

Perforations of the nasal septum following operative procedures

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SUMMARY

New operative methods have been introduced into nasal surgery in recent years; these are septoplastic, rhinoplastic and nasal reconstruction. These new methods are now employed together with the more traditional submucous septum resection. Today the above mentioned operations have been carried out in such large numbers that it is possible to commence comparing operative results.

The present investigation is a comparison of the number of septum perforations with 1) submucous septum resection, 2) septum correction with reconstruction of the septum skeleton, and 3) septum correction in connection with rhinoplastic of the outer nose, possibly supplemented by nasal reconstruction.

In the latter case a systematic suturing of all mucosal lacerations has been carried out, partly to prevent septum perforations and partly in order to keep the septum flaps intact during reimplantation of the cartilage and bone with the object of constructing a solid septum skeleton.

While primary suturing of the mucosa is a relatively simple procedure, the closure of postoperative septum perforations is far more difficult. The results depend on the size of the perforation and the amount of cartilage and bone material still remaining in the septum.

It must therefore be advisable to employ operative techniques which are able to prevent septum perforations or at least reduce their number to a minimum.

INTRODUCTION

It is not uncommon to find patients with septal perforations in a specialist E.N.T. practice. In some of these patients the perforations produce no symptoms, and are discovered coincidentally, while in other patients they cause considerable inconvenience and produce great strain on the patient.

Peroperative or postoperative septum perforations often result from the presence of a pathological condition in the nasal septum, such as deformities of the cartilaginous and osseous skeleton, often combined with atrophy,

changes caused by scar formation and adhesions of the mucosa. The surgeon has hardly any opportunity of influencing the site of the perforation, or of predicting what complications are liable to arise from it. It will be relevant, therefore, to learn operative methods that should ensure an intact nasal septum, or at least, reduce to the lowest possible number of perforations. Operations on the septum are very common, and there is, therefore, a considerable material that can form the basis for comparing the results of the various operative procedures.

The oldest and still the most commonly used operation, is the submucous resection, which was devised by Killian around the change of the century. In this operation the mucosa is elevated on both sides of the cartilaginous septum and a part of the septal cartilage removed, partly in order to remedy the deformities sited in the cartilage, and partly in order to expose the osseous septum. Strips of cartilage are left under the nasal bridge and behind the columella in order to retain stability of the outer nose.

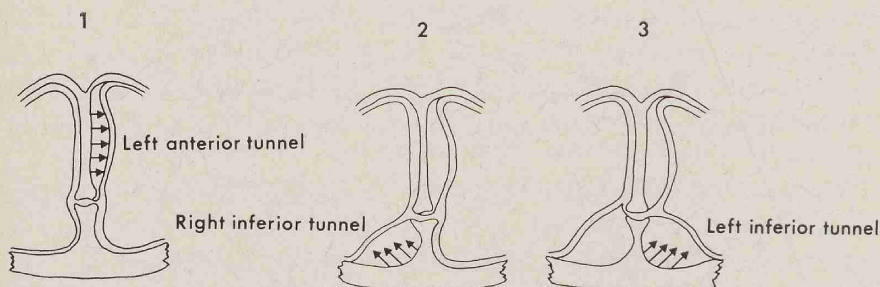


Figure 1. Elevation of the mucosal membrane from the left side of the septum skeleton (1) and from the bottom of the nasal cavities (2 and 3). The three tunnels thus created are connected, providing an excellent view of the operative field.

In conservative and reconstructive septal procedures the mucosa is elevated on one side of the cartilaginous septum only, in order to ensure an efficient blood supply. To obtain the best possible view of the operative field, the mucosal membrane is dissected from the floor of both nasal cavities. Thus, it is possible to get such a good view of the septal skeleton, that the procedure can be limited to excision, or correction, of the deformed parts of the septum only (Figure 1). Afterwards, the removed pieces of cartilage and/or bone can be flattened and cut as required, with subsequent re-implantation between the flaps of the septum. The object of this procedure is to construct a solid septal skeleton with which to divide the two nasal cavities, and to form a strong base for the nasal mucosa (Figure 2).

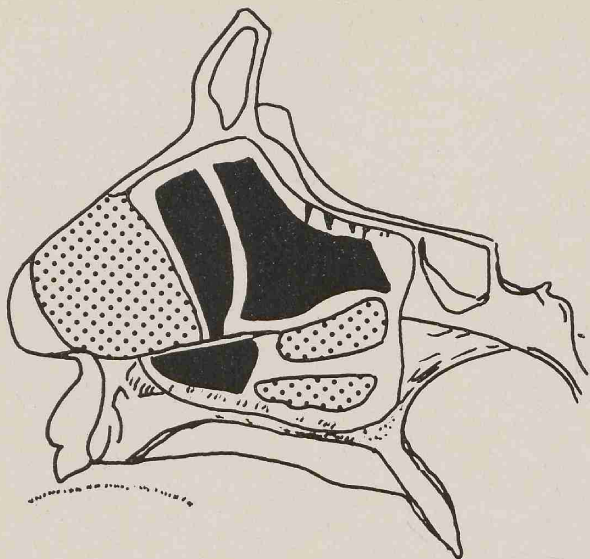


Figure 2. The whole of the osseous septum and posterior edge of the cartilage have been removed. The material thus obtained is smoothed and carved and later re-implanted between the mucosal flaps at the rear of the nasal septum.

The third method consists of actual rhinoplastic procedures, often supplemented by nasal reconstruction. In these operations the structures of the septum and the nasal vault are mobilized, usually in the same seance. For example, in cases of collapsing alae, the operation may consist of a septal reconstruction supplemented by a shortening of the outer nose, and overlapping of the cartilaginous skeleton. Removal of scar tissue and reconstruction of the nasal cartilage around the nasal valve region or osteotomies with repositioning of the osseous nasal pyramid, are also very frequent procedures, when these combined operations are undertaken.

ETIOLOGY OF NASAL PERFORATIONS

Primary perforations can occur in the immediate postoperative period and manifest themselves at the time when the nasal packs are removed. In other cases, the nasal mucosa apparently appears intact and perforation is first diagnosed at a later stage, when the de-vitalized or necrotic parts of the mucosa have had time to be rejected. A perforation can also be hidden beneath large crust formations, which at times, form complete moulds of the nasal cavity. Such moulds are quite possibly the method employed by the organism to support and immobilize a weakened nasal septum.

Secondary perforations can occur months, and at times years, postoperatively, and may be caused by mucosal atrophy or result from scar-like changes in the mucosal membrane. The cause of this postoperative atrophy is not quite clear, but appears to be connected with vascular changes and turbulent air-currents, particularly in front of an overlooked septal deflection.



Figures 3 A and B. A. Patient with syphilitic destruction of the nasal pyramid and osseous septum.



B. Patient suffering from Wegener's midline granuloma, with mainly destruction of the cartilaginous nasal skeleton and a large septum perforation with crust formation and pronounced fetor.

Traumatic perforations can be seen in connection with nasal fractures accompanied by septum rupture, or septum haematoma, with loosening of the perichondrium. Infection of a haematoma can lead to necrosis of the cartilage, which in turn, may result in perforation of the nasal septum.

Artificial perforations can be seen with digital traumas, or following the excessive use of cauterisation or corrosive compounds for the treatment of nasal haemorrhage. Picking the nose often takes place owing to irritation of the nasal mucosa, for example, behind a septum dislocation. Crust formation gradually occurs, with ulceration followed by perichondritis.

Acute postoperative inflammation, with pain and a rise in temperature, can necessitate the removal of nasal packs too soon after an operation, and thereby increase the risk of perforation of the septum.

At times chronic infection, such as tuberculosis and syphilis can give rise to perforations of the nasal septum. The tubercular changes are confined to the cartilaginous part of the nose, while syphilis mainly attacks the osseous skeleton, with an accompanying fetid secretion (Figure 3A). Healing takes place later with considerable scar formation. Collagene diseases, such as midline granuloma, or Wegener's granuloma, are characterized by extensive crust formation, together with almost total collapse of the outer nose (Figure 3B).

In certain industries the nasal mucosa is exposed to chemical irritants or toxic necrotic compounds, which, after prolonged exposure, can give rise to defects of the mucosa, with subsequent perichondritis.

When persons, who are addicted to cocaine or heroin, find it impossible to employ the intravenous route owing to thrombosis of the veins, they often tend to satisfy their craving for the drug by "sniffing". In a large material of "sniffers" it has been found that up to 5% suffered from perforations, this was found most frequently in women, where the veins are frequently difficult to find, and possibly, because women are especially interested in concealing their addiction.

SYMPTOMS OF SEPTUM PERFORATION

Perforations situated anteriorly and high in the septal cartilage, most frequently produce symptoms, in the form of excessive crust formation accompanied by fetor. There is, usually, frequency in bleeding, with subsequent mucosal lesions and scar-like healing. Continuous irritation can result in nose-picking with subsequent exposure of the cartilaginous skeleton.

A few patients complain of an uncomfortable feeling of an increased width of the nasal cavities, accompanied by changes in resonance, dryness of the mucosa, symptoms of pharyngitis and headache.

Whistling can occur with very small perforations, while thin scarred septa

can bring about fluttering movements during respiration. A number of patients complain that they are no longer able to blow their nose, and have a feeling of a thick lump, situated behind the soft palate.

If large parts of the cartilaginous septum have been removed then considerable scar retraction can occur, often accompanied by deformities and scar formation around the narrowest part of the nose, at the internal os, and a lack of support of the nasal alae during inspiration. This form of nasal stenosis is often very uncomfortable owing to the sudden blocking of inspiration. The condition is frequently accompanied by a continuous sniffing, which normally worsens the condition, and is very distressing for those in the vicinity.

In addition to respiratory disturbances caused by nasal stenosis, the patient can suffer from severe cosmetic complaints owing to saddle formed deformities, retraction of the columella and "ballooning" of the lobular cartilage (Figures 4 and 5).



Figure 4. A patient with a large perforation of the cartilaginous septum, accompanied by crust formation and nasal stenosis after submucous septum resection. Postoperatively there was a disfiguring deformity, with saddle nose and ballooning of the lobular cartilages.

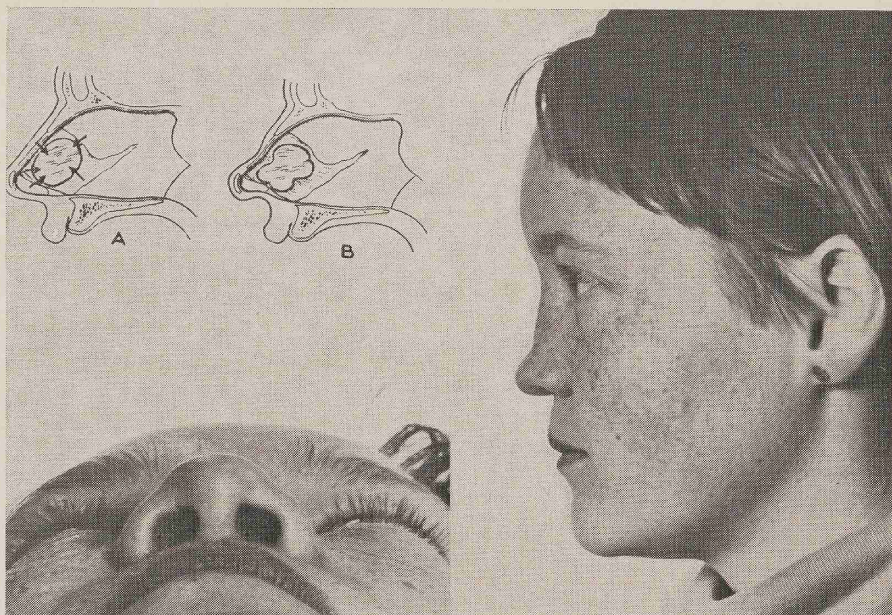


Figure 5. The drawing shows partial removal of the cartilaginous septum (A) with development of scar formation, which has caused concentric contractions, with saddle formed lowering of the nasal bridge and retraction of the columella (B) (after Fomon). The changes are shown on a patient, who in addition to the above has hypoplasia of the outer nose with a short columella and child-like widening of the nostrils, after septum resection at the age of 3 years.

CLOSURE OF POSTOPERATIVE SEPTUM PERFORATIONS

Small perforations can be closed by means of sliding pedicle flaps. These can be prepared by elevation of the mucosal membrane on both sides of the septum, after which they can be mobilized by placing incisions at the base of the flaps. Preferably, these should be moved in opposite directions, for example, from the bottom on one side and from the top on the other, in this manner the suture lines are at various levels.

Double pedicle grafts are used in cases of large perforations, and particularly so when they are elongated; this requires considerable undermining of the mucosal membrane in the bottom of the nasal cavities, and especially around the perforation itself. The flaps are mobilized by incisions as far from the perforation as possible.

In cases of very large perforations it may be necessary to employ single pedicle grafts, these have the advantage of being extremely mobile, but, on the other hand, compromise the blood supply so that there is always the possibility of the graft being rejected, or the occurrence of mucosal atrophy with widespread scar formation (Figure 6). Therefore, many rhinologists

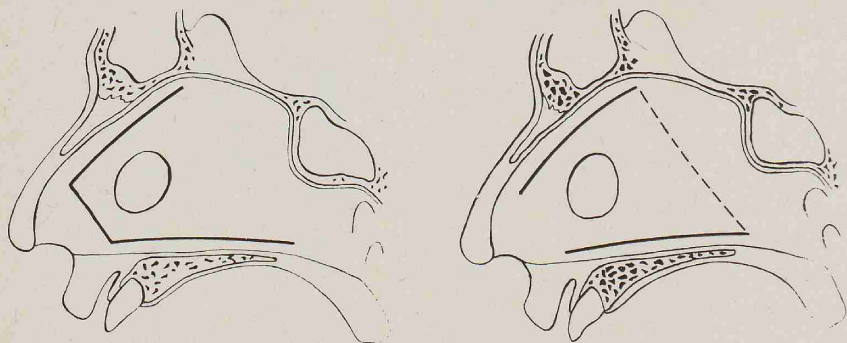


Figure 6. A. Single pedicle flap from the right side of the septum, produced by undermining the mucosal membrane and mobilization by means of the incisions as shown. B. The preparation of mucosal flaps on the left side. This flap forms a hinge in the front and can be pulled out of the nasal cavity and be sutured prior to re-implantation (after CLIMO).

prefer to use pedicle flaps from the mucosa of the oral cavity. After mobilization, these flaps are tunneled through a stab incision, made in the alveolo-labial sulcus. From there they are brought into the nasal cavity through a channel, folded out fan-wise, and sutured to the edges of the perforation.

"Composite grafts" consisting of cartilage and skin from the pinna, can be carved to fit the septal defect. The edges of the skin can be sutured to the mucosa, and at a later date the skin can be peeled off, in order that the mucosal membrane can grow inwards from the periphery of the perforation. Finally, there is the technique of employing skin transplants in a similar manner to that used with Saunder's dermoplastic, in the treatment of Osler's disease. Skin transplants are often used in combination with other methods for covering wound surfaces on the inner side of mucosal transplants.

Before commencing the operation it is necessary to estimate the amount of cartilage and bone left in the septum, that can be used for the reconstruction. After careful shrinking, the septum is inspected and palpated in order to obtain an impression of the quality of the cartilage, the extent of the scar tissue and the amount of adhesions between the mucosal flaps, as well as any possible septal defects and atrophic areas of the mucosa still present in the nose.

In those cases where only the central parts of the cartilage have been removed, it is usually fairly easy to separate the blades of the septum, and thus obtain material from the septal skeleton for interposition between the mucosal flaps. The situation is far more difficult when only small bridges of cartilage remain beneath the nasal dorsum and behind the columella. In these cases, one often

finds atrophic cartilage and pronounced scar formation, together with distortion of the nasal structures, in addition to considerable tension of the mucosal lining.

Another difficulty with regard to the closure of a septum defect, is the size, which will usually be inversely proportional to the amount of mucosa available for covering the perforation.

Normally it is considered that a diameter of approximately 1.5 cm is the maximum size likely to prove successful. Attempts at closing larger perforations will usually be a failure, and the patient will often become further disabled. At times however, it may be possible to obtain more mucosa for covering the perforation by lowering the nasal pyramid and shortening the outer nose. This operation will often be indicated in cases where nasal deformities already exist together with collapsing alae.

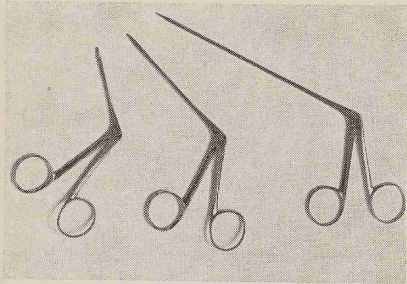
Following the introduction of more modern methods for the correction of septum defects, it is generally accepted that the number of cases of septum perforation have been considerably reduced. However, no actual proof of this assumption has been reported.

Today there is an increasing tendency to use the so-called Cottle method. This is a synthesis of previously used techniques, which have been co-operated and co-ordinated in such a manner that there is a wide view of the operative field, and at the same time, a plentiful blood supply to the septal mucosa. The method also permits the possibility of supplementing the procedure with rhinoplasty and nasal reconstruction, so that the whole procedure can be carried out in one stage.

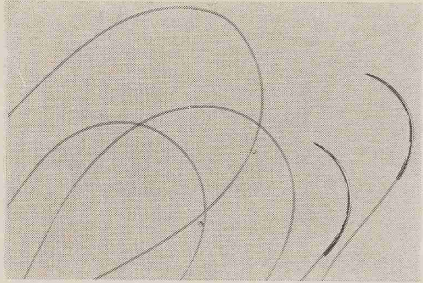
With this operative method of septum correction it is possible to go directly to the deviated and deformed parts, so that in many cases the procedure can be confined to the osseous septal skeleton, while the cartilaginous skeleton can be retained wholly or in part. In this manner it is possible to avoid the primary and secondary disturbances of function and the cosmetic complications that are a result of operative procedures on the cartilaginous septum. Cottle's method also provides excellent opportunity of rebuilding a stable nasal septum by re-insertion of material removed from the septum skeleton. The cartilage and bone removed is smoothed with a bore, modelled and cut into shape, prior to re-implantation.

In many cases it is impossible to avoid tearing the mucosa, which may be stretched out over pointed spurs and sharp ridges. On the other hand, it may be so thin and atrophic, with septal scarring, that it is easily lacerated.

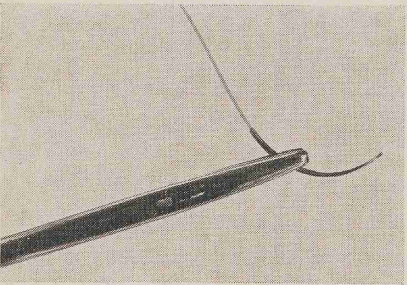
In such cases suturing of the mucosa is indicated in order to permit insertion of bone and cartilage to be carried out in the normal manner. The damaged and sutured parts of the mucosa will then be supported by the rebuilt nasal skeleton (Figure 7).



A.



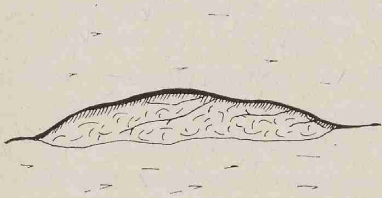
B.



C.

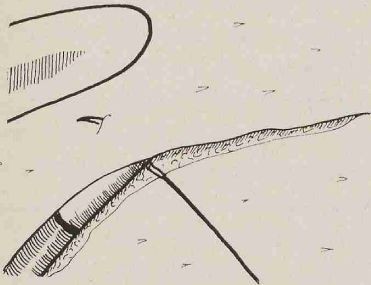
Figure 7. Suturing of mucosal lacerations.

A. B. C. Stuemmer's needle holders are employed, sizes 5, 7 and 10 cm. The suture material consists of 4-0 chromic catgut double armed with sharp round needles. 4-0 chromic. Double armed, micropoint-cutting G2. Ophthalmic 798 G. 4-0 chromic. Double armed, micropoint-cutting G3. Ophthalmic 793 R. In order to obtain sufficient fixation of the needles the blades of the forceps are provided with ground ridges.

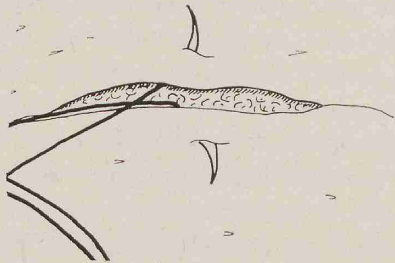


D.

D. E. F. The wound edges of the lacerations have a tendency to gape, particularly when the mucosal membrane is somewhat stretched. The edges of the wound are fixed by the blade of a nasal speculum while the needle is passed through the upper and lower wound edges.



E.



F.

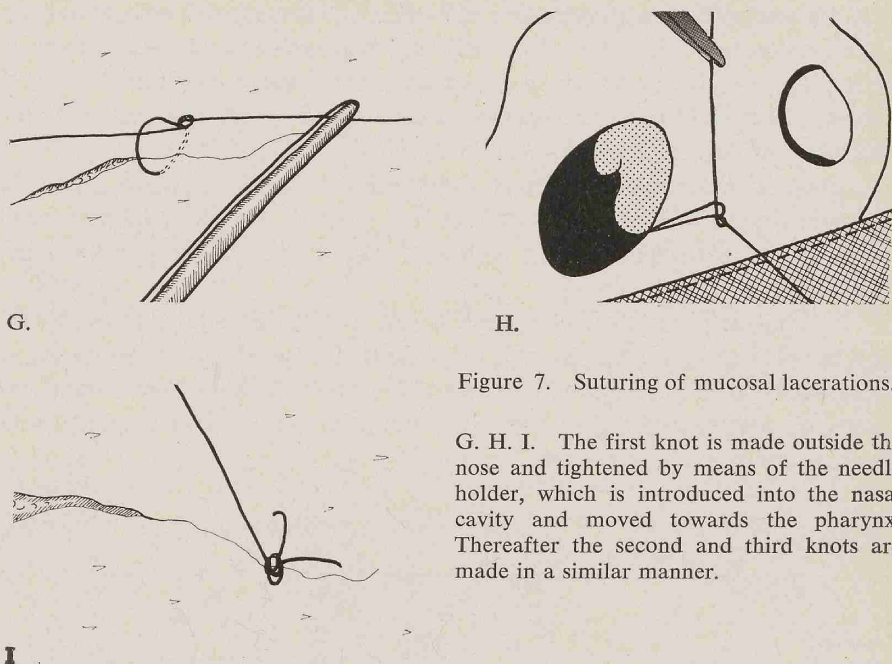


Figure 7. Suturing of mucosal lacerations.

G. H. I. The first knot is made outside the nose and tightened by means of the needle holder, which is introduced into the nasal cavity and moved towards the pharynx. Thereafter the second and third knots are made in a similar manner.

The method also ensures that the surgeon can carry out his previously planned operation.

MATERIAL

Septum correction according to the method of Cottle, combined with rhinoplasty and nasal reconstruction, as necessary, was the operative technique employed at the E.N.T. Department of the Odense University Hospital during the period 1.4.1973 to 31.3.1976. A total of 304 patients were subjected to operation within the above mentioned period, and it was possible to carry out a follow-up examination on 286 of these patients. Of the 286, reposition and suture of mucosal lacerations together with re-implantation of cartilage or bone, in order to provide support for the mucosal lesions, was carried out in 46.2% of the patients.

The observation time varied between 5 and 49 month, with an average of 8.7 months; the frequency of septum perforation was 1.4% (4 patients).

This frequency of perforation (1.4%) was compared in the present investigation to the following:

1. A pilot study of 100 consecutive patients from an operation material of 114 patients of the E.N.T. Department of the Odense University Hospital. Fourteen of the 114 patients could not be contacted for various reasons.

Cottle's septoplasty with retention of as much of the septal cartilage as possible had been employed on these patients. The bone and cartilage removed during the operation had been smoothed and carved and re-implanted between the septal flaps. The lacerated septal mucosa was carefully re-positioned and support provided by the rebuilt septum skeleton.

A follow-up examination, with an observation time of 6 months or more, revealed septum perforation in 5% of the patients. The material consisted of 70 men, 14 women and 16 children, with a ratio between males and females of 5 : 1.

2. A follow-up examination carried out in 1976 at Blegdams Hospital, of 118 patients from a material of 173 patients. The observation time varied between 3 and 36 months. There were 79 men and 39 women, while no operation was carried out on patients below the age of 15 years. The ratio between men and women was 2 : 1.

Table 1. The patients followed-up during a 3 years period and percentage distribution of the operated men and women.

	1973	1974	1975	Total	% of total
Women	28	27	34	89	31.0
Men	70	69	58	197	69.0
Total	98	96	92	286	100.0

The operative method employed was a modification of the submucous septum resection, in which as much as possible of the osseous and cartilaginous skeletons were retained. This follow-up examination, carried out by Sloth and Kølendorf, revealed a frequency of perforation of 16.9%.

As perforations of the nasal septum can develop up to several months after operation, the study of Borg and Siemens (1959) showing a septum perforation frequency of 5% after an observation time of only 14 days is not included in the present investigation.

Follow-up study	No. of patients	Observation time	Frequency of perforations
I. Odense University Hospital 1969	100	6-12 months	5 %
II. Blegdams Hospital 1976	118	3- 6 months	16.9%
III. Odense University Hospital 1977	286	5-49 months	1.4%

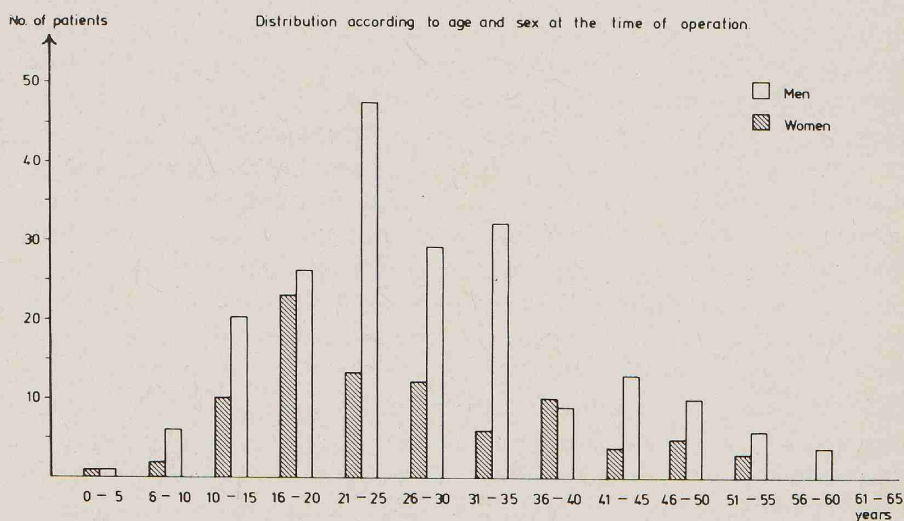
Statistical analysis using paired comparison of the material did not reveal

any significant difference between I and II, but a significant difference between II and III ($P < 5.1 \times 10^{-7}$) (Table 1, 2 and 3).

Table 2. The number of sutured mucosal lacerations are more or less evenly distributed throughout the period under study, while the perforations show a tendency to diminish in size and number.

	1973	1974	1975	Total	% of total
Sutured	44	42	46	132	46.2
Perforations	3	0	1	4	1.4

Table 3. The distribution of the patients with regard to age and sex, with a maximum incidence in women between the ages 16 and 20 years, and in men between 21 and 25 years.



DISCUSSION

Since the turn of the century opinion has been formed that suturing of the septal mucosa should be carried out in order to prevent the development of septum perforations. However, little has been written concerning the method which should be employed, and it appears that routine suturing of mucosal defects has hardly ever been carried out.

It is the experience of the present authors, that a good view of the operative field, and minimal haemorrhage, are prerequisites for good results. It is preferable to delay the suturing until septal flaps have been completely mobilized and the deformed parts of the septum skeleton removed. At this point in the procedure there is often a surplus of mucosa which will allow

the edges of the wound to be sutured together without any disturbance of the blood supply, or stretching of the mucosa.

In order to carry out the necessary manipulations, long thin needle forceps and sharp curved needles should be used; the latter should be inserted into the edges of the mucosa, while this is held in position by the blades of a nasal speculum.

Normally it is easiest to suture lacerations on the horizontal plane, and more difficult to treat the rarer vertical lacerations. In order to obtain the best results, it is advantageous to use needles with different curves. Normally chromic catgut of 0.05 thickness is used; this lasts for approximately 12 days before absorption takes place, by then, the edges of the wound should have had sufficient time in which to heal.

At present, treatment of manifest postoperative septum perforations is carried out using many different methods. Normally the individual surgeon has been able to carry out only a very limited number of operations, so that in actual fact, the majority of articles published have been case reports, and have not dealt with studies of actual representative material.

However, a number of patients with septum defects develop nasal stenosis, and cosmetically disfiguring deformities, which should be dealt with by rhinoplasty and/or nasal reconstruction. In connection with the above mentioned procedures it would be expedient to attempt the closure of a patient's septum perforation by means of one of the methods described herein, or a combination of them. It will not be possible to close the defect completely in all cases, but at times, one can successfully reduce the size, or move it to an area of the septum where the airconditioning is more effective. The best results of septo-plastic are achieved presumably, not by suturing the mucosal flaps alone, but almost certainly by the re-establishment of a solid septum skeleton, which will provide a firm base on which the mucosa can rest while healing. The theory that the nasal septum does not function as a support, and is of no importance in respect of stability of the nasal construction as a whole, no longer appears to be well founded. On the contrary, a stable septum may be of inestimable help in cases, where it has been necessary to mobilize and reconstruct the nasal pyramid.

It is almost impossible to calculate the chances of avoiding perforations in all operated cases, where only one septum blade remains intact. Trauma of the mucosa, formation of turbulent air currents and atrophic changes, are uncontrollable complications, which are best avoided by careful suturing of the mucosa and interpositioning of cartilage and bone.

ZUSAMMENFASSUNG

Die in den letzten Jahren in der Rhinochirurgie hinzukommenen neuen

Techniken (Septo- und Rhinoplastik sowie nasale Rekonstruktion) haben sich heute mit der traditionelleren submukösen Septumresektion bei einer so grossen Anzahl von Eingriffen erfolgreich bewährt, dass es jetzt möglich erscheint, die operativen Erfolge und Komplikationen gegen einander abzuwägen zu können.

Die vorliegende Untersuchung ist ein Vergleich der entstandenen Septumperforationen nach 1) submuköser Septumresektion, 2) septales Korrektur mit Rekonstruktion und 3) septaler Korrektur in Zusammenhang mit Rhinoplastik der äusseren Nase, mit oder ohne nasale Rekonstruktion.

Bei der letzten Methode werden muköse Einrisse vollständig suturiert, teils um Septumperforationen zu verhindern, teils wegen der Erhaltung der septalen Lappen während Reimplantation von Knorpel und Knochen zur Konstruktion eines soliden Septumskelettes.

Während die Primärsutur der Mucosa eine relativ einfache Prozedur darstellt, ist die operative Beseitigung septaler Perforationen erheblich schwieriger. Die Ergebnisse des Eingriffes sind von der Grösse der Perforation und der im Septum zur Verfügung stehenden Menge Knorpel und Knochen abhängig. Operative Techniken, die vor septalen Perforationen schützen können, müssen daher vorzuziehen sein.

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