



Exclusive Endoscopic Approach in the Management of Sinonasal Inverted Papilloma

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Abstract

Background: With the advancement in endoscopic endonasal surgeries, there has been a change in the surgical approach from the traditional open surgeries to the more conservative endoscopic endonasal approach for the management of sinonasal inverted papilloma. In the present study, we have shared our experience of endoscopic excision inverted papilloma involving the paranasal sinuses in a tertiary care hospital. **Materials and methods:** It is a retrospective case series of 28 patients who underwent endoscopic excision of inverted papilloma of paranasal sinus in a tertiary care hospital from April 2017 to October 2020. The medical records were retrospectively analyzed for the clinical, radiological, pathological, intraoperative and postoperative findings and later compared among the surgical approaches. **Results:** Of the total of 28 patients with inverted papilloma (3; Krouse 2 and 25; Krouse 3), 11(21.4%) patients were operated through endoscopic modified Denker, 8(39.3%) patients with endoscopic medial maxillectomy and 6(21.4%) patients with endoscopic sinus surgery. Patients who underwent modified endoscopic approach had lesser complications compared to the standard endoscopic procedures. **Conclusion:** Endoscopic excision of the sinonasal inverted papilloma can be a valid alternative to the open surgical approach, enabling complete clearance of the disease with a minimal complication rate. A large population with a long-term follow-up may be needed for a better understanding of the results.

Keywords Inverted papilloma · Endoscopic approach · Management

Introduction

Inverted papilloma of the nose and the paranasal sinus is a benign epithelial tumour that accounts for approximately 0.4 to 4.7% of all sinonasal tumours. Although it is a benign tumour, the characteristic features of local aggression, high recurrence rate and the coexistence of a malignant transformation give it a unique position in contrast to the other sinonasal tumour [1–4]. Diagnosis is usually achieved by the complete correlation of the radiological and the characteristic histopathological features of the specimen. Surgical excision of the tumour is considered curative, although

adjuvant radiotherapy is advised limited to specific cases of coexisting carcinomas. With the advancement in endoscopic endonasal surgeries, there has been a change in the surgical approach from open surgeries to the conservative endoscopic endonasal approach [5]. Meta-analyses have shown that endoscopic techniques to resection of Inverted papillomas (IPs) have significantly lower recurrence rates than open procedures, both currently and historically [2, 3]. Despite these advances, specific subsites in the paranasal sinus are still inaccessible through standard endoscopic approaches. Hence the conventional endoscopic approach to the tumour has been modified in the recent past, especially for the tumour originating from the inferior/anterolateral wall of the maxilla [6–14]. In contrast, the combined surgical approaches, i.e., endoscopic and canine fossa trephine/Caldwell-Luc, are often utilized in the above condition for complete removal of the disease [15–19]. Due to the increased postoperative morbidities associated with the combined surgical approaches, endoscopic endonasal procedures are preferred nowadays [18, 19]. The modified

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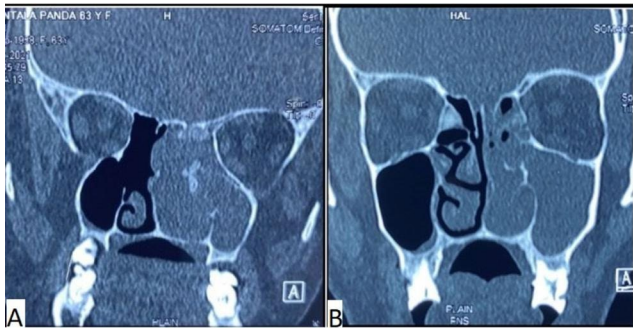


Fig. 1 **A.** Non-contrast CT scan (coronal cuts) showing a soft tissue density in the left nasal cavity and the maxillary sinus with a focal hyperostosis over the medial wall of the maxillary sinus, suggesting the site of origin of tumour. **B.** Non-contrast CT scan (coronal cuts) showing a soft tissue density involving the left side of the nose and hyperostosis was found over the anterior ethmoid air cells

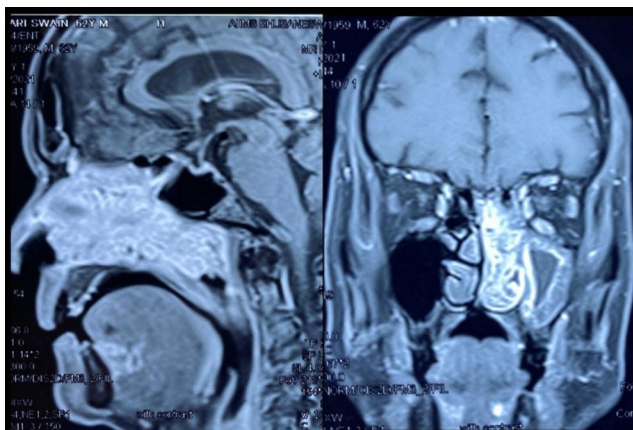


Fig. 2 Contrast-enhanced MRI (T1-weighted, parasagittal and coronal cut) shows the typical convoluted cerebriform pattern in the left side of the nose involving the maxillary and ethmoid sinuses

endoscopic procedures can be successfully utilized for the complete removal of the tumour from the anterolateral/inferior wall of the maxilla without the need for a separate sublabial incision [16, 20]. Again, the modified endonasal approach is a conservative surgery, ensuring complete clearance of the disease and reducing the complication rate and postoperative morbidities in the patients. In the present study, we have shared our experience of 28 patients who underwent endoscopic endonasal excision of the inverted papilloma involving the paranasal sinuses in a tertiary care referral hospital.

Materials and methods

It is a retrospective case series consisting of 28 patients with inverted papilloma who underwent surgery involving the nose and paranasal sinuses from April 2017 to October 2020 in the Department of Otorhinolaryngology in a tertiary

Table 1 Krouse staging system for inverted papilloma

Stage 1	Disease is limited to the nasal cavity alone
Stage 2	Disease is limited to the ethmoid sinuses and medial and superior portions of the maxillary sinuses
Stage 3	Disease involves the lateral or inferior aspects of the maxillary sinuses or extension into the frontal or sphenoid sinuses
Stage 4	Disease involves tumour spread outside the confines of the nose and sinuses as well as any malignancy

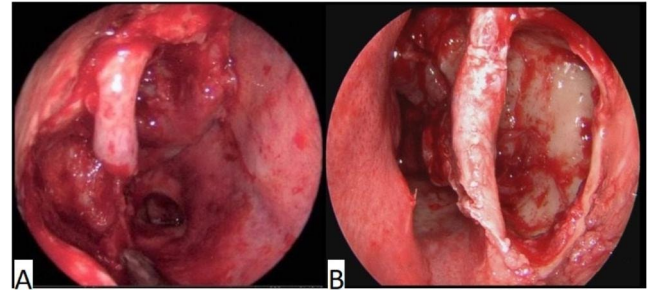


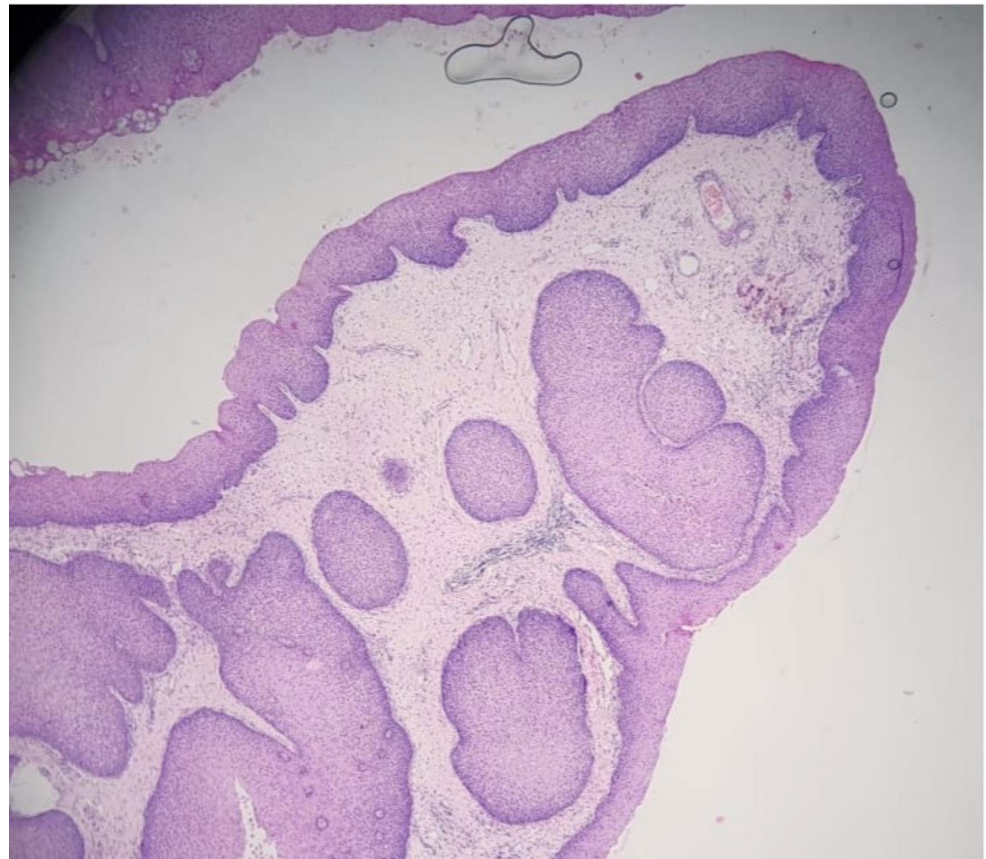
Fig. 3 A histopathological slide shows polyps lined by mature stratified squamous epithelium and endophytic growth/nests of mature squamous islands surrounded by oedematous stroma, suggestive of inverted papilloma (H&E 4x)

care referral hospital. The medical records were reviewed and the clinical, radiological and surgical parameters were evaluated in each patient. In the preoperative assessment, the primary symptoms, diagnostic nasal endoscopic findings, radiological features and pathological diagnosis were carried out. Intraoperative findings like injury to the vital structures, duration of surgery, and average blood loss were assessed. Similarly, in the postoperative period, the local complications like the epiphora, crusting and synechia and the recurrence of the disease were looked for in the follow-up period. The radiological features (CT/MRI) in each patient were evaluated to find out the possible site of the origin of the tumour and its extension into the adjacent structures (Figs. 1 and 2). The staging of the disease (Table 1), and surgical procedures, including the intraoperative and postoperative complications, were assessed in all the patients and later compared among the surgical approaches. The preoperative diagnosis was correlated with the final histopathological report (Fig. 3).

Surgical Procedure

All the patients underwent modified endoscopic endonasal surgery for the excision of the tumour. Conventional endoscopic sinus surgery was performed in cases where the tumour was found to involve the ethmoid /frontal sinus. Tumour involving the medial wall of the maxilla were subjected to the endoscopic medial maxillectomy. Similarly, tumour involving the floor, anterior lateral and inferior lateral wall were subjected to the modified endoscopic Denker

Fig. 4 **A.** Intraoperative photograph after endoscopic medial maxillectomy by modified endoscopic Denker. The black arrow shows the incised nasolacrimal duct. **B.** Intraoperative photograph of endoscopic pre-lacrimal crest approach. The white arrow shows the intact nasolacrimal duct and the black arrow indicates the preserved inferior turbinate



approach for exaction of the tumour. All the procedures were performed by a team of surgeons well trained in routine and advanced endoscopic procedures. All endoscopic endonasal procedures were performed under general anaesthesia. The polypoidal tissue in the anterior nasal space was excised by a microdebrider and a space was created for the instrumentation. Similar to the standard endoscopic sinus surgery, uncinectomy was performed as a preliminary step in each case. Antrostomy was performed and the polyps in the antrum and in the middle meatus were excised. A 70° rigid nasal endoscope was used to inspect the possible attachment of the tumour over the antral wall. An incision was made over the nasal mucosa at the junction between the floor and the lateral nasal wall till the periosteum. A second incision was made just anterior to the anterior attachment of the inferior turbinate overlying the bony pyriform aperture and the periosteal flap was elevated. The medial maxillary wall of the maxilla was drilled out from the floor of the nose inferiorly to the medial orbital floor superiorly and the anterior wall of the maxilla anteriorly to the posterior wall of the maxilla posteriorly. After the complete delineation of the tumour, it was excised with adequate drilling of its bony attachment. At the end of the procedure, the nasolacrimal duct was identified in each case which was later sharply cut to prevent stenosis in the postoperative period. The

modified endoscopic procedures have been demonstrated in Fig. 4. Tumours involving the anterior wall and the inferior wall have undergone the endoscopic Denker approach. Two parallel incisions are made along the floor and the lateral wall (anterior to the head of the inferior turbinate) through the periosteum and subperiosteal dissection is carried out to expose the edge of the pyriform sinus and the neurovascular bundle. Special attention was given to preserving the infraorbital nerve and the vessels. The surgical procedure in the pre-lacrimal approach is very much similar to the endoscopic Denker, where both superior and inferior incisions were made along the floor and the lateral wall, respectively. The mucoperiosteum is elevated along with the nasolacrimal duct (NLD). The anterior lateral wall of the maxillary sinus is drilled out to enter the maxillary sinus and the attachment of the tumour. After removal of the tumour, the normal sinus mucosa is removed and the underlying bone is removed. At the end of the surgery, the transposed nasal mucosa and NLD were repositioned, and the anterior portion of the transposed nasal mucosa was sewn to the lateral wall. Conventional ribbon gauze nasal packing was done after achieving adequate hemostasis in each procedure. Patients were discharged 48 h after the endoscopic medial maxillectomy after the removal of the nasal packs.

Table 2 Patient demographic data and clinical characteristics(n = 28)

Characteristics	Value/ No of patients, N(%)	Range
Male	21(75%)	
Female	07(25%)	
Mean age of patients (Year)	53.71 ± 10.08	36–76
Mean duration of the disease (months)	16.68 ± 10.66	4–50
Mean duration of follow-up (months)	14	8–34
Site		
Left	12(42.9%)	
right	16(57.1%)	
Stage	3(25)	
Bilateral	2(7.1%)	
Krouse staging:2	25(89.28%)	
Krouse staging:3	03(10.71%)	
Comorbidities		
DM	5(17.9%)	
HTN	4(14.3%)	

DM; Diabetes Mellitus, HTN; Hypertension

Follow-ups

Patients were advised for a routine check-up at the end of 1 month and three months after the primary surgery. Patients were followed every three months for the first year and thereafter once a year from the second year. At each follow-up visit, patients were subjected to diagnostic nasal endoscopy to look for any recurrence of the disease and the complication. CT scan was advised in patients where the endoscopic findings were suspicious of recurrent disease.

Results

A total of 28 patients diagnosed with sinonasal inverted papilloma who underwent surgical excision were retrospectively evaluated in a tertiary care hospital. Of 28 patients, 21(75%) were male and 07(25%) were females. The mean age of the patients at the diagnosis was 53.71 ± 10.08 years (range 36–76 years). The demographic data have been shown in Table 2. The mean follow-up period was 14 months (range 8–34 months). The most frequent presenting symptom was unilateral nasal obstruction observed in 14(50%) patients, epistaxis in 8(28.6%) patients, followed by rhinorrhoea in 6(21.4%) patients. Of 28 patients, 25(89.2%) were grouped as stage 3 disease and 3(10.7%) patients in stage 2 during the initial presentation to the department of otolaryngology. A total of 2(7.1%) cases were operated on for the disease recurrence, and the rest 26(92.9%) of cases were operated on for the primary diseases. The right nasal cavity was found to be involved in 16(57.1%) cases and left a nasal cavity in 12(42.9%) patients. The bilateral nasal cavity was found to be involved in 2(7.1%) cases.

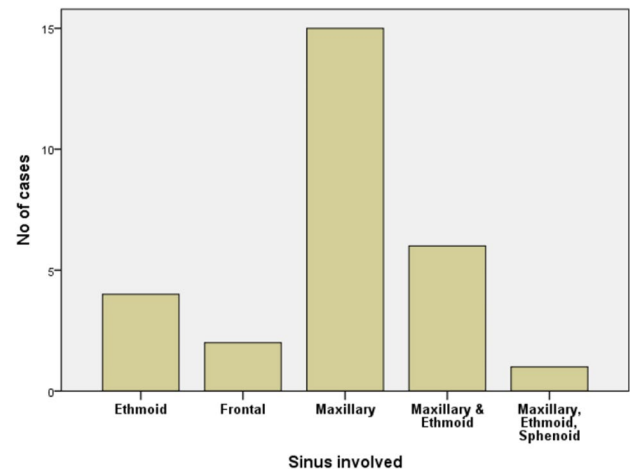


Fig. 5 Bar diagram showing the involvement of tumours in various paranasal sinuses

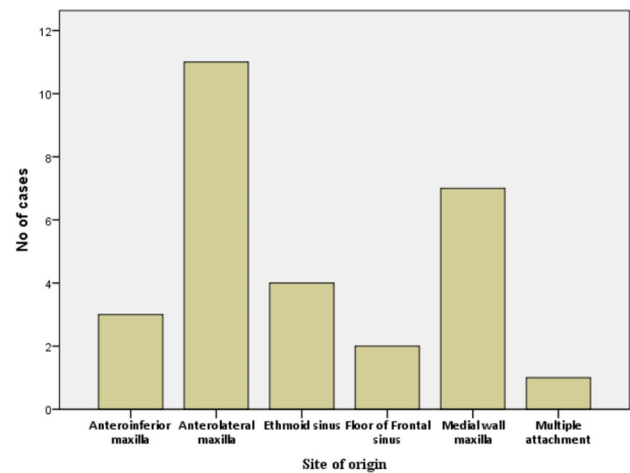


Fig. 6 Shows the site of origin of inverted papilloma in paranasal sinuses

The average duration of disease before coming to the hospital was 16.68 ± 10.66 (range 4–50 months). Of 28 patients, 5(17.9%) were diabetic and 4(14.3%) were hypertensive during their first presentation to the department. Isolated maxillary sinus was found to be involved in 15(53.6%) cases. Multifocal involvement (maxillary and ethmoid) was noticed in 12(42.85%) cases and one patient had involved the maxillary, ethmoid and sphenoid based on the radiological findings. The affection in various paranasal sinuses has been demonstrated in Fig. 5. Of a total of 28 patients, 3(10.7%) patients presented with stage 2 Krouse staging and 25(89.3%) patients with stage 3 disease. Based on the radiological finding (CT/MRI), the tumour originated from the anterolateral wall in 11(39.3%) cases, the medial wall in 7(25%) cases, and multiple attachments in one case (Fig. 6). Surgical excision was the standard treatment offered to each

Table 3 Comparison of perioperative complications with respect to various endoscopic approaches

Characteristics	MED (n=11)	EMM (n=8)	ESS(n=6)	PLC(n=3)	P value
Epiphora	1	2	0	0	0.421
Numbness over cheek	0	2	0	0	0.146
Epistaxis	1	0	0	0	0.659
Recurrence of the disease	1	0	0	0	0.659

MED; Modified Endoscopic Denker, EMM: Endoscopic Medial Maxillectomy, ESS: Endoscopic Sinus Surgery, PLC: Prelacrimal Crest approach

patient with inverted papilloma. Of 28 patients, 11(21.4%) patients were operated through modified endoscopic Denker(MED), 8(39.3%) patients had undergone endoscopic medial maxillectomy(EMM), 6(21.4%) patients had undergone endoscopic sinus surgery(ESS) and 3(10.71%) had operated through Prelacrimal Crest approach(PLC) for the complete excision of the tumour. Of the total 28 patients who underwent endoscopic excision, 3(10.7%) had epiphora, 2(7.15) patients had numbness over the face, and epistaxis and tumour recurrence was noted in one patient each (Table 3). Of 3 patients with epiphora, two patients of epiphora underwent endoscopic dacryocystorhinostomy (endo-DCR) in the postoperative period and one recovered with regular lacrimal syringing. The average blood loss in the endoscopic excision of the tumour was found to be 285.0 ± 78.81 ml (range 180-450ml). The final pathological report was coinciding in 27 cases, and one patient was associated with squamous cell carcinoma, where radical surgery was performed. When the clinical parameters like age, sex, laterality of the tumour, clinical staging, sinus affected, average blood loss during the surgery and postoperative follow-up, we did not get any significant difference among the four surgical approaches (p > 0.05). Similarly, when the postoperative complications were compared among endoscopic procedures, the results were found to be insignificant, as shown in Table 4. But when the results were compared

for the sinus involved and the site of origin, it was found significant(p = < 0.05). At the average follow-up period of 14.64 years, one patient presented with disease recurrence after surgical excision through medial maxillectomy.

Discussion

Surgical excision is considered the standard treatment offered to patients with sinonasal inverted papilloma. With the advancement of endoscopes in the past decade, there has been a paradigm change in the surgical approach for sinonasal inverted papilloma from open surgery to the endoscopic approach. Again, endoscopic nasal surgery ensures complete clearance of the disease and decreases the recurrence rate of the tumour [21–24]. Later could be due to the wide-angled visual field, which helps in identifying the site of attachment of the disease for complete excision. Various endoscopic approaches have been described in the literature depending upon the site of origin and extension of the tumour in different sinuses. Endoscopic excision of the tumour can ensure complete clearance of the disease with minimal post-operative complications and morbidities as compared to the open surgical approach [25–27]. Although the surgical approaches depend upon the stage of the tumour, there is no uniform staging system for sinonasal inverted papilloma [28–30], which often leads to variable treatment outcomes. In the present study, a total of 28 cases of inverted papilloma have been managed by various endoscopic approaches. There were no significant differences noted with respect to the demographic characteristics and the staging of the disease among the patients managed by different endoscopic procedures. As demonstrated in the present case, a total of 14 cases (ESS;6 cases, EMM;8 cases) have been operated through standard endoscopic procedures. Similarly, 11 patients had operated through the EMM approach and 3 cases have operated through PLC. Again, there has been the modification of the endoscopic approaches in relation

Table 4 Comparison of different clinical parameters among different surgical approaches

Characteristics	MED (n=11)	EMM (n=8)	ESS(n=6)	PLC(n=3)	P value
Age(years)	47.45 ± 14.25	57.50 ± 13.06	53.17 ± 18.07	48.67 ± 8.02	0.498
Sex (M:F)	7:4	7:1	4:2	3:0	0.449
Laterality (Rt:Lt)	6:5	6:2	4:2	2:1	0.462
Staging (stage 3:2)	11:0	8:0	3:3	3:0	0.013
Duration of disease(months)	19.00 ± 10.45	20.50 ± 14.99	10.88 ± 5.59	16.00 ± 10.66	0.310
Follow-up (Months)	16.82 ± 8.81	14.50 ± 4.66	11.67 ± 2.33	13.00 ± 4.35	0.450
Sinus involved (M:E:F:Multiple)	0:0:8:3	0:0:7:1	4:2:0:0	0:0:0:3	0.000
Site of origin (AI:AL:E:F:MW:Multiple)	0:11:0:0:0:0	0:0:0:0:7:1	0:0:4:2:0:0	3:0:0:0:0:0	0.000
Duration of surgery	147.27 ± 36.63	176.25 ± 23.26	159.17 ± 14.97	186.32 ± 14.97	0.090
Blood loss(ml)	295.45 ± 72.85	286.67 ± 95.84	291.25 ± 83.39	226.67 ± 64.29	0.620

MED; Modified Endoscopic Denker, EMM: Endoscopic Medial Maxillectomy, ESS: Endoscopic Sinus Surgery, PLC: Prelacrimal Crest approach, M: Maxillary sinus, E: Ethmoid sinus, F: Frontal sinus, AI: Anteroinferior wall of maxilla, AL: Anterolateral wall of maxilla, MW; Medial wall of maxilla

to the location and extension of the disease. Conventional endoscopic sinus surgery (ESS) is the standard procedure for stage I inverted papilloma, where the disease is limited to the nasal cavity/ethmoid/frontal/superior wall of the maxillary sinus. Although rare, stage I tumours involving isolated ethmoid sinus/nasal cavity can be successfully managed by standard endoscopic sinus surgery. In contrast, in the present case series, the utility of the surgery has been extended to a stage 2 tumour with limited extension to the ethmoid sinus and medial wall of the maxillary sinus. As shown in the present study, ESS was performed in 6 patients with stage 2 Krouse staging. There was no need for the medial maxillectomy or transposing/excision of the nasolacrimal duct and excision of the turbinates. There were no significant intraoperative/postoperative complications found in this procedure. Endoscopic medial maxillectomy is considered the standard surgical procedure often practiced in patients involving the medial wall of the maxillary sinus [31]. The medial wall of the maxillary sinus with the tumour along with the turbinates are usually excised under endoscopic visualization. In the present series, 8(28%) patients underwent medial maxillectomy because of their wide attachment to the medial/superior wall of the maxillary sinus. Although EMM can ensure complete removal of the tumour, it has its own disadvantages, especially the epiphora and the numbness over the cheek in the postoperative period. As demonstrated in the present study, epiphora and numbness over the cheek were detected in 2 patients each, one month after the surgery. In the recent past, various modifications in the standard endoscopic approaches have been practiced, especially for the complete removal of the disease, minimizing the postoperative complications. MED is a novel endoscopic technique to assess the tumour attached to the anterior/lateral wall without the need for a separate sub-labial incision. It was originally described by Denker and Sturmman/Canfield under endoscopic visualization.[32–34]. Besides adequate exposure to the disease, the anterosuperior alveolar and infraorbital nerves are also better visualized, facilitating the preservation of these neural structures. Although the postoperative complications can be reduced, the patient can have pain and swelling over the cheek, alar collapse and rarely epiphora [35]. In the present series, 11(39.92%) patients with inverted papilloma were successfully managed by the MED approach. Although epiphora was detected in one patient, the rest of the patients were free of complications during the postoperative period. Similarly, the PLC approach was utilized in selective cases of inverted papilloma involving the anteroinferior wall of the maxillary sinus. It was originally described by Tsuta et al. [36] to provide a wider surgical field for the maxillary sinus. The PLC approach has lesser complications than described in the previous literature [37–39]. As demonstrated in the present study, three patients

underwent the surgical excision of the tumour through PLC approaches and till the last follow-up period, none of the patients had any significant complications. These encouraging results could be due to the minimal injury to the nasal mucosa and preservation of the nasolacrimal duct during the surgery. Only one patient operated through the EMM approach had endoscopic and radiological reappearance of the disease 12 months after the primary surgery. There was no significant difference in complications among the different surgical approaches ($p > 0.05$), which could be due to the small sample size leading to asymmetric distribution of cases in different surgical groups. A large population with a long-term follow-up is needed to compare the efficacy of various endoscopic approaches in managing sinonasal inverted papilloma.

Limitations

The study has a relatively small sample size with a retrospective design. The majority of the patients were diagnosed with stage 2 and stage 3 Krouse 3 disease. The complication rate and quality of life were not evaluated by any subjective/objective tests. A large population with a long-term follow-up is needed to compare the efficacy of various endoscopic approaches in the management of sinonasal inverted papilloma.

Conclusion

With the advancement in endoscopic endonasal surgeries, there has been a change in the surgical approach from the traditional open surgeries to the more conservative endoscopic endonasal approach. Although open surgery/combined endoscopic procedures are practiced for complete clearance of the disease involving the anterolateral/inferior wall of the maxillary sinus with advanced disease, a modified endoscopic approach can be a valid alternative for these tumours with minimal postoperative complication. Due to the evolution of wide-angle endoscopes with a magnified visual field, the endoscopic endonasal approach can ensure complete clearance of the disease. Although a small sample size, the results of the endoscopic approach to sinonasal inverted papilloma were quite encouraging. A large population with a long-term follow-up may be required for a better understanding of the results.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s12070-022-03332-6>.

Declarations

Research Involving Human Participants All procedures performed in studies involving human participants were 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.

Disclosure of Potential Conflicts of Interest There are no conflicts of interest among the authors.

Informed Consent Written informed consent has been taken from each patient prior to the surgery and same has been informed to the institute reviewer board. No part of the body has been demonstrated in the case report without the permission of the patient.

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