

## ORIGINAL STUDY

# Inverted papilloma of the maxillary sinus and endoscopic endonasal medial maxillectomy

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## ABSTRACT

**INTRODUCTION.** A medial maxillectomy (MM) consists of a complete resection of the medial wall of the maxillary sinus. Traditionally, the surgery is performed via an open approach. With more familiarity and expertise in endoscopic sinus surgery, the endonasal approach is feasible.

**OBJECTIVE.** To expose the surgical technique and report the results of endonasal endoscopic medial maxillectomy in a series of 9 consecutive patients with inverted papilloma involving the maxillary sinus.

**MATERIAL AND METHODS.** From August 2006 to December 2012, 9 patients with an inverted papilloma involving the maxillary sinus have been operated on with this procedure. There were 8 men and 1 female. The mean age was 64.5 years old (range: 43-83). In 4 cases, it was a primary surgery, whereas in the other 5 cases it was a revision surgery. In the latter group, 2 patients underwent a mini Caldwell Luc procedure and the others underwent an ethmoidectomy associated with a middle antrostomy (n=2) or an inferior meatotomy (n=1). The delay between the previous surgery and the present surgery varies from 3 years to 30 years.

**RESULTS.** All the patients are free of disease at the time of writing with a mean follow-up of 37 months (range: 5–77). This has been confirmed by a nasal endoscopy and CT scans. In one case, we have had a posterior bleeding requiring a sphenopalatine artery ligation. There were no other major per- or postoperative complications. Patients suffered from crusting for at least 3 months postoperatively, necessitating daily nasal douches. One patient is still complaining of intermittent epiphora when he is exposed to wind. 2 patients had an opacification of the ipsilateral frontal sinus. In one case, a reopening of the frontal ostium was performed.

**CONCLUSION.** Endoscopic medial maxillectomy can be successfully performed for the resection of inverting papilloma involving the maxillary sinus and/or the intersinonasal wall. Compared to open approaches, this kind of surgery seems to be equally effective, with less postoperative morbidity. An important technical point is to do the anterior osteotomy in front of the nasolacrimal duct in order to expose the prelacrimal recess that is typically an area for recurrence. Exact determination of the tumor attachment during the surgery is another key point for success. Long follow-up is required, as the inverted papilloma can be a very slow growing tumor, particularly when it is in the maxillary sinus.

**KEYWORDS:** inverted papilloma, maxillary sinus, endonasal medial maxillectomy, extended endoscopic surgery, radical surgery

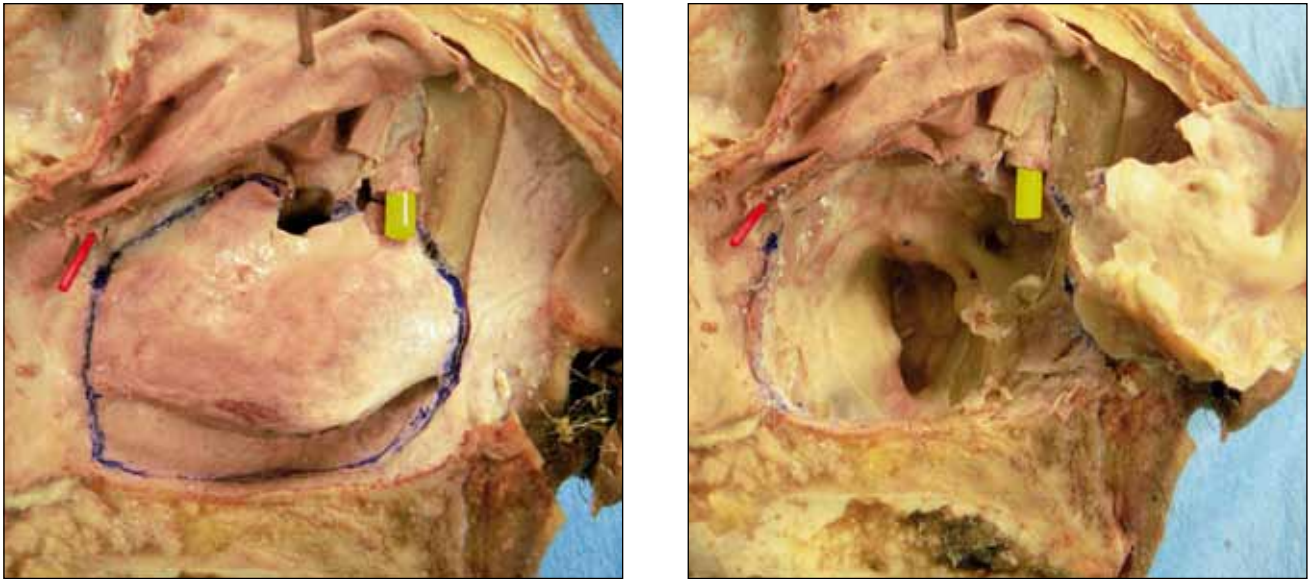
## INTRODUCTION

Medial maxillectomy (MM) consists of a complete resection of the medial wall of the maxillary sinus. The limits are inferiorly the nasal floor, superiorly the ethmoid sinus, anteriorly the anterior maxillary wall, including the nasolacrimal duct, and posteriorly the vertical plate of the palatine bone<sup>1</sup>. Figure 1 illustrates the procedure on a ca-

daver. Typically, a complete ethmoidectomy is also performed during the same surgical procedure tailored to the type and extension of the disease.

The indications for such an extended surgery are<sup>2</sup>:

1. Benign tumors (e.g. inverted papilloma) with involvement of the lateral nasal wall, the ostiomeatal complex and the medial maxillary wall.
2. Recurrent inverted papillomas, confined to the



**Figure 1** Medial maxillectomy – cadaver demonstration - yellow structure: nasolacrimal duct; red structure: sphenopalatine artery; blue line: limits of the resection.

maxillary sinus, which cannot be completely removed with a more conservative approach.

3. Malignant tumors confined to the medial wall of the maxillary sinus.
4. Access to the lateral or posterior walls of the maxillary sinus or to the infratemporal fossa. An illustrative indication is the removal of a juvenile angiofibroma extended to the infratemporal fossa.

In the past, the procedure was performed via an open approach (a Rouge-Denker, a lateral rhinotomy or a midfacial degloving approach)<sup>3,4</sup>. Since the late 1990s, thanks to a greater familiarity and expertise in endoscopic endonasal surgery, the endonasal approach was proposed as an alternative to the open approach<sup>2,5-13</sup>.

The authors report herein their 6 years' experience with the endonasal endoscopic medial maxillectomy

(EMM), describe the surgical technique and comment their results of surgery of inverted papilloma involving the maxillary sinus.

## MATERIAL AND METHODS

9 patients were operated on between August 2006 and December 2012 (Table 1). There were 8 men and 1 female. The mean age of this cohort of patients was 64.5 years old (range: 43-83).

There was a primary surgery in 4 cases, and a revision surgery in the 5 other cases. In the latter group, 2 patients previously underwent a mini Caldwell-Luc and 3 patients an ethmoidectomy associated with a middle antrostomy (n=2) or an inferior antrostomy (n=1).

All the patients had a complete preoperative assess-

**Table 1**

No.	Patient	Age (years)	Type of surgery	1 <sup>st</sup> surgery	Last surgery	Follow-up(months)
1	V.M.	58	Primary surgery	-	2006 Left Ethmoidectomy & MM	77
2	T.D.	58	Primary surgery	1996 Standard FESS X2	2008 Revision: Left MM	57
3	C.M.	43	Primary surgery	2006 Mini Caldwell-Luc	2008 Revision: Right ethmoidectomy + MM	53
4	H.F.	59	Primary surgery	1999 FESS - antrostomy	2008 Revision: Left MM	52
5	M.J.	83	Primary surgery	2004 FESS + bimeatotomy	2009 Revision: Left MM	36
6	M.J.C.	64	Primary surgery	Mini Caldwell Luc in the 80s	Left ethmoidectomy & MM	25
7	S.K.A	58	Primary surgery	-	Left ethmoidectomy & MM	22
8	C.E.	76	Primary surgery	-	Left ethmoidectomy & MM	9
9	P.F.	83	Primary surgery	-	Right ethmoidectomy & MM	5

ment including a biopsy, a computed tomography of the sinuses and a magnetic resonance imaging. In any case, there was an infiltration of either the lateral or anterior walls of the maxillary sinus. No patient had a malignant transformation concomitant to the inverted papilloma (IP).

### Surgical technique

The surgery was conducted under general anaesthesia, the patient in a recumbent position. Neurosurgical cottonoids soaked in a solution of adrenalin (1mg of adrenalin mixed into 40 ml of saline) were placed in the nasal cavities for at least 10 minutes before the surgery. The lateral nasal wall was infiltrated with a solution of Lidocain 1% plus adrenalin (1/10000).

The procedure started with a dacryocystorhinotomy performed in a high position, as described by PJ Wormald in 2003<sup>14</sup>. The lacrimal pathway was cut at the junction of the lacrimal sac and the nasolacrimal duct. Then the tumor was removed from the middle meatus and the upper part of the maxillary sinus with conventional Blakesley forceps. The sphenopalatine artery was then coagulated with a bipolar cautery. The inferior turbinate was completely removed with a scissor and the microdebrider (XPS - Medtronic – tricut blade). Afterwards, osteotomies were done with a hammer and a chisel. One was performed very anteriorly at the level of the maxillary crest, in front of the nasolacrimal eminence; the other was performed inferiorly and horizontally, parallel to the junction of the nasal floor and the medial wall of the maxillary sinus. With such a wide access and using angulated telescopes (45° and 70° telescopes) and forceps, the IP and the sinus mucosa adjacent to its implantation were completely removed. The dissection was made in a subperiosteal plane. Drilling of the site of attachment was done with a diamond drill, transnasally. A sublabial approach through the canine fossa was never used in this cohort of patients.

Frozen sections were done to ensure that all the tissue margins were free of tumor.

A bicanalicular silicone tube was put in place for 3 months postoperatively and a nasal packing for 2 days. The patient received broad-spectrum antibiotics for 5 days postoperatively. He was informed to clean his nose with nasal douches comprising a saline solution and to put a nasal ointment 3 times a day as long as crusting persists.

Postoperative cares under endoscopic guidance with removal of the crusts were done 3 times, postoperatively (day 2, 9 and 21) and later on if crusting was persistent.

A computed tomography of the sinuses was ordered 6 months after surgery and after 2 or 3 years. The follow-up consultation was made every 3 months during the first postoperative year, and every 6 months for the next 5 years.

## RESULTS

The mean follow-up period is 37 months (range 5 to 77 months).

All the patients are free of disease at the time of writing, based on an endoscopic evaluation and radiologic studies. On the postoperative CT scan, a common finding was a thickening of the soft tissue on either the lateral, inferior or superior walls of the maxillary sinus. 1 patient was complaining of crusting 11 months postoperatively. 1 patient presented an epiphora when he was exposed to the wind.

We had one case of posterior bleeding necessitating a coagulation of the sphenopalatine artery. We had no other major complications, particularly no CSF leakage.

2 patients had an opacification of the ipsilateral frontal sinus. In one case, a specific procedure directed to the frontal sinus was performed.

The pathological examination of the surgical specimen confirmed that the tissue margins were free of disease in all cases. There was no malignant transformation concomitant to the IP. Figure 2 illustrates one clinical case.

## DISCUSSIONS

A medial maxillectomy (MM) is a radical surgery indicated for the removal of expanding processes involving the maxillary sinus or the intersinonasal wall, which cannot be completely removed with a more conservative procedure.

One of the most common indications is surgery for inverted papillomas (IPs) confined to the maxillary sinus. IPs are benign tumors characterized by high recurrence rates, tendency toward multicentricity, a capacity to erode adjacent bones, to extend to the orbit or intracranial cavity, and associated with a risk of malignant transformation in 5% to 15% of the case<sup>4,15</sup>. The sole treatment for IPs is surgery. The goal is to achieve a complete resection of the tumor and surrounding mucosa with minimal cosmetic deformities and functional disabilities. In the past, the golden standard was the lateral rhinotomy combined with an open medial maxillectomy<sup>3,4</sup>. Even if this approach was highly effective, providing the surgeon an excellent visualization of the tumor attachments and the possibility to extend the approach to adjacent areas (orbit, cranial vault, frontal and contralateral ethmoid sinus), tailored by the tumor extension, the open approach was associated with a significant postoperative morbidity: numbness of the upper lip, hypoesthesia of the cheek and in the area of the trigeminal nerve (V2), lacrimal problems (epiphora and dacryocystitis<sup>16</sup>). Blindness was also reported<sup>17</sup>.

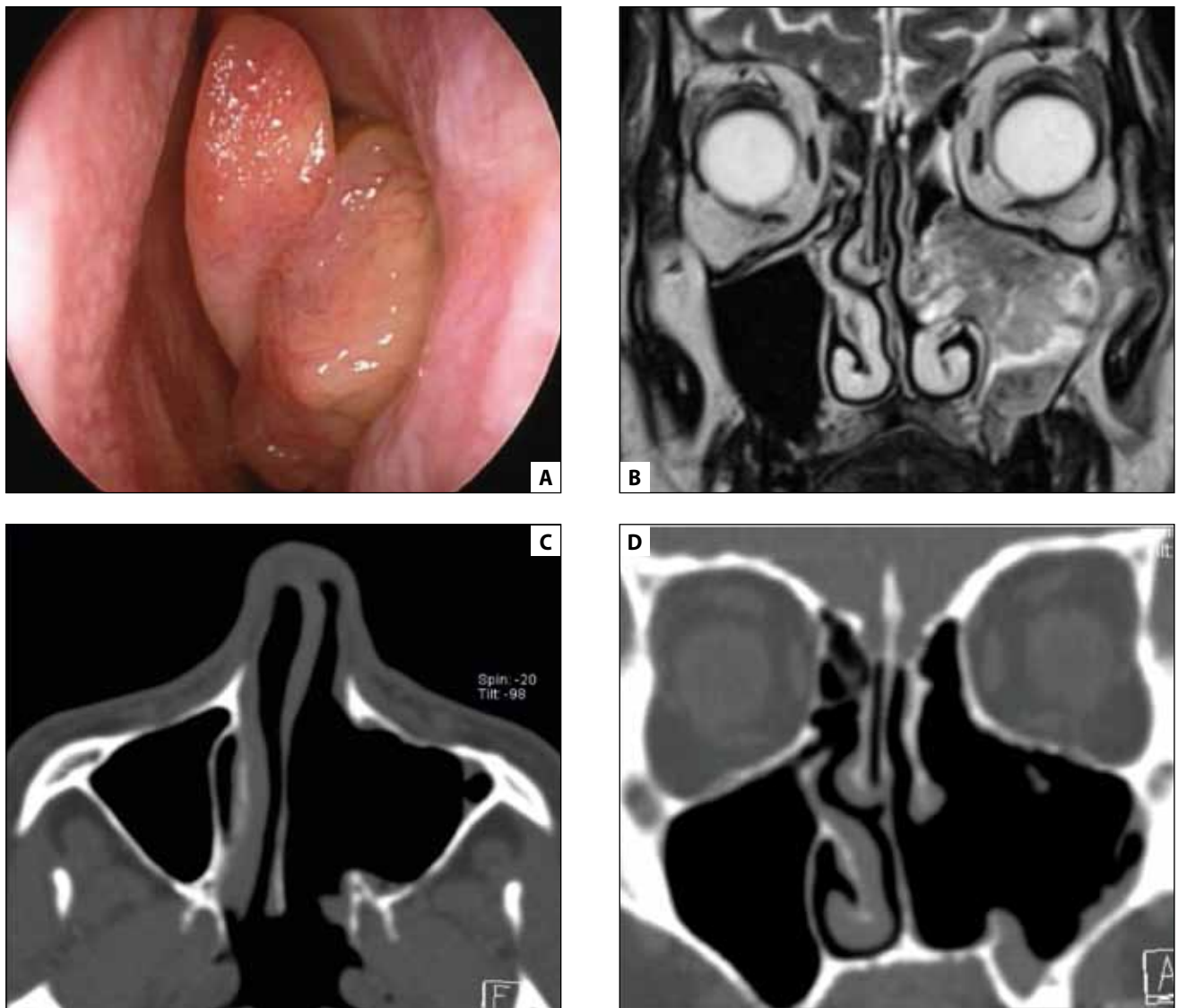
With the advances in endonasal endoscopic sur-

gery, the endonasal approach was proposed as an alternative to the open approach. A complete ethmoidectomy associated with a middle antrostomy and/or a sphenoidotomy was then performed successfully by numerous surgeons for a large number of inverted papillomas. This was well reported in a meta-analysis conducted by Busquet and published in 2006<sup>18</sup>. Nevertheless, 2 localizations remain a challenge: the lateral portion of the frontal sinus and the maxillary sinus<sup>19,20</sup>.

In 2000, in the Belgian ENT journal<sup>19</sup>, the authors pointed out that recurrences of IPs were much more frequent in the maxillary sinus than in the ethmoid sinus, when the patients have undergone first an ethmoidectomy and a middle antrostomy. Our series of patients confirmed this assertion, as 3 patients had a recurrence of IP in the maxillary sinus after a com-

plete ethmoidectomy associated with a middle antrostomy (2 cases) and a bimeatotomy (1 case).

This can be explained by different factors. The first one is that the surgeon might have confused FESS and ESS. FESS means functional endoscopic sinus surgery. It was first dedicated for the treatment of inflammatory sinonasal lesions. The background of FESS is a maximal preservation of the healthy mucosa. For IPs, the surgery must be radical, consisting of a complete resection of the tumor and the surrounding mucosa<sup>5</sup>. Another explanation is that the surgeon underestimated the true extension of the IP within the maxillary sinus, leading to an inadequate (too limited) surgical procedure. At this time, it is important to remind the conclusion of an anatomic study published in 2003 by Sadeghi N<sup>9</sup>. The author reported that 64% of the



**Figure 2** A: nasal endoscopy – inverted papilloma extruding from the middle meatus  
 B: MRI showing a complete involvement of the left maxillary sinus  
 C & D: postoperative CT scans showing a maxillary sinus free of disease.

volume of the maxillary cavity is below the lateral attachment of the inferior turbinate on the lateral nasal wall and 10 to 15% of the volume of the maxillary sinus cavity is located in the prelacrimar recess. This anatomic study pointed out that a wide opening is mandatory to have an optimal vision on all the walls and recesses of the maxillary sinus and on the sites of tumor origin and attachments during the surgery<sup>21</sup>. A middle antrostomy, even a large one, combined or not with an inferior antrostomy or a mini-Caldwell-Luc, do not provide an optimal vision on the entire maxillary cavity and so, are certainly not the best option of treatment for IPs extended to the lateral portion of the maxillary sinus or to the intersinonasal wall. As a result of this, the Belgian report recommended to perform a true Caldwell-Luc procedure<sup>19</sup>. Nevertheless, when the medial maxillary wall or the inferior turbinate are infiltrated by the IP, a complete resection of the intersinonasal wall (Denker procedure) must be done<sup>7,13,21</sup>. When the lateral portion of the tumor is not reachable through the endonasal approach, a limited external approach through the canine fossa can be combined with the endonasal approach<sup>7,10</sup>. Once more, this limited external approach must allow a complete extirpation of the base of insertion of the IP. When this is not the case, recurrence is possible. 2 patients in this series had been operated on with a limited Caldwell Luc procedure and experienced recurrence some years later.

Another important issue is the duration of the follow-up for a patient operated for an IP. As illustrated by our series, recurrence in the maxillary sinus can be symptomatic 10 years after an endonasal conventional surgery. This can be explained by the fact that the maxillary sinus is a large cavity in which the papilloma can grow slowly without clinical symptoms. This is not the case for other localizations such as the ethmoid or the sphenoid sinuses, which are symptomatic sooner and easily visualized by the nasal endoscopy. A very long and close follow-up is therefore mandatory for all patients with an IP. An endoscopy through the surgical opening is mandatory every 6 months for at least 5 years. From this point of view, a medial maxillectomy has the advantage of providing a large and permanent vision in the maxillary sinus, making easier and earlier the detection of recurrences with the nasal endoscopy.

The management of the recurrences is still a controversial issue in the literature, taking into account that the behaviour of the tumor may be more aggressive and the association with a squamous cell carcinoma more frequent<sup>5,8,22</sup>. Therefore, most authors prefer to do an external approach, whereas others opt for an endonasal approach, with the possibility to combine it with a limited external approach when needed. In our limited number of cases, we used the endonasal approach only. The patient was informed before the

surgery of a possible switch to an external approach if necessary. The dissection was done in a subperiosteal plane. All the different walls of the maxillary sinus and the sites of attachment of the IP were clearly visualized using angulated telescopes. The site of implantation of the tumor was meticulously drilled out. We did not find any malignant transformation of the IP or infiltration of the anterior and lateral maxillary walls.

Concerning the surgical technique, there are two different ways to do a medial maxillectomy. The first one consists of en bloc resection and the other is a sequential fragmental resection. Based upon Busquet's meta-analysis, there is no statistically significant difference in the recurrent rates between these 2 modalities<sup>18</sup>. That is the reason why we preferred to do a sequential resection and a step by step surgical approach. All the procedure was then performed with a permanent visual control and a bloodless surgical field.

A crucial technical point is to do the osteotomy very anteriorly, in front of the lacrimal crest, in order to expose the prelacrimar recess, area of possible recurrence.

The postoperative morbidity after such an extended surgery is low and far less important compared to the one observed after an external approach. Crusting remains the major problem for a period of minimum 6 months. No change in the voice quality was observed.

## CONCLUSIONS

In conclusion, an ENT surgeon dealing with primary or recurrent inverted papilloma involving significantly the maxillary sinus must be able to perform a medial maxillectomy. It is an extended radical surgical procedure that is safe, reproducible and very effective. We recommend doing a step by step procedure, allowing a complete extirpation of the tumor and the sinus mucosa, in a bloodless surgical field, with an optimal exposure and vision of the origin and attachments of the tumor. A sublabial approach can be combined to remove a tumor extension in the anterolateral recess or the anterior maxillary wall. Malignant transformation of IP in the lateral portion of the maxillary sinus is a contraindication for a pure endonasal technique. A precise determination of the origin and site of attachment of the IP intraoperatively is of utmost importance for a successful surgery. Postoperatively, a very close and long follow-up is necessary to detect any recurrence.

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## REFERENCES

1. Tanna N., Edwards J.D., Aghdam H., Sadeghi N. - Maxillectomy as the initial oncologic approach to sinonasal neoplasms: the anatomic basis. *Arch Otolaryngol Head Neck Surg.*, 2007;133(11):1139-42.
2. Kountakis Stilianos E., Önerci M. - Endoscopic medial maxillectomy. *Rhinologic and Sleep Apnea Surgical Techniques*, Springer Berlin Heidelberg, 2007;6:119-124.
3. Bielamowicz S., Calcaterra T.C., Watson D. - Inverting papilloma of the head and neck: the UCLA update. *Otolaryngol head neck Surg.*, 1993;109(1):71-6.
4. Phillips P.P., Gustafson R.O., Facer G.W. - The clinical behaviour of inverting papilloma of the nose and paranasal sinuses: report of 112 cases and review of the literature. *Laryngoscope*, 1990;100(5):463-9.
5. Myers E.N., Fernau J.L., Johnson J.T., Tabet J.C., Barnes E.L. - Management of inverted papilloma. *Laryngoscope.*, 1990;100:481-490.
6. Han J.K., Smith T.L., Loehrl T., Toohill R.J., Smith M.M. - An evolution in the management of sinonasal inverting papilloma. *Laryngoscope.*, 2001;111(8):1395- 400.
7. Wormald P.J., Ooi E., van Hasselt C.A., Nair S. - Endoscopic removal of sinonasal inverted papilloma including medial maxillectomy. *Laryngoscope.*, 2003;113(5):867-73.
8. Kraft M., Simmen D., Kaufmann T., Holzmann D. - Long-term results of endonasal sinus surgery in sinonasal papillomas. *Laryngoscope.*, 2003;113(9):1541-7.
9. Sadeghi N., Al-Dhahri S., Manoukian J.J. - Transnasal endoscopic medial maxillectomy for inverting papilloma. *Laryngoscope*, 2003;113(4):749-53.
10. Tomenzoli D., Castelnuovo P., Pagella F., Berlucchi M., Pianta L., Delù G., Maroldi R., Nicolai P. - Different endoscopic surgical strategies in the management of inverted papilloma of the sinonasal tract: experience with 47 patients. *Laryngoscope*, 2004;114(2):193-200.
11. Krouse J.H. - Evolution in the management of inverted papilloma. *Otolaryngol Head Neck Surg.*, 2009;140(3):336-7.
12. Lane A.P. - The role of endoscopic sinus surgery in the management of sinonasal inverted papilloma. *Curr Opin Otolaryngol Head Neck Surg.*, 2009;17(1):6-10.
13. Lawson W., Patel Z.M. - The evolution of management for inverted papilloma: an analysis of 200 cases. *Otolaryngol Head neck Surg.*, 2009;140(3):330-5.
14. Tzirbas A., Wormald P.J. - Mechanical endonasal dacryocystorhinostomy with mucosal flaps. *Br J Ophthalmol.*, 2003;87(1):43-7.
15. Kaufman M.R., Brandwein M.S., Lawson W. - Sinonasal papillomas: clinicopathologic review of 40 patients with inverted and oncocyte schneiderian papillomas. *Laryngoscope.*, 2002;112(8Pt1):1372-7.
16. Eloy P., Bachy V., Grulois V., Bertrand B. - Pyocele of the lachrymal sac – a late and unusual complication after surgery for a juvenile nasopharyngeal angiofibroma. *Clin Ophthalmol.*, 2008;2(1):211-5.
17. Kalavagunta S., Roy D., Fish B., Jackson S. - Blindness following medial maxillectomy. *Rhinology*, 2002;40(4):223-5.
18. Busquet J.M., Hwang P.H. - Endoscopic resection of sinonasal inverted papilloma: a meta-analysis. *Otolaryngol. Head Neck Surg.*, 2006;134(3):476-82.
19. Bertrand B., Eloy P., Jorissen M., et al. - Surgery of inverted papillomas under endoscopic control. *Acta Otolaryngol Belg.*, 2000;542:139-50.
20. Mortuaire G., Arzul E., Darras J.A., Chevalier D. - Surgical management of sinonasal inverted papillomas through endoscopic approach. *Eur Arch Otolaryngol*, 2007;264(12):1419-24.
21. Sukenik M.A., Casiano R. - Endoscopic medial maxillectomy for inverted papilloma of the paranasal sinuses: value of the intraoperative endoscopic examination. *Laryngoscope*, 2000;110:39-42.
22. Lee T.J., Huang S.F., Lee L.A., Huang C.C. - Endoscopic surgery for recurrent inverted papilloma. *Laryngoscope*, 2004;114(1):106-12.