, 6, 8].

We report our experience in nasal septal perforation surgery, using the endonasal approach, bilateral local mucoperichondrial and mucoperiosteal bipedicled flaps and septal or auricular conchal cartilage grafts. The technique has not previously been described in detail, and to our knowledge no Danish study has yet been published on this subject. Our purpose is to focus attention on septal perforations and demonstrate that surgical closure can be performed successfully.

MATERIAL AND METHODS

We retrospectively reviewed 19 patients (14 men and five women) who underwent surgical repair of symptomatic septal perforations during a five-year observation period between 2005 and 2009 (details are presented in **Table 2**). None of the patients referred had absolute contraindications to surgery, hence all were included.

The patients had a mean age of 41.7 years (range: 17-74 years). The presenting symptoms were nasal obstruction (63%), crusting (53%), epistaxis (47%), deformities (16%) and whistling (16%). Prior to surgery, all patients had a general ear, nose & throat examination that included complete visualization of the nasal septum.

The perforations varied in size from 3 mm to 25 mm (mean: 13 mm) and all perforations were located at the anterior part of the cartilaginous septum. None of the patients had previously undergone surgical treatment of their perforation.

No major co-morbidity was documented except for one patient (case no. 18) who suffered from diabetes and cardiac disease (and was treated with anti-coagulants due to a prosthetic heart valve).

According to the standard recommendations at our department, all patients were reexamined six weeks and six months postoperatively. Furthermore, all patients were encouraged to contact the department in case of recurring symptoms.

Outcome was assessed on the basis of a comparison between preoperative and final follow-up assessment of perforation size and symptoms.

Surgical technique

Surgery was performed in general anaesthesia.

Local anaesthetic (1% lidocaine and epinephrine 5 micrograms/ml) was administered at the donor site and the nasal mucosa was decongested with a solution containing 2 ml cocaine 10%, 2 ml epinephrine 1‰ and 1 ml sodium bicarbonate 8.4% and infiltrated with 2% lidocaine and epinephrine 12.5 micrograms/ml to reduce intraoperative bleeding.

The conchal cartilage graft was harvested with intact perichondrium on both sides via an incision at the border of the anthelix. The skin was closed with nonabsorbable sutures (Monosof 5-0), and a pressure dressing (Melolin) was applied to both sides of the concha and secured with nonabsorbable sutures (Surgipro 4-0). The pressure dressing was removed one day postoperatively.

A hemitransfixion incision was performed on the right side with preparation of upper and lower right and left tunnels ad modum Cottle. The dissection was made under the perichondrial layer of the septum and extended around the perforation. Septal deviation was corrected at this stage of the operation if deemed necessary and septal cartilage was harvested in case of excessive deviations. The inferior tunnels were continued laterally under the periosteal layer of the nasal floor to the insertion of the inferior turbinates. Releasing incisions were made under the inferior turbinates in the anterior-posterior direction, which permitted the creation of bilateral bipedicled anterior and posterior based flaps. The incisions were placed individually according to the size and location of the perforation. The two superior tunnels were extended under the roof of the nose just laterally to the junction of the upper lateral cartilag-

es and the septum without releasing incisions. From a completely elevated position, the inferior flaps were pulled medially and cranially to cover the perforation. The superior margin of the inferior flaps was sutured to the inferior margin of the superior flaps with absorbable sutures (Monocryl 5-0) thereby pulling the mucosa covering the roof caudally and covering the perforation without tension. The nasal floor was left uncovered. Next, the cartilaginous graft was placed in the perforation between the mucosal flaps to serve as a third tissue layer and prevent opposing suture lines. Quilting stitches were performed with absorbable sutures (Monocryl 4-0).

Silicone splints (Merocel) were placed bilaterally and sutured with absorbable sutures (Monocryl 4-0) to prevent synechiae and to preserve the humidity of the sutured flaps. No other nasal packing was performed. The splints were removed one week postoperatively (**Figure 1**).

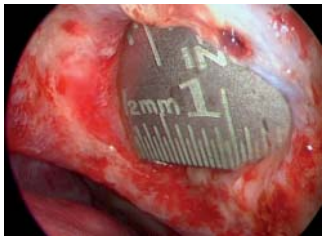
RESULTS

The median follow-up period was 12 weeks (range: 6-164 weeks). Complete closure was accomplished in 16 of the 19 patients (84%) without major intra- or postoperative complications. One patient had a prolonged stay due to postoperative bleeding, sinusitis and depression (case no. 18). All other patients were hospitalized for less than 24 hours. Total symptomatic resolution was documented in 18 of the 19 patients (95%). One patient (case no. 9) reported no change in symptoms. We used septal cartilage in six (32%) patients and auricular conchal cartilage in 13 (68%) patients. We observed no morbidity associated with the graft donor site. The results are presented in **Table 3**.

DISCUSSION

The incidence of septal perforations is estimated to approx. 1% [2, 6, 16, 17]. This estimate seems to be based on a single publication [13]. It has previously been stated

Average perforation. Photographer: *Claus Gregers Petersen.*



that two-thirds of septal perforations do not present symptoms [14, 18]. In our opinion, the estimated incidence seems extremely high, but this may reflect that more than two-thirds are without symptoms and therefore never seek treatment. The catchment area of our department comprises approximately 670,000 inhabitants. Given a 1% incidence and two-thirds being asymptomatic, we would expect roughly 2,200 symptomatic septal perforations yearly. As described, only 19 patients were referred over a five-year period. This simplified calculation suggests that the condition is either over-estimated or under-treated. Many factors may influence this result and the subject requires further investigation.

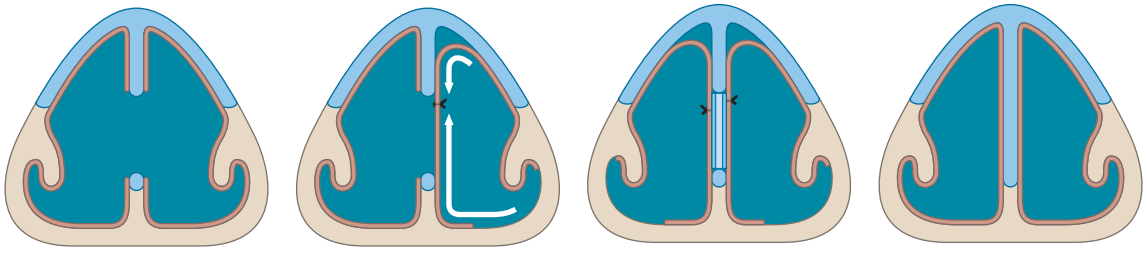
As previously mentioned, establishment of the aetiological background is essential for correct treatment and selection for surgery. Absolute contraindications comprise conditions where the underlying cause cannot be treated preoperatively [3, 5, 8-10]. Relative contraindications include pathological conditions that predispose postoperative bleeding or infection and/or conditions that compromise general anaesthesia.

Septal perforations can be managed using various surgical techniques depending on the location and size of the perforation. Especially, the vertical height is thought to correlate with the degree of difficulty [3, 10].

The surgical techniques include variations in the approach to the nasal cavity, the design and source of flaps and interposition grafts. The legion of different approaches and surgical procedures has been reviewed elsewhere [2, 5, 6, 10]. Closure rates vary greatly and

FIGURE 1

Surgical techniques.



A. Septal perforation | B. Elevation of the flaps | C. Interposition graft | D. Reconstructed septum

TABLE 3

Results.

Case no.	Graft	Operation time[a], min.	Outcome	Follow-up[b], weeks
1	Septal	120	Closed	8
2	Conchal	122	Closed	12
3	Conchal	125	Subtotal closure	92
4	Septal	95	Subtotal closure	6
5	Conchal	195	Closed	6
6	Conchal	165	Closed	21
7	Conchal	145	Closed	7
8	Conchal	185	Closed	12
9	Conchal	230	Failure	99
10	Septal	76	Closed	49
11	Septal	207	Closed	6
12	Conchal	90	Closed	69
13	Conchal	115	Closed	18
14	Conchal	160	Closed	6
15	Septal	90	Closed	17
16	Conchal	130	Closed	20
17	Septal	100	Closed	10
18	Conchal	No data	Closed	164
19	Septal	70	Closed	12

a) Mean: 134 min. b) Median: 12 weeks.

several studies report a 100% success rate, but the number of patients has been limited; and although promising, results remain statistically insignificant [6]. In the present study, the endonasal approach was chosen because all perforations were located anteriorly and had a maximum vertical height of 25 mm. This approach has obvious advantages as it leaves no scars, carries no risk of tip-rotation and provides sufficient surgical view and space for instrumentation. For larger (> 30 mm in vertical height) and/or more posteriorly located perforations, an external rhinoplasty approach will be preferable.

Intranasal mucosal flaps have the advantage of maintaining the normal nasal physiology [3, 5, 10]. The local flaps can be either mono- or bipedicled or uni- or bilateral. It was demonstrated that bilateral mucosal coverage is associated with successful septal surgery [1]. Bipedicled flaps are preferable because of increased vascularization [1, 3, 10] with the disadvantage being limited advancement [15]. The success rates have been improved by using bilateral local flaps and even further increased when these were combined with interposed autogenous connective tissue grafts or allografts [1-3]. A fundamental prognostic factor is tension-free closure and total mucosal coverage on at least one side [3, 9]. The dissection must be performed carefully to avoid mucosal tears, and no part of the septum left should be uncovered bilaterally because of the risk of reperforation [9]. Using local bilateral bipedicled flaps, we experienced no intranasal complications, nor flap necrosis.

A multitude of autologous and heterologous connective tissue interposition grafts have been used in combination with the techniques described above. Again, no single graft has proven superior for the closure of all perforations [1, 2, 5, 6, 10]. We believe, as other authors, that autologous grafts are preferable [5, 10] and that cartilage should be preferred over fascia as it provides greater support for the regenerating mucosa [9]. Reconstructing the original septal architecture and physiology as a triple-layered structure seems reasonable and is advocated by several authors [3, 4, 6, 8, 15].

Septal cartilage is easily harvested within the surgical field. Disadvantages include a limited quantity of material and with previous nasal/septal trauma/surgery, the quality can also be reduced. For these reasons, conchal cartilage was used when instead.

Auricular cartilage has previously been used by other authors as an alternative donor tissue with demonstrated suitability [1, 9, 19, 20].

We achieved complete or subtotal closure in 18 of 19 patients. These results are comparable to previously published results. It is obvious that direct comparison is difficult due to the variations in surgical techniques, number of patients included, size of perforations and duration of follow-up periods. Our follow-up period was 6-164 weeks, primarily because of patient compliance issues, as all patients were offered long-term follow-up. It is tempting to conclude that satisfied patients would be more prone to renounce control. Compared to previously published studies, the number of patients included is acceptable, yet a larger material would have been preferable as statistics in these small cohorts become insignificant.

CONCLUSION

In the present study, we achieved total relief of symptoms in 18 of 19 patients and observed no major complications or donor site morbidity. The technique described uses recognized surgical principles for reconstruction of the original nasal architecture and physiology, and we believe that the method yields durable and soloid surgery results. It is a one-step procedure with a favorable surgery length, provided it is performed by experienced staff, and it also has the advantage of a short overall admission period. The endonasal approach leaves no scars, reduces the risk of tip-rotation and offers sufficient view and room for instrumentation.

We conclude that this method is suitable for treatment of perforations up to at least 25 mm in vertical height.

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CONFLICTS OF INTEREST: None

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