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Outcomes Of Surgical Treatment In Inverted Papilloma Of Nose And Paranasal Sinuses - A Retrospective Study

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Abstract:
Background: *Inverted papilloma is a rare benign tumor of the nasal cavity and paranasal sinuses arising from the Schneiderian membrane. It exhibits local aggressiveness, high recurrence rates, and potential for malignant transformation. The Krouse classification is commonly used to stage the disease. Surgical resection remains the primary treatment, therefore this study is done to evaluate the surgical outcomes and recurrence rates associated with two surgical approaches: endoscopic medial maxillectomy and lateral rhinotomy with medial maxillectomy.*
Methods: *A retrospective study was conducted among 40 inverted papilloma patients,surgically treated from June 2014 to May 2023 at a tertiary care hospital. Patients with incomplete medical records, partial resections, or associated malignancies and loss to follow-up were excluded. Tumors were staged using the Krouse staging system. Surgical approaches were categorized as endoscopic medial maxillectomy (EMM) and lateral rhinotomy with medial maxillectomy (LRMM). Data was analyzed using SPSS version 22.0 with chi-square/Fisher's exact tests and logistic regression. Kaplan–Meier analysis was used to assess time to recurrence.p value of <0.05 was considered statistically significant.*
Results: *The mean age was 49.4 ± 3.2 years with a male predominance (67.5%).Most patients presented with unilateral nasal mass and nasal obstruction and the mean symptom duration was 16.5 ± 3 months.55% underwent LRMM and 45% EMM, with more complications noted in the LRMM group.B Hospital stay was significantly (p < 0.001) longer in LRMM (6.2 days) compared to EMM (3.1 days).Recurrence occurred in 17.5% of patients, with no significant difference in recurrence- free survival between the two groups.*
Conclusions: *EMM is a safe and effective option for early-stage disease,since it is associated with fewer complications, shorter hospital stay, and no functional impairment compared to LRMM. Long-term follow-up is important to monitor recurrence. Both techniques showed similar recurrence rates and recurrence-free survival outcomes*
Keywords: *Nasal obstruction, Nose neoplasms, Inverted Papilloma, Paranasal sinuses*

1. INTRODUCTION

Inverted papilloma also known as Reingertz tumor is a rare benign epithelial tumor of the nasal cavity and paranasal sinuses that arises from the Schneiderian membrane of the ectoderm(1).Approximately it accounts to 0.5%-4% of the nasal tumors with an annual incidence of 0.6–1.5 cases per 100,000 per year (2).Males are more frequently affected than the females and it commonly occurs in the fifth to sixth decades of life(3) (4).

The occurrence of inverted papilloma in the nasal cavity and paranasal sinuses was first documented by Ward in the year 1854.However in 1935 Reingertz described the nature of the tumor and noted its characteristic inverted nature in underlying stroma. As per World health
organization 2005 classification, inverted papilloma is under Schneiderian papilloma category, alongside exophytic and oncocytic variants (5).

Inverted papilloma is characterized by its endophytic growth pattern and is notable for its locally aggressive nature, high recurrence rate and transformation to malignancy, more commonly to squamous cell carcinoma. Risk factors reported for recurrence following surgical intervention include advanced tumor stage and history of smoking(6). Etiology for inverted papilloma is not known, few studies have proposed its association with tobacco exposure, chronic inflammation and environmental exposure (7) (8).Many studies have suggested its strong association with human papillomavirus (HPV) infection particularly with low risk subtypes HPV 6 and 11(9) (10).Conversely Mohajeri et al. did not support the

role of
the human papillomavirus (HPV) as an etiological factor for IP occurrence(11).
Currently there is no universally accepted stating system for Inverted Papilloma. Amongst the proposed staging systems the Krouse classification has been widely used due to its ease of implementation and reproducibility which focuses on the extent of the tumour(12).
Surgical resection still remains the cornerstone of treatment. Endoscopic medial maxillectomy (EMM) is a minimally invasive procedure, offering advantages such as reduced morbidity, enhanced visualization, and preservation of nasal and facial structures. Conversely, lateral rhinotomy with medial maxillectomy (LRMM) offers better access thus reserved for large or extensively invasive tumors, at the cost of increased postoperative morbidity and cosmetic disfigurement (13) (14).
Long-term surveillance with regular endoscopic and radiologic follow-up is important to detect recurrence early and to guide timely intervention (14). While current evidence favors EMM for its superior safety and recovery profile, the selection of the surgical approach should be
individualized. Thus, this study is done to evaluate the surgical outcomes and recurrence rates in patients undergoing surgery for inverted papilloma of the nose and paranasal sinuses using two surgical approaches: endoscopic medial maxillectomy and lateral rhinotomy with medial maxillectomy.

MATERIALS AND METHODS

A retrospective study was conducted on patients diagnosed with Inverted Papilloma of nose and paranasal sinuses who underwent surgical treatment over a period of 10 years from June 2014 to May 2023 in the Department of Otorhinolaryngology and Head & Neck in R L Jalappa Hospital. A total of 40 patients diagnosed with histopathologically confirmed inverted papilloma were included in the study.
Patients were excluded if they had incomplete medical records or were lost to follow-up. Those who underwent only partial tumor resection or had a prior history of sinonasal malignancy or concurrent carcinoma were excluded.
Institutional ethics committee clearance was obtained prior to the study. Demographic, clinical, radiological and surgical data were collected retrospectively.Radiological parameters like location of tumor, presence of bone erosion, involvement of orbit and nasopharyngeal extension. Intraoperative findings like extent of tumor invasion and completeness of resection. Postoperative complications like incidence of bleeding, facial swelling, nasal crusting, orbital edema, and diplopia. Functional outcomes like assessment of nasal obstruction, swallowing difficulties and speech impairment. Surgical approaches were divided into two groups: endoscopic medial maxillectomy (EMM) and lateral rhinotomy with medial maxillectomy (LRMM). Tumours were classified according to Krouse staging system:
T1: Confined to nasal cavity.
2: Involves medial wall of maxillary sinus, ethmoid sinuses, or osteomeatal complex. T3 → Involves any other part of the maxillary sinus aside from the medial wall (superior, inferior, anterior, posterior, lateral), or involving frontal or sphenoid sinus.
T4 → Tumour which extends beyond paranasal sinuses or malignant neoplasm.
Tumor recurrence at follow-up visits and its association with the surgical techniques used was analyzed. Data was entered in Microsoft excel version 16 and statistical analysis was performed using SPSS version 22.0. Descriptive statistics was done and independent t test is done to evaluate statistical significance between mean duration of hospital stay in two groups. Kaplan meir survival curve for analysis of time of recurrence.The confidence intervals was set at a 95% level and $p<0.05$ were considered statistically significant.

RESULTS

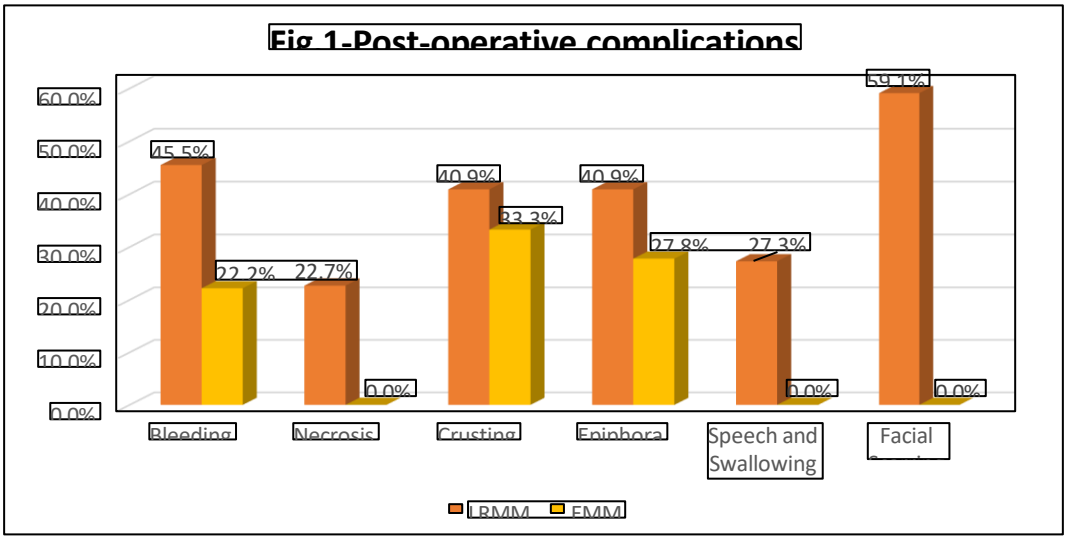
The mean age of the participants was 49.4$\pm$3.2 years ranging from 32 to 69 years, with the
majority being the males (67.5%, n=27) compared to females (32.5%, n=13). Most of the patients presented with unilateral nasal mass (90%, n=36) followed by nasal obstruction (85%), post-nasal discharge (25%), hyposmia (22.5%), rhinorrhea (20%), bilateral nasal mass (10%) and nasal bleeding (7.5%). The mean duration of symptoms was 16.5$\pm$3 months.
Pre-operative radiological findings revealed large mucosal polypoidal growth in the maxillary sinus, among the 40 patients, 90%(n=36) had tumor extension into ethmoid sinus and 82.5%(n=33) into the frontal sinus, while 17.5%(n=7) showed extension into the nasopharynx. Involvement of skull base in 10%(n=4) of the patients. Majority of the tumors were found in left side (57.5%,n=23) followed by right side(32.5%,n=13) and 10%(n=4) bilateral nasal mass.

Deviated nasal septum was found in 12.5%(n=5) of the patients. The tumors were classified

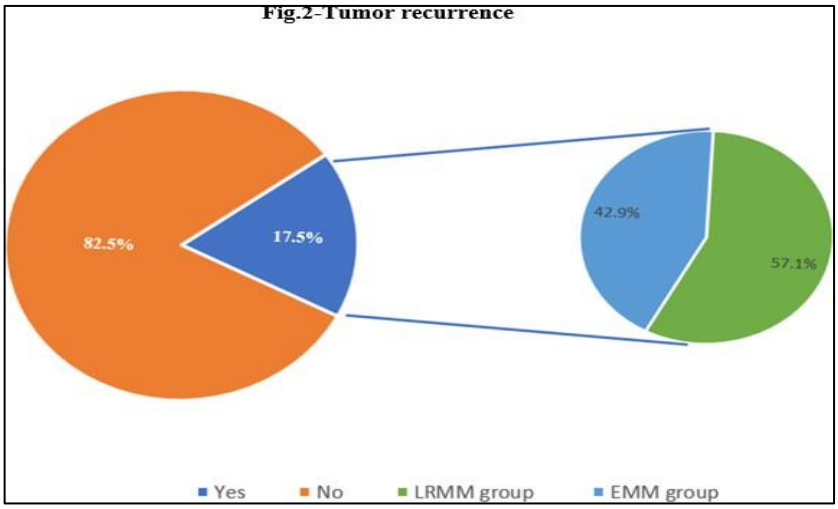
based on the Krouse staging system, about 20%(n=8) of the patients were staged as T1,35%(n=14) patients as T2, 30% (n=12) patients as T3 and 15% (n=6) as T4.
Table 1-Krouse staging system

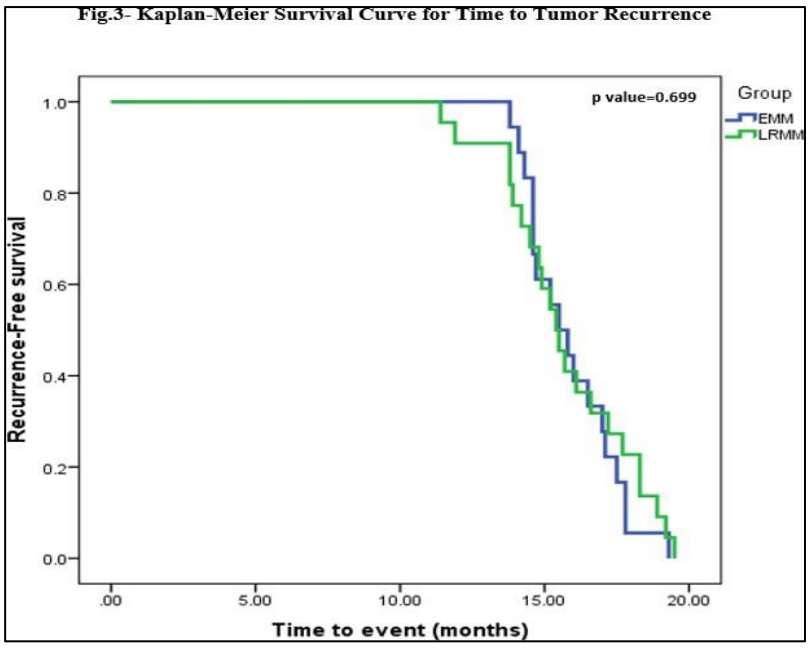
Krouse staging system	**Lateral rhinotomy with medial maxillectomy (LRMM) (n=22)**	**Endoscopic medial maxillectomy (EMM) (n=18)**
T1	-	8(44.4%)
T2	4(18.2%)	10(55.6%)
T3	12(54.5%)	-
T3	6(27.3%)	-

Out of the 40 patients,55% (n=22) underwent Lateral rhinotomy with medial maxillectomy (LRMM) and 45% (n=18) of the patients underwent endoscopic medial maxillectomy (EMM). Intraoperatively 22.2% (n=4) of the patients had extension till skull base in the endoscopic medial maxillectomy group and 36.4% (n=8) of the patients had tumor extended till nasopharynx in the Lateral rhinotomy with medial maxillectomy.



As shown in Fig.1 post-operative complications were more common in the LRMM group compared to the EMM group.Notably, facial scarring (59.1%) ,bleeding (45.5%) and epiphora (40.9%) were significantly higher in LRMM. Complications like necrosis and speech/swallowing difficulties occurred exclusively in LRMM group. EMM group demonstrated a comparatively safer postoperative profile with fewer or no major complications. There were no instances of CSF leak or significant blood loss requiring blood transfusion.The mean duration of hospital stay was longer in LRMM group (6.2±2.1 days) compared to EMM group (3.1±1.2 days) and difference was statistically significant ($t=5.85, p<0.001$).
The Mean duration of follow-up was 16±2 months. Functional impairment was observed
in about 31.8% of the patients in LRMM group and no evidence of functional impairment in EMM group.Overall 17.5% had recurrence of tumor , with 4 patients in the LRMM group and 3 patients in EMM group as shown in Fig.2. The Kaplan-Meier survival analysis (Fig.3) showed
no statistically significant difference in recurrence-free survival between the LRMM and EMM groups.Both groups exhibited similar survival curves, with most recurrences occurring between 12 and 18 months.





DISCUSSION

The current study found a mean age of 49.4 ± 3.2 years which is consistent with existing literature(15).In a study done by Coutinho et al mean age was reported as 60 years, which is higher than that observed in our study, Most of the studies highlighted the higher incidence of inverted papilloma among males which is in line with our study (3)(15)(16).

Majority of the patients presented with unilateral nasal mass and nasal obstruction which is in line with the typical clinical presentation of inverted papilloma. The average duration of

ymptoms was found to be 16.5+3 months which further supports the slow onset and progression of the disease (16)

Radiologically, maxillary sinus was the most commonly involved site, with extension into ethmoid (90%) and frontal sinus (82.5%), which is similar to a study done by Coutinho et al(16). Tumor involvement of the skull base (10%) and nasopharynx (17.5%) highlights the locally aggressive nature of inverted papilloma. The left sided predominance (57.5%) observed in this study is also in line with earlier findings, though the clinical relevance of laterality remains unclear(3).

Based on Krouse staging system, most patients were classified as T2 and T3.The open approach (LRMM) was done for advanced stage tumors (T3 and T4) while early stage tumors were treated endoscopically (EMM). This staging guides the choice of surgical modality.

Intraoperatively, it was found that the EMM group had skull base involvement more commonly (22.2%) than the LRMM group (36.4%). The LRMM group had more post-op complications, such as facial scarring, hemorrhage, and epiphora. These results indicate the invasive nature of the traditional method, while EMM is relatively safer with very complications, these findings are in line with a study(3).

The duration of hospital stay was significantly longer in patients undergoing LRMM 6.2 ± 2.1 days

compared to EMM 3.1 ± 1.2 days, similar to previous studies in which patients undergoing endoscopic surgery had a faster recovery and shorter hospitalization (3) (16).
Functional impairment was reported only in the LRMM group (31.8%) denoting the disruptive nature of the procedure. Despite these differences the recurrence rate was comparable between
groups (17.5% overall), with 4 cases in LRMM and 3 in EMM.The recurrence rate was higher in this study compared to the literature(3). Kaplan-Meier survival analysis showed that there was no statistically significance in recurrence-free survival ($p = 0.699$) suggesting that both approaches are similarly effective in disease control when appropriately selected based on tumor extent which is in parallel with the literature(16).
Overall, the study suggests the role of endoscopic surgery as a less morbid yet equally effective option for managing inverted papilloma, particularly in early-stage disease. Open approaches remain necessary in advanced cases but are associated with increased complications and longer recovery.

CONCLUSION

Endoscopic medial maxillectomy (EMM) demonstrated less complications, shorter hospital stay, and no functional impairment compared to lateral rhinotomy with medial maxillectomy (LRMM).Both approaches showed comparable recurrence rates and recurrence-free survival.
Facial scarring and other postoperative morbidities were higher in the LRMM group. EMM is effective and preferable in early-stage disease when anatomically feasible. Long-term follow-up remains essential to detect and manage recurrences.

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