

ORIGINAL ARTICLE

A new modified speculum guided single nostril technique for endoscopic transnasal transsphenoidal surgery: an analysis of nasal complications

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Abstract

The endoscopic transnasal, transsphenoidal surgical technique for pituitary tumour excision has generally been regarded as a less invasive technique, ranging from single nostril to dual nostril techniques. We propose a single nostril technique using a modified nasal speculum as a preferred technique. We initially reviewed 25 patients who underwent pituitary tumour excision, via endoscopic transnasal transsphenoidal surgery, using this new modified speculum-guided single nostril technique. The results show shorter operation time with reduced intra- and post-operative nasal soft tissue injuries and complications.

Keywords: endoscopic transnasal transsphenoidal surgery; nasal complications; pituitary tumour; single nostril technique

Introduction

Today, a number of approaches are commonly used for the purpose of excision of pituitary adenomas. These range from microsurgical to endoscopic procedures. Recent years have seen a shift in the surgical techniques for pituitary tumour excision from the traditional microscopic surgery to fully endoscopic surgery using a transnasal approach.^{1–7} The use of endoscopes offers a brighter and broader panoramic view with illumination and magnification of the sella structure when compared with the traditional conical view of the microscope. The tumour can be resected not only precisely but also with fewer surgical complications and therefore with greater safety.^{8–9} Furthermore, endoscopic procedures may be regarded as being less invasive and these procedures may vary from using either a single nostril or both nostrils

to access the region of the sella turcica.¹⁰ In the four hands, binasal technique, soft injury to the nasal structures possibly increases as both the nostrils are now used. Some surgeons also perform turbinectomies to increase the space required by the two hands technique.

We propose a single nostril technique using a modified nasal speculum that allows up to three instruments excluding the endoscope to be used with a single nostril, while at the same time minimizing the soft tissue injury to the nasal structures.

Method

A prospective review of the initial 25 patients who underwent pituitary tumour excision via endoscopic transnasal transsphenoidal surgery using this new modified speculum guided single nostril technique from June 2008 to March 2010 was performed. The demographic data, intraoperative and post-operative outcomes of these patients, were reviewed.

The primary goal of this review was to evaluate the intraoperative and post-operative outcomes, mainly nasal complications, of this new modified speculum guided single nostril technique for endoscopic transnasal transsphenoidal surgery of pituitary tumour excision.

Surgical technique

The patient is orotracheally intubated and positioned in a standard supine position with his/her neck in a slightly extended position. The surgeon stands on the patient's right facing the patient. The C-arm of an image intensifier has its axis lined 90° to the patients head centred upon the sphenoid sinus.

The patient's midface is prepared and draped with towels. An oropharyngeal pack is placed, and both nasal cavities are flushed with Moffat's solution with a Foley catheter used as a posterior packing for 5 min. Moffat's solution contains a mixture of 10% cocaine (3 mg/kg/body weight), adrenaline (0.1 mg/kg/body weight) at 1:1000 concentration, 8.4% of sodium bicarbonate, and normal saline for vasoconstriction.

Using a rigid 0° or 30° nasal endoscope, the nasal septum is infiltrated with the mixture of lignocaine and adrenaline at 1:80000 concentration bilaterally at the osteocartilag junction. The right mucoperichondrial flap is raised with freer elevator until the sphenoid rostrum while the osteocartilag junction is excised in order to raise the left mucoperichondrial flap. Later, the vomer is removed in order to view directly on the sphenoid rostrum. The sphenoid ostium is bilaterally identified.

Next, the new modified speculum is then inserted and expanded in between the mucoperichondrial septal flap via a right nostril. This not only opens the anterior sphenoid sinus wall widely but also compresses the middle turbinates laterally without any columella incision.

The instrument that we propose is a Killian's speculum that is modified by adding a holding bar that allows the attachment of a conventional self-retaining retractor system to maintain the position of the speculum once it is in the position (Fig. 1). This holding device also allows the attachment of a navigation array in the event the surgeon wishes to introduce the device using navigation techniques. It has a blade narrower than the conventional Hardy's speculum that is used for transnasal transsphenoidal surgery.

This holding device also is not flared nor has serrations at its working end, and the advantage of this is that the risk of soft tissue injury is reduced. However, the disadvantage is that it is unable to keep its position and therefore depends on the retraction system to keep it in place.

The blades of the speculum, in addition to maintaining an open channel, also serve to protect the nasal mucosal from any accidental injuries and, at the same time, guide instruments that are passed in and out of the nostril. The rigid nasal cartilage, together with the speculum blades, forms a triangular channel that allows the passage of the endoscope that is usually held at the top of the nostril and a sucker as well as any other instruments that are required such as curettes, dissectors blades and a high-speed drill



Fig. 1. The new modified Killian's speculum for single nostril technique.



Fig. 2. The blades of the new modified speculum available in various lengths can be interchanged to allow optimal exposure.

(Supplementary Video 1 to be found online at <http://informahealthcare.com/doi/abs/10.3109/02688697.2013.791667>). The blades that are also available in various lengths can be interchanged to allow optimal exposure (Fig. 2).

The rest of the exposures, including the exposure of the sphenoid sinus, the sella turcica and the removal of tumour, are carried out in the conventional manner under direct endoscopic visualization using conventional tools employed in endoscopic transsphenoidal surgery.

The nasal passages are washed out and inspected for any bleeding points, and the septal flap is returned to its central position. Later, both nostrils were packed with Merocels.

The nasal passages of all the patients were inspected six months after surgery and a post-operative magnetic resonance imaging (MRI) was also performed within the first six months following the surgery. A comparison of the MRI was made with respect to the degree of tumour removal by a radiologist.

Results

A total of 25 consecutive patients underwent a transnasal transsphenoidal surgery using this new modified speculum guided single nostril technique to remove their pituitary tumour between the period of June 2008 and March 2010. These comprised 11 males (44%) and 14 females (56%) ranging from 16 to 75 years of age with the mean age of operation of 45.3 years.

Ten (40%) of 25 patients presented with headache either chronic or acute, and nine (36%) patients presented with visual disturbance (67% of them had a bitemporal hemianopia during their formal visual field assessment). Seven (28%) patients had hormonal disturbances. Four (16%) patients had incidental findings of a large pituitary adenoma.

Pre-operative MRI was performed in all the patients. Twenty-two patients were found to have macroadenoma, and three patients had microadenoma. Pre-operative MRI also showed that 20 of 25 patients had extrasellar extension of the tumour which was further categorized using the Hardy-Wilson classification.¹¹ Grade A suprasellar extension were seen in five (20%) patients, and Grades B and C in four (16%) patients, respectively. Two (8%) patients had Grade D, and five (20%) patients had Grade E extrasellar extension (Fig. 3). The duration of surgery ranged from 80 to 180 min with the mean operative time of 117 min.

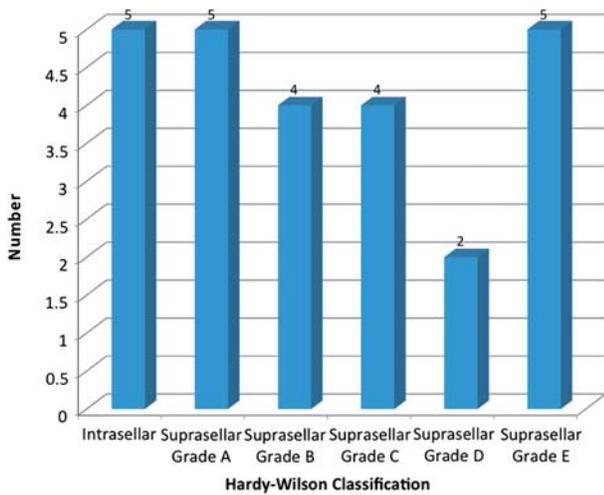


Fig. 3. Intrasellar and extrasellar extensions of Pituitary tumours.

There were no intraoperative complications or difficulties encountered with the use of this new modified speculum throughout the surgery. In fact, this modified speculum provided a wider surgical corridor, better visualization, more room for manoeuvrability of instruments and decreased the need to clean the endoscope from soiling without causing any injuries to nasal cavities. None of these patients had converted to the binostril approach or microsurgery.

All the patients were packed with merocels post-operatively. The average nasal packing was 48 h ranging between 24 and 72 h. Twenty-three of the 25 patients had their nasal packing removed two days after their operation

The average hospital stay was five days with a range of 3–15 days. Fifty percentage of the patients remained in hospital beyond five days due to endocrine disturbances requiring corrections.

Only one patient developed a cerebrospinal fluid leak that was identified intraoperatively, and an immediate repair was performed successfully with no further complications.

Ninety percentage of the patients complained of nasal obstruction, runny nose and bad smell with crusting during the initial two weeks post-surgery. However, all these symptoms subsided after daily nasal douching as well as weekly nasal toileting for the initial four weeks in the ENT clinic. Proper education of nasal-care post-surgery was conveyed to each patient by the trained nurse. No other major immediate nasal complications like acute sinusitis or bleeding were noted.

A direct nasal endoscopic examination was performed a month after surgery and revealed that all 25 patients had good healing of nasal soft tissue with no synechiae between the nasal septum and lateral nasal wall. No other nasal complications were noted after three months of follow-up.

Eleven patients had complete removal of tumour, and more than 90% of tumour resection was achieved in 11 patients. Three patients had less than 90% of their tumour excised.

Five (20%) patients had intrasellar confined tumour while the other 20 (80%) patients had suprasellar extension. All the patients with intrasellar confined tumour achieved a complete removal. Of the 20 patients with suprasellar extension, 6 also had a complete removal while 11 patients with suprasellar extension had more than 90% of their tumour removed. One patient with Grade A suprasellar extension and two patients with Grade E suprasellar extension had less than 90% removal of the tumour (Fig. 4).

The pre-operative MRI scans were used to assess the maximum diameter of tumour in the saggital, axial and coronal plane, and the tumour size was calculated using the Di Chiaro formula (length × width × height × π/6). The pre-operative tumour size ranged from 0.01 to 13.90 cm³ with a mean volume of 6.32 cm³.

Discussion

Pituitary surgery has evolved over the last century from the large craniotomies to microsurgical techniques and more recently performing the entire operation endoscopically.¹⁻⁶ While the two nostrils, four hands technique provides the necessary exposure to allow an adequate operation to be performed, there is the likelihood of damage to both nasal passages. This is especially so when surgeons of lesser experience try and pass instruments in and out of the nose. In order to obtain an adequate exposure, additional manoeuvres such as turbinectomies have been proposed.

The use of a speculum to maintain the passage is routine with a transnasal transseptal transsphenoidal surgery performed microsurgically. The speculums used have, however, been large and have their tips modified to keep them in position. This leads to damage to the mucosa membrane lining the nostril. Our proposed, modified, slimmer

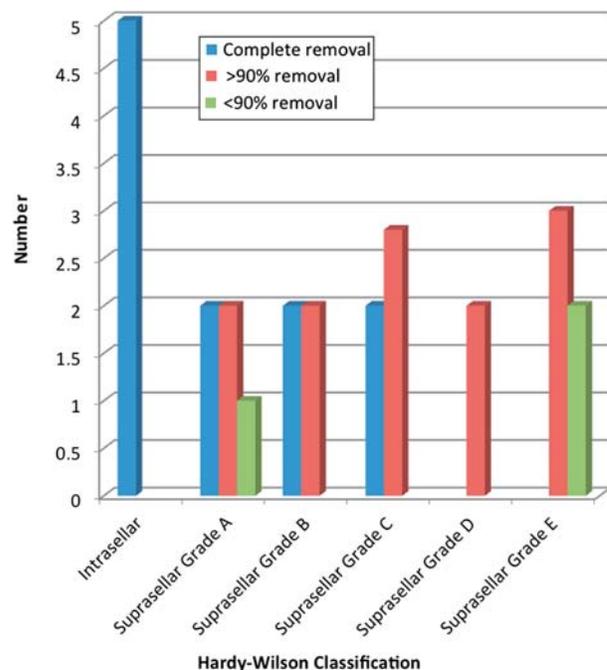


Fig. 4. Relationship between surgical outcome and extrasellar extension.

and smoother speculum blade with the spring-type locking mechanism that can be attached to the retractor system is more suitable for endoscopic work as it allows the nasal passage to be widened without the necessary turbinec-tomies and at the same time protect the nasal passage by acting both as a funnel to guide instruments in and out of the nostril and as a protective barrier preventing inadvertent mucosal injury. This is especially so when instruments such as high-speed drills and blades are being used. The spring-type locking system prevents kick-back of the nasal blades and reduces the need for adjustment of nasal blades during excision. Furthermore, columella incision to widen the nostril is not needed with this modified speculum. The use of this system also in our opinion reduces the frequency with which we were required to remove the endoscope for cleaning purposes.

We have reviewed the initial 25 patients who underwent pituitary tumour excision via endoscopic transnasal transsphenoidal surgery using this new modified speculum guided single nostril technique. In a recent systemic review and meta-analysis on endoscopic pituitary surgery by Tabae et al.¹², the mean duration of surgery ranged between 102 and 255 min. The duration of surgery in our study ranged from 80 to 180 min with a mean operative time of 117 min. The wider and better visualization of the surgical field allows quicker access to the sella turcica as well as reduces the need to clean the endoscope from soiling by contact with the soft tissue in the nasal passages. This probably contributes to shorter surgical time in this study.^{13,14} The latter together with the presence of a funnel-like proximal end also enables surgeons in training to perform this operation whilst developing the technique of introducing endoscopes and other instrument more rapidly and easily.

None of the procedures needed to be converted to a binostril approach or microsurgical technique as the wider nasal cavity created by compression of turbinates provided adequate visualization and sufficient space for interaction of two instruments and an endoscope simultaneously. When required we were also occasionally able to introduce three instruments in addition to the endoscope.

Nasal obstruction, discharge and bad smell with crusting are the most common nasal symptoms post-surgery in the initial 2–3 weeks due to the disturbance of normal nasal mucosa during surgery. However, with the proper technique of managing immediate post-surgery complication by daily nasal douching and weekly nasal toileting, all these nasal symptoms will resolve in four weeks. Patient's education of post-surgery nasal care before the surgery is crucial to reduce the incidence of immediate post-surgery nasal complications.

Haruna et al. reported that a bilateral approach had a high incidence of partial adhesion between the middle turbinates and the olfactory cleft.¹⁵ However, in our study, the post-operative direct nasal endoscopic examination revealed good healing of nasal soft tissue and no significant synechiae between the nasal septum and the lateral nasal wall (Supplementary Video 2 to be found online at [\[informahealthcare.com/doi/abs/10.3109/02688697.2013.791667\]\(http://informahealthcare.com/doi/abs/10.3109/02688697.2013.791667\)\).](http://</p>
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The result of the tumour clearance in our study was consistent with other larger studies using both the microsurgical and endoscopic techniques, and these techniques did not compromise tumour excision. Jain et al.'s 45% of complete removal of the pituitary tumour with residual tumour was observed in 45.46% and 33.33% of patients with functioning and nonfunctioning tumours, respectively.¹⁶ It was also noted that in the presence of suprasellar extension, there was a 60% incidence of having residual tumour when compared with that of our study.

Conclusion

The new modified speculum-guided single nostril technique for endoscopic transnasal transsphenoidal surgery is a minimally invasive surgery with a minimal nasal soft tissue dissection. The wider and better visualization of surgical field that is provided by this new modified speculum results in shorter operative duration, reduces the intraoperative complications and difficulties, as well as minimizes injury to the nasal soft tissue post-operatively especially in Asians who have narrow nasal cavities.

Declaration of interest: The authors declare that there is no conflict of interest. The authors alone are responsible for the content and writing of the paper.

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Supplementary material available online

Supplementary Video 1. A view of 2 instruments within the nose and external appearance TSS single nostril surgical views.wmv.

Supplementary Video 2. The internal view of post-operative appearance.