EDORIUM Journals

Video J Clin Res 2018;1:100002VAM08PD2018.
www.videojournalofclinicalresearch.com

ORIGINAL ARTICLE PEER REVIEWED | OPEN ACCESS

Minimally invasive endoscopic septoplasty

Pierre-François Dolhen, Samuel Lipski, Antoine Noel

ABSTRACT

This paper analyzes a retrospective study of 131 consecutive cases septoplasties performed using our endoscopic procedure. Clarification and new definitions of endoscopic septoplasty approaches are emphasized: Trans-Nasal Endoscopic Septoplasty (TNES) with an endoscope into the nasal fossa and Trans-Septal Endoscopic septoplasty (TSES) with an endoscope into the septal pocket. The patient's cohort is selected for treatment of persistent nasal obstruction and septal deviation needing surgery. The procedure is carried out on a well-defined homogenous population. Additional actions on inferior turbinate, rhinopharynx, or external procedures for columellar deformities are performed to obtain a free symetric nasal pathway. Most of our surgeries (98%) is carried out endoscopically alone and only 2% of cases necessitated "hybrid" non-endoscopic adjuvant surgery to treat septo-columellar and other major caudal septal deformities as valve surgery. In the studied population, we observed 89% of significant posterior deformities, not only septal. Subjective evaluation of the nasal obstruction is achieved by using a simplified NOSE Scaling (sNOSE) giving an 87.8% satisfaction rate. Results showed a low level of complications such as perforation, hematoma or synechia, confirming the minimally invasive denomination of this procedure (MIES) with minimal operation time, in particular with TNES. Endoscopic Septoplasty (ES) had major advantages in Classical Headlight Septoplasty (HLS), such as enhancing the visualization of posterior nasal region and better final visual evaluation of the global nasal permeability. We recommend Minimal Invasive Endoscopic Septoplasty (MIES) to improve results, minimize complications, and to improve the pedagogic impact of the procedure. Video material illustrates the endoscopic procedures; moreover, ongoing developments in ultra-high, 4K, 4KHDR definition further emphasizes these advantages.

Keywords: Minimally invasive endoscopic septoplasty, Nasal obstruction, Septal deviation, Septoplasty, Trans-Nasal endoscopic septoplasty, Trans-Septal endoscopic septoplasty

Pierre-François Dolhen[1], Samuel Lipski[2], Antoine Noel[3]

Affiliation: [1]ENT Department Head, CHU Tivoli ULB La Louvière Belgium; [2]Resident Department CHU Tivoli ULB La Louvière Belgium; [3]Assistant Department CHU Tivoli ULB La Louvière Belgium.

Corresponding Author: Pierre-François Dolhen, ENT Department Head, CHU Tivoli ULB La Louvière Belgium; Email: pdolhen@gmail.com

Received: 08 February 2018
Accepted: 01 May 2018
Published: 04 June 2018

How to cite this article

Dolhen P, Lipski S, Noel A. Minimally invasive endoscopic septoplasty. Video J Clin Res 2018;1:100002VAM08PD2018.

Article ID: 100002VAM08PD2018

****

doi: 10.5348/100001VAM08PD2018OA

INTRODUCTION

Septoplasty is one of the most common procedures used to correct nasal deflection when patients present persistent nasal airway obstruction [1]. Septoplasty is carried out alone or in some cases together with other procedures on external deformities or action on turbinate to free the nasal fossa [2]. Since the beginning of septoplasty, the goal was to insure the correction of deflection of the nasal septum with minimal traumatism and no residual deformities. Nevertheless, subjective

results on obstruction remained uncertain and the frequency of complication is quite high. Satisfaction rates based on various evaluation scales gave from 42 to 85% [3–4]. The complication rate varies from 4 to 36% [5–7].

Today, septoplasty is still commonly carried out using headlights or a cold light speculum. Minimal vision, poor illumination on the posterior part of the septum (vomer) and nasal fossa lack of magnification and weak identification of concomitant nasal abnormalities (turbinates or rhinopharyngeal pathologies) often dimish the efficiency of these techniques [8–9]. The use of a speculum introduces or mask deformities in spreading anatomical structures. Another negative point lies in the difficulty of sharing the operation field between senior surgeon and assistant.

Early, rhino-endoscopists discovered the advantage of using the same endoscope to perform septoplasty prior to the functional endoscopic sinus surgery (FESS), dacryocystorhinostomy or skull base surgery. So far, despite its numerous advantages, ES failed to replace classical headlights speculum, in contrast with other fields of rhinology, such as FESS or endoscopic skull base surgery [10–14], where it now clearly dominates. Nevertheless, several advantages of endoscopic septoplasty were recognized for revision septoplasties, for example [15].

At this point, it is difficult to compare different endoscopic septoplasty technical approaches because of the lack of clear definition of ES in the literature. Therefore, this paper categorises the different technical procedures and clarifies their specific applications in ES surgery. To do so, we suggest differentiating the Trans-Nasal Endoscopic Septoplasty (TNES) with an endoscope into the nasal fossa and the Trans-Septal Endoscopic Septoplasty (TSES) with an endoscope into the septal pocket (Video 1 and 2).

Videos

Video 1: Trans-Nasal Endoscopic Septoplasty (TNES) with an endoscope into the nasal fossa.

Video 2: Trans-Septal Endoscopic Septoplasty (TSES) with an endoscope into the septal pocket.

Video 3: Trans septal under water complex spur and crest cartilage palissade.

Video URL at: http://www.videojournalofclinical research.com/archive/2018-2018100002VAM08PD-dolhen/100002VAM08PD-full-text.php

This study clarifies the concept of Endoscopic Septoplasty (ES) and evaluates if the newly developed technique can be categorized as minimally invasive. We used a well-defined homogenous group of patient presenting nasal obstruction. A optimal way to evaluate their obstruction is obtained by using simplified scaling methods. This articles assesses the advantages and possible consequences of the technique, compared to the more conventional approaches (HLS).

Subjective evaluation of patient nasal obstruction is done by a 5 step simplified Scaling Score derived from NOSE score (sNose).

MATERIALS AND METHODS

Eligibility criteria

Retrospective analysis of 460 consecutive cases of endoscopic septoplasties between October 2013 and October 2015 is carried out. All the patients selected for this endoscopic septoplasty study complained of persistent intractable nasal obstruction and presented a significant degree of septal deviation, confirmed by endoscopic evaluation and or CT scan. In this the study, all procedures are performed in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent is obtained from all individual participants included in the study.

Patients with access septoplasty before FESS, dacryocystorhinostomy or septorhinoplasty are excluded (n= 253) to avoid inserting bias confusion in evaluating this poly symptomatic population (epiphora, esthetic consideration, and smelling problems). Also, sixty-seven patients, which as principal complaints snoring and one patient with concomitant indication of amygdalectomy are also excluded. Initially, surgery was only performed on patients with severe or strong obstruction however the study also includes seven cases of mild obstruction, at the demand of the patient. In the course of the study, we lost contact with eight patients.

The group of patients includes septal deviation in combination with other various etiologies like vasomotor rhinitis, vasoconstrictor addicts, trauma, allergic rhinitis with no result under nasal steroids and antihistamines, complex congenital septoturbinal deformities and persistent or residual rhinopharyngeal adenoids. We have also included patients, who needed complementary procedures to the endoscopic septoplasty to gain optimal result in nasal obstruction. The complementary procedures are a columellar plasty, resection of concha bullosa, adenoids reduction or reductional turbinoplasties. In summary, 131 patients fulfilled our eligibility criteria.

Endoscopic septoplasty operative technique

Devices/instrument: A 4 mm endoscope 0° Olympus® HD mounted with a Visera camera connected to a 22-inch full HD screen (1920 x 1080 pixel resolution) and a 19-inch HD screen for the assistant was used. Endoscrub (Medtronic®) is used to clean the lens or to produce

Figure 1: Set up ES Endoscrub cleaning/irrigation system on the right side. Could light and camera cable upside the field with the 4 mm 0° endoscope.

continuous irrigation. The main surgical instrument was the Freer Storz® suction elevator allowing smooth undermining and soft suction to avoid collapse and trauma to the mucosa (Figure 1).

Surgical technique: Two distinct endoscopic approaches are utilized: Trans-Nasal Endoscopic Septoplasty (TNES) with an endoscope into the nasal fossa and the Trans-Septal Endoscopic Septoplasty (TSES) with the endoscope into the septal pocket.

a) The trans-nasal endoscopic septoplasty (TNES)

In Trans-Nasal approach, the endoscope stays in the nasal fossa, anterior unilateral spur or posterior crest is directly reached on the convex side, or if bilateral on both sides. It is the optimal procedure to isolate the deformed area: an anterior spur can just be transected (mucosa and cartilage). If a bony protrusion occurs, the powered burr is used, or simply an osteotome to remove the premaxilla.

In case of an isolated vomerian posterior crest, a mini super-inferior tunnel is realized 3 mm anterior to the deformity and the osteoteocartilaginous crest is pulled out on the same side.

b) The trans-septal endoscopic septoplasty (TSES)

The Trans-Septal approach is used for more extended deformities, like the classical anterior-posterior spur-crest complex and for more severe deformities. The mucosa and the perichondrium are transected just before the convex side and superior (subperichondrally) and inferior (subperiosteally) tunnelisation is carried out on both sides exactly like a Cottel technique; the endoscope being placed into the new-created nasal pocket. The cartilage and the bony deformed portion of the septum are removed by chondrotomy or osteotomy or are reshaped to achieve correction in respecting the septal framework. The palisade technique is used for antero-superior cartilage deformation of the quadrangular cartilage (vertical strips of the cartilage, luxation or limited resection are realized if necessary). If extended portion of the septum have to be resected because of global deformities, the crushed or modeled cartilage is reinserted to reconstruct the septum.

In case of sharp deformities, especially on the top of the spur and crest complex, it is almost impossible to preserve the mucosal layer. In such cases, horizontal section of the mucosa, parallel to the floor of the nasal fossa is preferred rather than risking resections and loss of mucosa. The inferior and superior flap must then be re-approximated at the end of the surgery. In some cases, we experimented our newly developed technique called Trans-Septal Underwater endoscopic septoplasty (TSUES) with a continuous irrigation into the septal pocket. Water injection and pocket inflation without any suction, giving a kind of hydrotomy and providing easy access to hidden area posterior to sharp deflection into the septum.

When another cause of obstruction is identified, adequate endoscopic action is combined with the endoscopic septoplasty to suppress the concomitant cause of obstruction: adenoid shaving, concha bullosa excision reduction turbinoplasty, Torwald cyst marsupialization or valve plasties is used in this series. The procedure stops when endoscopic visual permeability and the symmetry on both sides is optimal. Without action on inferior turbinate, there is no need for packing or splinting the nasal fossa, contributing to dimishing the discomfort of the procedure. Turbinoplasty or radio frequency of the inferior turbinate implies nasal packing on the first day and splinting with silicone for 8 days respectively. No septal incision suture is needed.

Study outcomes

Type of major deformation and associate anatomical abnormalities are counted. We considered vomerian crest, adenoid hypertrophy, Torwald cysts or concha bullosa as posterior deformities. We checked the total number of posterior deformities encountered. The endoscopic follow-up was done for one week and one month after the surgery. Subjective results were obtained pre-operatively directly from the patient and 10 to 30 months after the surgery by phone. For the evaluation of nasal obstruction, we used a 0 to 4 grade scale, with zero meaning no obstruction and 4 complete obstruction. A score of 0 or 1 post-operatively is considered as a good result.

Statistical analysis

We used a Wilcoxon t test for qualitative ordinal data. It is performed to compare the preoperative and postoperative sNOSE scale. Quantitative data are analyzed on Chi-square test or Student t test. A p value <0.05 was considered statistically significant. Analysis

Table 1: Characteristics of the population

Characteristics	Number of cases	Percentage (%)
Gender		
Male	84	64.1
Female	47	35.9
Age		
Mean ±SD	31 ± 15.2	
Range	10–71	
Preoperative sNOSE scale	131	
0–1	0	0
2	7	5.3
3–4	124	94.7

SD: Standard deviation

was performed using the XLSTAT software version 2016 (Addinsoft. 2016. XLSTAT 2016: Data Analysis and Statistical Solution for Microsoft Excel. Paris, France 2016).

RESULTS

A total of 131 consecutive patients received endoscopic treatment by the senior surgeon and two young resident surgeons. The majority of patients were male (64.1%), ages range from 10 to 71 years, with a mean of 31. Most patients achieved 3 and 4 scores (94.7% of cases) in sNOSE scale preoperatively except 7 (5,3%) who presented a score of 2 (Table 1).

The principal septal deviation observed was a homolateral anterior posterior spur-crest complex (74.8%). Posterior anatomical abnormalities were described in 89% of cases. The most common posterior abnormality is a vomerian crest (84%). Other posterior abnormalities, such as posterior hypertrophy of the inferior turbinate, residual adenoids or torwald cyst were recognized in 26.7% of cases and treated. Only 2 cases of significant concha bullosa were described representing 1.5 % of the cases, while Torwald cyst accounted for 0.7% (Figure 2).

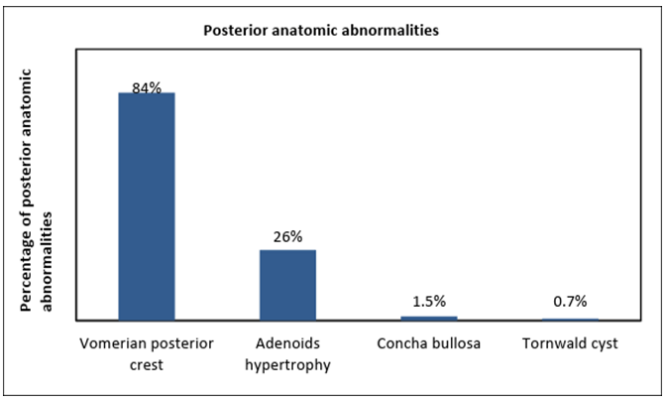

Figure 2: Posterior anatomical abnormalities.

Operative procedure

Endoscopic Septoplasty alone is possible in all but 2.3% of cases. Additional external approach is made in three cases when the caudal end or the columellar septum is deformed or too anterior for endoscopic approach (2%). Even in these cases, the other septal job is done by endoscopic septoplasty in the beginning of the operation. Different situations of septal deflections occured: we described 16% isolated anterior spurs; 9.2% isolated posterior vomerian crest and 74.8% complex anterior-posterior spurs and crests. TNES were well adapted to the isolated deflections (Figure 3). The TSES approach is the most frequently used for anterior-posterior in continuity deviation. If needed, other endoscopic actions on turbinates and adenoids can be carried out at the same time, including turbinal outfracture (100%), radiofrequency (29.8%); turbinoplasty reduction (61.8%). In case of reduction turbinoplasty maximum reduction reached 50% and on average 30%. Concha bullosa is treated by lateral and external endoscopic resection.

Mean operative time (except additional procedures and based on 6 consecutive cases realized by senior surgeon each) for the TSES was 21 ± 2 min. Mean operative time was significantly shorter for the TNES: 7 ± 2 min.

Functional assessment

The sNOSE scale (4 to 0) improves post surgery from 3.4 ± 0.5 on average pre-surgery to 0.9 ± 0.6 ($p < 0.05$) post-surgery. The gain is 2.5 on average in all the population. 87.8% of patients presented good results with a score less than one (less than a minimal/light obstruction or no obstruction at all) and 11.8% as unsatisfactory results (at least score of 2, n = 16). In 33% of cases, 0 obstruction was noted (Figure 4).

Statistically significant p value ($p < 0.05$) was obtained when comparing satisfaction scores obtained in sNOSE by senior surgeon (10 years experience of endoscopic septoplasty) and the youngest surgeons (2 years maximum of endoscopic septoplasty).

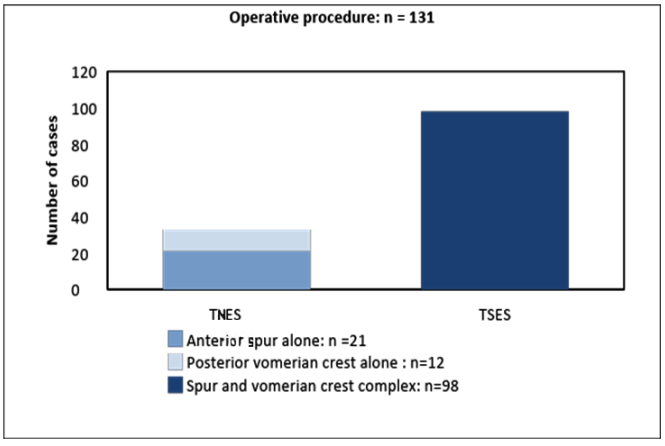

Figure 3: Operative procedures.

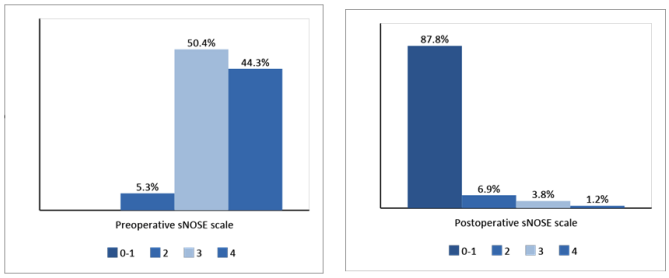

Figure 4: Functional Assessment.
sNOSE scale: 0 = Any obstruction, 1 = Very mild obstruction; 2 = Moderate obstruction; 3 = Fairly bad obstruction; 4 = Severe obstruction

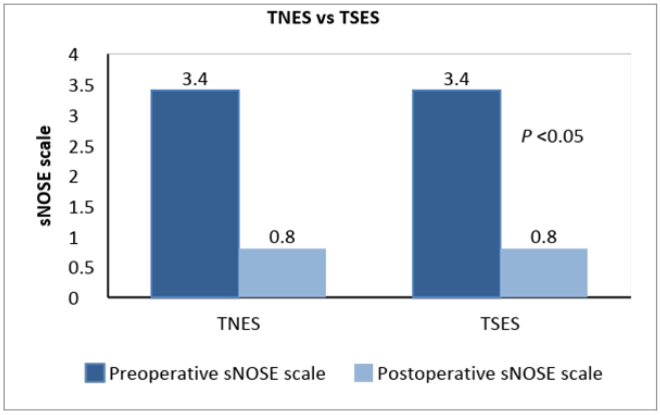

Figure 5: Trans-Nasal endoscopic septoplasty (TNES) vs Trans-Septal endoscopic septoplasty (TSES).

When TNES and TSES were tested separately: the gain was 2.5 each and identical. The sNOSE score improved from 3.4 ± 0.6 on average preoperatively to 0.9 ± 0.8 (p <0.05) postoperatively. We did not find a statistically significant difference between TNES and TSES (Figure 5). Three groups are defined depending on the time the telephone interview took place. The call group 1 from 6 to 10 months; call group 2 from 10 to 20 months and call group 3 from 20 to 30 months after the surgery. Group 3 was the first operated cases.

Complications

There were six cases with complications in the TSES group. The most frequent complication is persistent septal deviation and septal hematoma. No complication was noted in TNES.

We had three cases of minimal crusting; one case of persistent nasal obstruction was associated with micro septal perforation. The cause of unsatisfactory result was not clearly identified and no empty nose syndrome was identified (Table 2).

Table 2: Complications

Types of complications (n=131)	TSES	TNES
Haematoma	3	0
Micro-septal perforation	2	0
Synechiae	1	0
Crusting	2	1

TNES: Trans-Nasal endoscopic septoplasty; TSES: Trans-Septal endoscopic septoplasty.

DISCUSSION

The novelty of our study is to consider a relatively large number of patient (131) with together septal deformities and nasal obstruction. Previous studies encompassed an even larger number of patients but did not focus exclusively on nasal obstruction and did not discriminate the motivation for carrying out the surgery (rhinoplasty, snoring, access to lacrymal duct [16, 17]). Consequently, their endoscopy technique and results could not be assessed.

Subjective evaluation of patients is sometimes based on scores like NOSE or SNOT-22 but without a clear consensus on the pertinence of these scores in patients with isolated nasal obstruction [18–19]. Some of them are validated (NOSE) but patient questioning and clear interpretation of these scales are often considered too abundant or even confusing for this specific mono symptomatic population. We suggest replacing the relative complexity of classical NOSE score by using a simplified NOSE scale (sNOSE 5 steps 0 to 4) to carry out an investigation subjectively and with as less bias as possible.

An alternative would be to link simple subjective scaling scores given by patient and objective measurements such as rhynomanometry. However, no clear correlation is established between subjective evaluations and measured results [20-21].

A pre-septoplasty score ranging from 3.4 (average population) to 0.9 post-operation gives a good idea of the global improvement (2.5 gains on average) of a residual nasal obstruction. Globally, 89% of satisfactory results of our method compares well to the 42–85% success rate of headlight speculum, even if the way to evaluate the results differs [3–4].

There was no significant difference in scores obtained in the groups ranging 6 to 10; 10 to 20 and 20 to 30 months after the surgery. This supports the long-term stability of the procedure.

When TNES and TSES were tested separately, no difference occured in gain score for the patient. The type of approach (TNES or TNES) applied does not matter but well the final endoscopic permeability is evaluation by the surgeon.

Direct endoscopic evaluation of a difficult area, especially for posterior deformities, identifies the residual cause(s) of nasal obstruction. Adenoids, posterior turbinate hypertrophy, Torwald cysts or synechia must be taken into account to obtain the best flow in both nasal fossa. In our study, we report a high incidence

of posterior significant septal deformations: 84% are described in opposition to the 28% noted by Becker [22]. If we consider the other posterior deformations producing nasal obstruction like adenoids (22%) and cysts (0,15%) posterior abnormalities reached 89%. We interpret this, as one of the principal explanations for the good results obtained with endoscopic septoplasty, compared to classical techniques. Because there is no need for speculum, MIES leaves the anatomy undistorted. The endoscope makes it possible to check the permeability of the nasal fossa without deformation, enhancing the final result.

With the endoscope, it beocmes possible to perform all kinds of septoplasty, from the Trans-Nasal approach for limited deviation and/or revision surgery to total septoplasty by a trans-septal approach in more complex situations or even extremely deformed septum. Only the very caudal-columellar deformity needs to be completed by additional external approach (<2% of cases).

In the majority of studies, the type of ES use is not mentioned. It seems that most commonly endoscopic septoplasty concern Trans-Nasal endoscopic septoplasty or sometimes a mix of Trans-Nasal and Trans-Septal endoscopic septoplasty [23-25]. Therefore, we insist on the existence of 2 types of ES depending on the position of the endoscope: the endoscope into the nasal fossa (TNES) and endoscope into the new created septal pocket (TSES). We confirm the interest to use the Underwater Trans Septal technique (TSUES) allowing a very clear visualization of anatomical details (like in orthopedic arthroscopy). The clear endoscopic vision overcomes the difficult and sharp deformities of the spetum and avoid rupturing the subperichondral layer.

The advantage of the TNES was already recognized in tricky situations like redo with “forgotten” isolated residual anterior spurs or posterior crest and no remnant of the quadrangular cartilage. In this situation, it is classically difficult to save the mucosa because of frequent absence of the cartilage, hypertrophy of the residual mucosa or scary tissue. Our procedure saves time for these challenging situations with a very simple and efficient approach avoiding dangerous tentative to undermine these fragile mucosa.

Headlight surgeons often minimize the endoscopic advantage of the best visualization of posterior region by the common opinion that spurs and posterior crests in the inferior aspect of the nasal cavity rarely contributing to nasal obstruction. They are just ignoring the posterior and inferior aspect of the nasal fossa and justify by this way a “voluntary” incomplete surgery. We cannot validate this attitude. Indeed, we identified in our study 86 % of case with significant posterior pathology including posterior septal deviation but 60% posterior hypertrophy of the inferior turbinate, 20 % of adenoid hypertrophy. This is probably one of the reasons for our good results (88 %) compared to traditional septoplasty.

General complication rates (4.5%) are low and have to be compared to the 4 to 25% described with HLS [5–7]. Additional complications due to the use of the endoscope or irrigation are not identified.

Small perforation is regularly encountered during mucosal elevation especially at the sharpest point of the septum but can be early recognized and limited. If a larger trauma occurs on the mucosa, endoscopic adjustment of the flap with or without fixation can be achieved eventually by the use of glue.

We noticed two cases of early septal asymptomatic micro perforation in our MIES (1.5%) but without complaining of the patient at the time of clinical evaluation. We could not be completely sure that later, these perforations would not enlarge without symptomatology manifestations. These results are less or equal to the best published rate of perforation.

MIES could also benefit of powered instrumentation developed for FESS to refine the result: A residual bony spur may be burred. Mucosal, cartilaginous or adenoid excess can be reduced by shaving under visual control with precision, unlike with HLS.

The TSES approach make it possible to stay under the subperichondral vascular layer, sparing the vessel webs, which are really endoscopically visible under the elevated perichondrium. Endoscopic evaluation easily identifies and controls excessive bleeding by monopolar or bipolar cauterization, for example, on the premaxillary. It renders endoscopic septoplasty less bloody than with conventional technique and packing are not necessary.

Septal hematoma is very uncommon. We noted three hematoma in the follow-up. (2.3%). A low rate of hematoma is linked to bloodless procedure and to the lack of a need to suture, allowing natural flow of blood through the incision.

An operation time, ranging from on average 7 min for the TNES and 21 min for the TSES, is clearly shorter than headlight speculum. Additional surgical option is not included in this calculation. We have to underline that our TNES operation time is a lot shorter than the other ES mentioned and that TSES time is comparable to those published already [26].

Unsatisfactory results are not considered as a complication and represent 11.8% of cases. We do not recognize precisely the cause of these poor results collected by phone. We suspected perhaps the lack of experience in endoscopic approach as suggested by difference between results obtained by senior and young surgeons. Another hypothesis, could be a lack of septal correction, unrecognized valve narrowing, ignoring another cause of nasal obstruction like turbinate hypertrophy or residual adenoids.

The study limitations are the involvement of other causes of nasal obstruction. Indeed some patients have turbinal hypertrophy, adenoids hypertrophy,... besides their septal deviation.

It is generally impossible to design a perfect study taking into account only the type of septal approach without considering the other factor of nasal obstruction. We adopt the most global endoscopic approach of the

nasal obstruction including for example endoscopic turbinoplatsy. In this manner, we introduce a bias because other procedure than septoplasty are used.

The educational impact of endoscopic septoplasty is obvious. Endoscopic septoplasty on a 22 inches and full HD definition screen allows describing more precisely the septal anatomy and gives the opportunity to share the sequence of septoplasty. Another step will be the use of Ultra High Definition (UHD) or 4K camera and very large screens (55 inches 4K) in the next generation of surgical equipment. The very high definition magnification and enhanced color spectrum are highly advantageous in all cases of endoscopic septoplasty. Participation of the entire surgical team and shortening the septoplasty learning curve for assistant surgeons was already recognized by Champagne & al [27]. The real learning curve is probably shortened for septoplasty because of a perfect visualization of the surgical anatomy and possibility of control by the senior surgeon. Indeed, a significative difference exists between results obtaiedn by the senior surgeon and the trainees. Champagned et al [27] showed that the learning curve stabilizes from 60 procedures. Probable reason for this difference reflects technical experience and better evaluation of the final result in determining the adequate additional procedure [27]. MIES will probably become the first step for learning endoscopic procedures. It is an opportunity for young ENT trainees to enhance their skills in endoscopic procedure in rhinology and thus gain experience with the other endoscopic endonasal surgery. Endoscopic septoplasty will also boost a new generation of endoscopic surgeons in basic rhinologic procedure as well as the skull base, ophthalmological but also endoscopic ear surgery [28–29].

Endoscopic septoplasty will probably become the procedure of choice for children with significative septal deformities and persistent nasal obstruction and when adenoid reduction alone or medical treatment could not lead to nasal breathing [30]. MIES releaves nasal obstruction in children with the minimal resected portion of the septum and takes into account of all parameters of the child obstruction (septal deviation, adenoids remnants and inferior turbinate). Straight and minimally scarred septum and low complications rate can thus be put in balance with the negative impact on cephalic growth in a child with poor or no nasal breathing [31]. The “no packing and no suture” possibility make MIES ideal for the pediatric population making the post-operative period simple and painless.

Fewer complications, shortened operation time, better visualization of posterior deformities, less morbidity and better approach of associated cause of obstruction make definitively our technique minimally invasive. New classification of endoscopic septoplasty technique (TNES, TSES, TSUES) and the proposed simple scale for nasal obstruction evaluation (sNOSE) do contribute to making easier future comparison to publish data on the subject.

CONCLUSION

Our experience with endoscopic septoplasty and analysis of data complete the minimal invasive concept MIS. Endoscopic septoplasty presented advantages compared to classical approach in many situations. The principal benefit is the best illumination and magnification of the field of view.

We made a distinction between the trans nasal and trans septal approach. We also described a completely new underwater septoplasty by trans-septal approach. We recognized 89% of significant posterior obstructive abnormalities justifying for us the endoscopic approach, which is largely superior to visualize and correct the posterior portion of the septum or the nasal fossa than conventional surgical procedures. The results of endoscopic septoplasty were assessed by the clear improvement of nasal obstruction.

We confirm that the minimally invasive label of this technique with very low incidence of complications. We recommend using it especially in pediatric population where surgery is needed.

REFERENCES

1. Manoukian PD, Wyatt JR, Leopold DA, Bass EB. Recent trends in utilization of procedures in otolaryngology-head and neck surgery. Laryngoscope 1997 Apr;107(4):472–7.
2. Devseren NO, Ecevit MC, Erdag TK, Ceryan K. A randomized clinical study: Outcome of submucous resection of compensatory inferior turbinate during septoplasty. Rhinology 2011 Mar;49(1):53–7.
3. Dinis PB, Haider H. Septoplasty: Long-term evaluation of results. Am J Otolaryngol 2002 Mar–Apr;23(2):85–90.
4. Sipilä J, Suonpää J. A prospective study using rhinomanometry and patient clinical satisfaction to determine if objective measurements of nasal airway resistance can improve the quality of septoplasty. Eur Arch Otorhinolaryngol 1997;254(8):387–90.
5. Gulati SP, Wadhera R, Ahuja N, Garg A, Ghai A. Comparative evaluation of endoscopic with conventional septoplasty. Indian J Otolaryngol Head Neck Surg 2009 Mar;61(1):27–9.
6. Gupta M, Motwani G. Comparative study of endoscopic aided septoplasty and traditional septoplasty in posterior nasal septal deviations. Indian J Otolaryngol Head Neck Surg 2005 Oct;57(4):309–11.
7. Bothra R, Mathur NN. Comparative evaluation of conventional versus endoscopic septoplasty for limited septal deviation and spur. J Laryngol Otol 2009 Jul;123(7):737–41.
8. Nayak DR, Balakrishnan R, Murty K D, Hazarika P. Endoscopic septoturbinoplasty: Our update series. Indian J Otolaryngol Head Neck Surg 2002 Jan;54(1):20–4.
9. Sousa Ad, Iniciarte L, Levine H. Powered endoscopic nasal septal surgery. Acta Med Port 2005 Jul–Aug;18(4):249–55.

10. Castelnuovo P, Pagella F, Cerniglia M, Emanuelli E. Endoscopic limited septoplasty in combination with sinonasal surgery. Facial Plast Surg 1999;15(4):303–7.
11. Castelnuovo P, Dallan I, Battaglia P, Bignami M. Endoscopic endonasal skull base surgery: Past, present and future. Eur Arch Otorhinolaryngol 2010 May;267(5):649–63.
12. Stammberger H, Posawetz W. Functional endoscopic sinus surgery. Concept, indications and results of the Messerklinger technique. Eur Arch Otorhinolaryngol 1990;247(2):63–76.
13. Kim SW, Yeo SC, Joo YH, Cho HJ, Seo SW, Jeon SY. Limited endoscopic high septoplasty prior to endonasal dacryocystorhinostomy: Our experience of nine cases. Clin Otolaryngol 2017 Dec;42(6):1363–6.
14. Rioja E, Bernal-Sprekelsen M, Enriquez K, et al. Long-term outcomes of endoscopic endonasal approach for skull base surgery: A prospective study. Eur Arch Otorhinolaryngol 2016 Jul;273(7):1809–17.
15. Becker DG, Kallman J, Spatola MA, Ramos JA. Endoscopic septoplasty in revision septoplasty and functional septorhinoplasty. Oper Tech Otolaryngol-Head Neck Surg 2001 Jun 1;12(2):91–4.
16. Kulkarni SV, Kulkarni VP, Burse K, Bharath M, Bharadwaj C, Sancheti V. Endoscopic septoplasty: A retrospective analysis of 415 cases. Indian J Otolaryngol Head Neck Surg 2015 Sep;67(3):248–54.
17. Sathyaki DC, Geetha C, Munishwara GB, Mohan M, Manjuanth K. A comparative study of endoscopic septoplasty versus conventional septoplasty. Indian J Otolaryngol Head Neck Surg 2014 Jun;66(2):155–61.
18. Rudmik L, Hopkins C, Peters A, Smith TL, Schlosser RJ, Soler ZM. Patient-reported outcome measures for adult chronic rhinosinusitis: A systematic review and quality assessment. J Allergy Clin Immunol 2015 Dec;136(6):1532–40.e2.
19. Stewart MG, Smith TL, Weaver EM, et al. Outcomes after nasal septoplasty: Results from the nasal obstruction septoplasty effectiveness (NOSE) study. Otolaryngol Head Neck Surg 2004 Mar;130(3):283–90.
20. André RF, Vuyk HD, Ahmed A, Graamans K, Nolst Trenité GJ. Correlation between subjective and objective evaluation of the nasal airway. A systematic review of the highest level of evidence. Clin Otolaryngol 2009 Dec;34(6):518–25.
21. Kim CS, Moon BK, Jung DH, Min YG. Correlation between nasal obstruction symptoms and objective parameters of acoustic rhinometry and rhinomanometry. Auris Nasus Larynx 1998 Jan;25(1):45–8.
22. Becker SS, Dobratz EJ, Stowell N, Barker D, Park SS. Revision septoplasty: Review of sources of persistent nasal obstruction. Am J Rhinol 2008 Jul–Aug;22(4):440–4.
23. Trimarchi M, Bellini C, Toma S, Bussi M. Back-and-forth endoscopic septoplasty: Analysis of the technique and outcomes. Int Forum Allergy Rhinol 2012 Jan–Feb;2(1):40–4.
24. Raynor EM. Powered endoscopic septoplasty for septal deviation and isolated spurs. Arch Facial Plast Surg 2005 Nov–Dec;7(6):410–2.
25. Prepageran N, Lingham OR. Endoscopic septoplasty: The open book method. Indian J Otolaryngol Head Neck Surg 2010 Sep;62(3):310–2.
26. Paradis J, Rotenberg BW. Open versus endoscopic septoplasty: A single-blinded, randomized, controlled trial. J Otolaryngol Head Neck Surg 2011 Feb;40 Suppl 1:S28–33.
27. Champagne C, Régloix SB, Genestier L, Crambert A, Maurin O, Pons Y. Endoscopic septoplasty: Learning curve. Eur Ann Otorhinolaryngol Head Neck Dis 2016 Jun;133(3):167–70.
28. Khan MM, Parab SR. Endoscopic cartilage tympanoplasty: A two-handed technique using an endoscope holder. Laryngoscope 2016 Aug;126(8):1893–8.
29. Horn IS, Tittmann M, Fischer M, Otto M, Dietz A, Mozet C. Endonasal nasolacrimal duct surgery: A comparative study of two techniques. Eur Arch Otorhinolaryngol 2014 Jul;271(7):1923–31.
30. Yilmaz MS, Guven M, Akidil O, Kayabasoglu G, Demir D, Mermer H. Does septoplasty improve the quality of life in children? Int J Pediatr Otorhinolaryngol 2014 Aug;78(8):1274–6.
31. Posnick JC, Agnihotri N. Consequences and management of nasal airway obstruction in the dentofacial deformity patient. Curr Opin Otolaryngol Head Neck Surg 2010 Aug;18(4):323–31.

****

Acknowledgments
We thank Dr. Philippe Claeys for helping with the revised version of this manuscript.

Author Contributions
Pierre-François Dolhen – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published
Samuel Lipski – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published
Antoine Noel – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Guarantor of Submission
The corresponding author is the guarantor of submission.

Source of Support
None

Consent Statement
Written informed consent was obtained from the patient for publication of this study.

Conflict of Interest
Authors declare no conflict of interest.

Copyright
© 2018 Pierre-François Dolhen et al. This article is distributed under the terms of Creative Commons Attribution License which permits unrestricted use, distribution and reproduction in any medium provided the original author(s) and original publisher are properly credited. Please see the copyright policy on the journal website for more information.

Access full text article on other devices

Access PDF of article on other devices