Endoscopic Removal of Tumors of Nose and Paranasal Sinuses: Our Experience

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ABSTRACT

Background: The endonasal endoscopic surgery has stood the test of time in managing inflammatory as well as other diseases affecting nose and paranasal sinuses.

Objective: To report our experience with endonasal endoscopic surgery of benign tumors and tumor-like conditions of the nose and paranasal sinuses.

Methods: The medical records of 92 patients with tumors and tumor-like conditions, who had undergone endoscopic surgery for removal of their lesions between 1999 and 2010, were retrospectively studied.

Results: The study included a total of 92 patients. Out of these patients, there were 24 with inverted papilloma, six juvenile nasopharyngeal angiofibroma, 10 intranasal hemangioma, 10 fibro-osseous lesions, four olfactory neuroblastoma, two schwannoma and neurofibroma, one glioma, two plasmacytoma, two pleomorphic adenoma, 11 pyogenic granuloma, 14 mucoceles and four giant cell reparative granuloma. The patients had a follow-up ranging from 6 to 78 months (mean: 42). Follow-up assessment included endoscopy and yearly CT scans. Three cases of recurrent tumor—two inverted papilloma and one mucocele were noted. These were managed endoscopically. There were no major complication encountered in this study and minor complications were orbital fat protrusion 8, synechiae 6 cases.

Conclusion: Benign tumors and tumor-like conditions of the nose and paranasal sinuses can be managed with endonasal endoscopic surgery with minimal morbidity.

Keywords: Endoscopic tumor resection, Nasal tumors, Paranasal sinus tumors.

INTRODUCTION

Traditionally, the tumors of nose and paranasal sinuses are managed by open approaches. Over the past two decades with the invention of nasal endoscopes, powered instruments, better imaging modalities and intraoperative navigation aids, these are being treated by minimally invasive surgery or with minimal morbidity and reduced hospital stay. Initially, the surgeons were operating only small benign tumors, but with the results they achieved with nasal endoscopes, they are now taking up even advanced and bigger tumors along with malignant ones. Further the advancements in radiotherapy techniques have enabled us to take care of the tumor which is left near the vital structures during resections. In this article, we describe our experience of treating tumors and tumor-like conditions of the nose and paranasal sinuses including anterior skull base with endoscope.

PATIENTS AND METHODS

The case records of all patients treated at Department of ENT and Head and Neck Surgery at Government Medical College Hospital, Chandigarh, and had undergone endoscopic resection between 1999 and 2009, were retrospectively reviewed. Only those cases having a biopsy report suggesting tumor were included in the study. The collected data which included demographic profile, symptoms, signs, radiological investigations, procedure done, and follow-up of the patients were tabulated and analyzed.

Preoperative Work-up

Preoperative work-up of the patients included routine investigations and the work-up for preanesthetic fitness. Diagnostic endoscopy was done in all the patients except those where lesion was completely filling the nasal cavity. Biopsy was done where the diagnosis was doubtful except in patient with vascular lesions like angiofibroma and hemangioma. Computerized tomography (CT) scan was performed for all patients except very small lesions like hemangioma and pyogenic granuloma on the septum. Magnetic resonance imaging (MRI) was done for those patients where the lesion was suspected to be extending intracranially.
In preoperative counseling, the patient was told about nature of the disease, prognosis, the procedure and likely complications. Consent for open procedure was taken from all the patients. After induction of general anesthesia, the nasal cavity was packed with saline adrenaline packs (1:50,000). In case a medial maxillectomy or extended procedure was required, saline adrenaline infiltration was also done on the anterior face of maxilla and nasofacial groove.

All tumors were removed with good healthy margin and for the purpose of description, endoscopic medial maxillectomy is being described here, as inverted papilloma was the most common and important benign tumor encountered in our experience. A curvilinear incision was made on the lateral wall of the vestibule just at the anterior end of the inferior turbinate. The soft tissue was elevated with the periosteum elevator to expose the anterior end of bony pyriform aperture inferiorly and superiorly. The same incision was taken superiorly up to the attachment of middle turbinate to the lateral wall of nose. With small osteotome, the vertical osteotomy (red line) was done to separate the medial wall of maxilla. Another horizontal osteotomy (blue line) was made to separate the medial wall from the floor as shown in the Figures 1A and B.

In cases where the nasal cavity was filled with mass or polypi, it was decongested with saline adrenaline to define the landmarks. If the landmarks were not clear even after the decongestion, the tissue was debulked using powered shaver and gradually making space for the landmarks to appear. All attempts were made to define the origin of the tumor while using the powered shaver, so that good tumor free margin could be achieved. After the removal of inferior turbinate and frontal process of maxilla, the lacrimal bone was removed and the lacrimal sac was marsupialized at the end of procedure. Thereafter, the lamina papyracea was removed keeping the orbital periosteum intact up to place to give tumor margin depending upon the extent of tumor in the CT scan. Further the bony removal was as per the extent of the tumor in the CT scan. In a typical case of inverted papilloma arising from the lateral wall of nose, the final cavity was bounded by cribriform plate and fovea ethmoidalis superiorly, sphenoid ostium and posterior choana posteriorly, lamina papyracea posterolaterally, anterolateral wall of maxilla laterally, medially nasal septum and finally inferiorly nasal floor and floor of maxillary antrum.

The procedure for angiofibroma was different. Most of our cases were stage 1 and 2 (Andrews). In these cases, we made a large middle meatal antrostomy and removed the middle turbinate. The bony wall anterior to the pterygopalatine fossa was removed to expose the sphenopalatine artery which was coagulated using bipolar forceps. The tumor was then mobilized from lateral to medial side, freed from other sides as well and removed. In large tumors, we used endoscopic assisted removal. After lateral rhinotomy, the frontal process of maxilla was removed along with lacrimal bone and posterolateral wall of maxilla was removed to expose the pterygopalatine fossa, and after identifying the lateral most end of the tumor, it was mobilized medially and the feeding vessel was cauterized. Rest of the procedure was same. Complete hemostasis was achieved using bipolar cautery and Surgicel where needed. Finally the cavity was packed with Merocel. The pack was removed after 48 hours and nasal suction was done to remove clots or any debris. Thereafter the patient was called after two weeks for cleaning of the cavity. The routine follow-up for all the patient was by check endoscopy done every 6 weeks initially for 6 months thereafter every 3 months for one year and from second year onward every 6 months for 3 years. Follow-up CT scan was done 6 months after the operation and later every year or whenever there was a suspicion of recurrence.
RESULTS

Ninety-two patients (55 males and 37 females) with benign sinonasal tumors and tumor-like conditions were treated endoscopically from 1999 to 2009. Table 1 shows the detailed analysis of the patients in term of tumor type, extent, procedure done and follow-up. Three cases had recurrence after endoscopic resection, which included two inverted papilloma, one with mucocele. Recurrent tumors were again managed with endoscope. One patient of olfactory neuroblastoma having large intracranial extension was given chemotherapy and radiotherapy had a residual tumor at 6 months follow-up and is alive with disease.

We had 24 patients with inverted papilloma (Table 1). All patients were managed by endoscopic medial maxillectomy as the tumor was localized to medial wall of maxilla. In three cases, the mass was extending up to the posterolateral wall of maxilla. In these patients, the lesion was removed and the posterolateral wall was drilled with diamond burr. In one case, there was frank erosion of the posterolateral wall which was removed with a curved curette starting medially and gradually coming laterally till normal bone was found. Two patients had recurrence. These were the patients where the tumor was extending up to lateral wall of the maxillary antrum including the one with frank erosion. These were removed endoscopically and in addition CO₂ laser was used over the tumor bed in an attempt to destroy the cell remnants if any. No major complications were observed and the patients were found to be disease-free with a follow-up of 16 to 62 months (Figs 2A and B).

We had six patients with juvenile nasopharyngeal angiofibroma (Table 1). The criteria for taking the cases for endoscopic excision were limited extent in CT scan as well as sufficient space to work in the anterior nasal cavity. Those tumors filling the nasal cavity completely and mass protruding from the nostril were straight way operated by open approach. The patients with stage IIIA was managed by endoscope-assisted removal along with lateral rhinotomy. Rests of the cases were managed endoscopically. None of the patients underwent embolization preoperatively. Surgery was completed in all patients without complication. During the follow-up period which ranged from 14 to 48 months, no patient had recurrence (Figs 3 and 4).

Ten patients were found with fibro-osseous lesions (Table 1). Four patients were having osteoma, one osteosarcoma, two ossifying fibroma and three were fibrous dysplasia. Three patients were having osteoma localized to fronto-ethmoid area and were removed with the help of drill. In the fourth case, there was orbital extension which was partially removed endoscopically, as he wanted relief for nasal obstruction and did not give consent regarding orbital complications. Patient with osteosarcoma was having the lesion in ethmoid area (Fig. 5) and was biopsied first. On histopathological examination, it was found to be osteogenic sarcoma and was advised surgery. The patient refused surgery and opted for radiotherapy. He received 60 Gy of radiotherapy but the tumor did not regress and later he underwent endoscopic excision. The patient is disease-free at 24 months postoperatively (Fig. 5). Two patients of ossifying fibroma were removed endoscopically as per the extent in Table 1. Patients with fibrous dysplasia were having lesion on the anterior surface of maxilla. Through small sublabial incision, the lesions were shaved with guarded burr on the drill under endoscopic guidance.

Four patients were seen with olfactory neuroblastoma (Fig. 6). The symptoms were nasal obstruction, occasional bleeding and headache. The diagnosis was established with biopsy and three cases were managed with endoscope. The tumor was removed with shaver initially till the site of...
<table>
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<tr>
<th>Type of tumor</th>
<th>Tumor subtype</th>
<th>No.</th>
<th>Age(years)</th>
<th>Radiological extent</th>
<th>Classification</th>
<th>Procedure</th>
<th>Follow-up (months)</th>
<th>Recurrence</th>
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<td>9-22</td>
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<td>I = 4, II = 1 III = 1 (Andrews)</td>
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<td>12-29</td>
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<td>24-48</td>
<td>–</td>
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<td>14, 22</td>
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<td>54</td>
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<td>44-58</td>
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<td>24-46</td>
<td>MS = 4, AE = 4 PE = 4, SS = 2</td>
<td>–</td>
<td>Endoscopic = 4</td>
<td>6, 24</td>
<td>2</td>
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NC = Nasal cavity, IT = inferior turbinate; MT = middle turbinate; MS = maxillary sinus; AE = anterior ethmoid; PE = posterior ethmoid; NP = nasopharynx; NS = nasal septum; SS = sphenoid sinus; PMF = pterygomaxillary fossa; ND = nasofrontal duct; SB = skull base; IC = intracranial, IO = intraorbital
Fig. 3: CT scan (axial and coronal view) showing juvenile nasopharyngeal angiofibroma

Fig. 4: Postoperative (48 months) CT scan axial and coronal views of angiofibroma

Fig. 5: Preoperative (left) and 24 months postoperative CT scan of osteosarcoma
attachment was seen. The tumor attachment in the upper part of the septum in the olfactory groove was fulgated with CO2 laser. Fourth case had inoperable extensive tumor with intracranial extension. Here, only biopsy was taken and patient was subjected to chemoradiations. He had partial response and is alive with residual tumor. Rest of the cases are tumor free with a follow-up of 14 to 36 months. Figure 7 shows the endoscopic view of the cavity 36 months postoperative. Other neurogenic tumors like schwannoma, neurofibroma and glioma have also been treated with endoscopic excision without any recurrence with an average follow-up of 14 to 42 months.

Two patients were found to have plasmacytoma (Table 1 and Fig. 8). There was no systemic involvement in these cases, and hence were managed with endoscopic excision and postoperatively radiotherapy was given. One patient had epiphora where the endonasal endoscopic dacryorhinostomy was done. Both patients are recurrence-free with a follow-up of 11 and 24 months (Fig. 9).

Pyogenic granuloma was found in 24 patients and was situated on the nasal septum. Majority of the patients were females (10) and all of them presented with bleeding from the nose. The diagnosis was made on nasal endoscopy and all the lesions were removed endoscopically with good health margins. Average follow-up ranges from 14 to 48 months and no recurrence was noted.

Ten patients were having vascular lesions on the nasal septum. The presentation was recurrent bleeding from the nose and these were diagnosed on nasal endoscopy. The excision was done with endoscope by cauterizing the healthy perichondrium with the help of bipolar cautery after tumor was removed including the normal perichondrium. The raw area over the septum was left to heal itself. Histopathological examination revealed eight capillary and two cavernous hemangiomas. No recurrence was noted in any cases.

Two patients with diagnosis of pleomorphic adenoma presented with obstructive symptoms and diagnosis was established by nasal endoscopy and biopsy. Subsequently, the excision was done endoscopically. No recurrence seen after 18 and 24 months of follow-up.

Twelve patients were seen with mucoceles; the most common site was frontoethmoid region. All the patients were offered endoscopic marsupilization, which is a very quick procedure. The success of the operation depends upon the size of marsupilization. Wider the openings, better the success rate. The proptosis with which these patients usually present takes time to settle. We found one patient with recurrent mucocele which was again managed endoscopically.
Four patients with the diagnosis of giant cell reparative granuloma were a surprise finding. These patients presented with polypoid disease and were taken up for endoscopic removal. The anterior polypoid mass was removed with shaver but then we found granulomatous bleeding mass filling the sinuses. The masses were excised using endoscope and the biopsy revealed giant cell reparative granuloma. Two patients are recurrence-free whereas two were lost to follow-up.

**DISCUSSION**

Originally pioneered by Messenklinger and later popularized by Stammberger and Kennedy, endoscopic sinus surgery (ESS) has become the standard treatment for inflammatory diseases of the nose and paranasal sinuses.\(^4\) With the greater use of endoscopes, people realized the potential of the techniques to use ESS for the management of lesions beyond the limits of paranasal sinuses like lacrimal surgery, optic nerve decompression, pituitary surgery and repair of cerebrospinal fluid leaks. This has happened because of better understanding of anatomy, better visualization with straight and angled endoscopes, high definition cameras, better radiological techniques including intervention radiology and powered instruments. The navigation system has further helped the surgeon to work comfortably in areas surrounded by vital structures.

There are a number of studies highlighting the use of endoscopes for excision of tumors of nose, paranasal sinuses and skull base.\(^5\)\(^-\)\(^9\) The endoscopic excision of tumors of nose and paranasal sinuses has the distinct advantage of better visualization, ability to obtain a magnified view and low patient morbidity. Some authors have reported even better results with endoscopic technique when compared with open technique.\(^10\)
Waitz and Wigand in 1992 were the first to publish the results of endoscopic sinus surgery for inverted papilloma. The author reported 35 patients who underwent endoscopic excision and 16 were operated by external approach. They found a recurrence rate of 17% for endoscopic resection group and 19% for open approach group showing that the recurrence rates were comparable. Initially only limited tumors were removed endoscopically, but more and more authors are reporting endoscopic medial maxillectomy or extended medial maxillectomy for these lesions. We in our series had tumor in stage II and III and our recurrence rate is 8.3%. A comprehensive meta-analysis comparing open and endoscopic technique by Busquet and Hwang reported a recurrence rate of 12% for the endoscopic technique. The better results in our series may be because of less number of cases and limited extent of the tumors.

The surgical resection is the most accepted for treatment of angiofibroma in early cases and can provide cure with minimum morbidity. However, for more than a decade, there had been a controversy about the approach whether open or endoscopic. The surgical technique should take into consideration the growth of craniofacial skeleton. The endoscopic excision of juvenile angiofibroma is safe and effective for small and intermediate-sized juvenile nasopharyngeal angiofibroma. However, for slightly larger tumors, stage III endoscope-assisted excision can be attempted. This helps the surgeon to go closer to the tumor and dissect it carefully without causing much bleeding. In addition, the feeder vessel can be cauterized or ligated early in the dissection. For stage IV tumor, we did not use endoscopic excision. We had six cases of angiofibroma and five were resected with endoscope and sixth was resected with lateral rhinotomy and later assisted by endoscope. We did not have any recurrence after a follow up period of 18 to 36 months. This may be because of lesser number and in addition the all the tumors were localized (Andrews stage I and II) except one. Most authors till now offer endoscopic resection for tumors limited to nasal cavity and paranasal sinuses and medial most part of the pterygopalatine fossa. Andrade et al reported 12 patients with eight in stage I and four in stage II, according to Andrew’s classification. Without preoperative embolization, he approached these tumors endoscopically. There was no significant difference in mean operating time. The intraoperative blood loss was almost half in endoscopic approach and hospital stay was also shortened by one day. Similarly, Midilli et al reported 42 cases of angiofibroma and he used endoscopic approach in 12 patients. These parameters are important as regards the surgery for angiofibroma is concerned.

Based upon the findings in the literature, endonasal surgery is combined with a preoperative embolization of arterial supply. However, one has to be careful in patients with intracranial extension, as blindness is one of the complications of embolization. Intranasal drill is a useful tool for the treatment of bony lesions in nose and paranasal sinuses. Most of the osteomas are found as an incidental finding on plain X-rays. These asymptomatic osteomas should be operated or not, is the question. Few authors are of the opinion that these should be operated before they cause symptoms. Most of the symptomatic osteomas are localized in the region of the frontal recess. These can be excised with the help of endoscope. The tumor can be removed by gradually drilling the bony mass until soft tissues of the surrounding structures are reached. If the total removal is not possible, an attempt should be made to achieve adequate drainage for the frontal sinus and the tract should be lined with mucosal flap from septum or middle turbinare or else a median drainage procedure may be required. In our series, one patient presented with frontal headache, nasal obstruction and forward protrusion of the eye ball. We did partial removal of the osteoma and patient is symptom-free on 5 years follow-up.

We operated one patient with osteosarcoma by endoscopic approach. It was present in the ethmoid gallery and was removed by medial maxillectomy after chemoradiation. The patient is asymptomatic after 36 months follow-up. Hye-Rim Park et al reported a case of osteosarcoma of the ethmoid sinus which was involving the skull base area. The tumor was removed by craniofacial resection. The tumor recurred after two months and was again resected. They reported 4 months tumor free follow-up.

Fibrous dysplasia is said to be benign disease and presents with cosmetic problems. Most of the authors feel that the asymptomatic fibrous dysplasia can be managed expectantly and surgery is done for symptomatic patients including cosmetic problems. However, our cases were concerned about their appearance. These patients were having their lesions on the anterior surface of maxilla, and hence, we removed their lesions with sublabial incision and used drill to give them the normal shape. However, these need to be followed up with CT scan to monitor their growth. There are limited case reports of removal of fibrous dysplasia with endoscope, and hence, the exact indications and results and complications are not clear.

The transnasal endoscopic approach has been proposed as the technique of choice in cases of intranasal hemangiomas of the nasal cavity and paranasal sinuses. When these
neoplasms rarely arise in the nasal cavity, they are predominantly capillary and are found attached to the nasal septum. Cavernous hemangiomas, on the other hand, are more likely to be found on the lateral wall of the nasal cavity. Intranasal hemangioma, when small localizes to septum or turbinate can be easily excised with endoscope. The only important point in management of these cases is not to disturb the tumor. First try to coagulate the normal tissue around the tumor and then remove it. For larger hemangiomas, we will advise open approach rather than endoscopic removal. We have removed one capillary hemangioma from the maxillary sinus but it was a surprise diagnosis to us as the patient did not present with symptoms and signs of hemangioma. Excision may be performed via endoscopic approach, it should be noted that debulking of the tumor will cause profuse hemorrhage. Therefore, enbloc resection of the tumor with normal peripheral tissues is advised. This could, however, be rather difficult in large tumors.

There are limited reports on the use of endoscopy for nasal pyogenic granuloma in the literature, and most of them have a rather limited number of patients. These tumors are generally not as vascular as cavernous hemangiomas. These tumors also usually have a narrow stalk with few if any large feeding vessels, making endoscopic removal or removal with direct visualization relatively straightforward. Lack of recurrence and complication in 18 patients showed that endoscopic surgery is a valuable mean for this relatively unusual entity.

Denker A et al (1929) reported first case in the literature of a pleomorphic adenoma of the nasal cavity. Although the vast majority of minor mucous and serous glands are located in the lateral nasal wall, pleomorphic adenomas in the nasal cavity mostly originate from the nasal septum. Larger studies of intranasal pleomorphic adenoma include 40 cases reported by Compagno and Wong and 59 cases reported by Wakami et al. Several surgical approaches have been used to achieve wide local clearance and these include intranasal, transnasal endoscopic, external rhinoplasty, lateral rhinotomy and mid-facial degloving. Recently, there are reports of endoscopic removal of pleomorphic adenoma from the nose but these are only case reports and it is difficult to draw any conclusion from the case reports as regards the recurrence rates.

Mucoceles of the paranasal sinuses are a frequent cause of orbital problems in adults because they constitute slow-growth cystic lesions caused by an obstruction of the paranasal sinus, with ensuing entrapment of the mucous-secreting epithelium. The most frequently involved paranasal sinuses are the ethmoidal and frontal sinuses, and occasionally the maxillary sinus. An endoscopic approach is the choice for the management of mucoceles. The procedure is quick and with least morbidity. The key to successful outcome is to make a large opening to avoid closure and recurrence our results are comparable to the published one as we follow the same principle of wide marsupilization and good postoperative care.

The term giant cell reparative granuloma was coined by Jaffe to describe certain tumors of jaw bones. It was said to be hyperplastic reparative reaction to intraosseous hemorrhage induced by trauma. Most physicians are in agreement that surgical excision and debulking are the standard treatment, with radiation being reserved for inoperable or recurrent cases. Surgical excision is recommended over simple curettage because of the higher risk of recurrence without complete excision. The tumor can be removed by open approaches as well as endoscopic approach.

Extramedullary plasmacytoma is a rare plasma cell proliferative disorder with a predilection for the head and neck region. Extramedullary plasmacytoma accounts for less than 1% of all head and neck cancers. Occasionally, it presents as a solitary lesion in the nasal cavity. Extramedullary plasmacytoma tends to occur in the sixth and seventh decades of life, and it is three to four times more common in men than in women. The treatment of extramedullary plasmacytoma involves radiotherapy and/or surgery. Because extramedullary plasmacytoma is radiosensitive, radiotherapy is the treatment of choice. Surgery is the recommended mode of treatment for tumors that are well localized and can be excised completely. Our cases (Fig. 7) were stage I as per Wiltshaw’s classification. The mass could be excised with endoscope and both the patients received radiotherapy postoperatively. Both the patients are recurrence free after 11 and 28 months of follow-up (Fig. 8). There are only few reports of endoscopic excision of plasmacytoma and it will not be appropriate to comment on the outcome of endoscopic removal of these tumors. Between 17 and 31% of patients diagnosed with extramedullary plasmacytoma develop multiple myeloma. Five-year survival rates for extramedullary plasmacytoma ranges between 30 to 80%. Most death occurs due to disseminated disease.

CONCLUSION

It can be safely concluded from the present experience, although small series, that endoscopic surgery can be done for tumors and tumor-like conditions of nose and paranasal sinuses. This is our early experience of treating the tumors and tumor-like conditions of the nose and paranasal sinuses. These are encouraging results. Although, all the tumors
which we treated had limited extent, but to start with the new technique one should start with limited lesions only. As the experience grows the surgeon can take up larger tumors also. A word of caution is that consent for open operation should always be taken from the patient in case the endoscopic excision is not possible because of some unforeseen reasons. And also the surgeon should be experienced enough to do the open surgical procedures and able to handle the complications of endoscopic sinus surgery like CSF rhinorrhea, optic nerve injury and orbital hematoma.

REFERENCES

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