



Comparative Evaluation of Endoscopic and Open Surgical Approaches in the Management of Sinonasal Inverted Papilloma: A Prospective Comparative Study

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Abstract

Background: Sinonasal inverted papilloma (IP) is a benign epithelial tumour characterized by local aggressiveness, a high propensity for recurrence, and a risk of malignant transformation. Complete surgical excision remains the cornerstone of treatment. Advances in endoscopic techniques have increasingly challenged conventional open surgical approaches because of improved visualization and reduced morbidity.

Objective: To compare the efficacy and safety of endoscopic and open surgical approaches in the management of sinonasal inverted papilloma.

Methods: A prospective comparative study was conducted in the Department of Otorhinolaryngology at Vydehi Institute of Medical Sciences and Research Centre, Bengaluru. Thirty patients with radiologically and histopathologically confirmed sinonasal inverted papilloma were allocated to undergo either endoscopic surgery or open surgery. Outcome measures included operative complications, postoperative morbidity, and tumour recurrence. Statistical analysis was performed using appropriate parametric and non-parametric tests, with statistical significance defined as $p < 0.05$.

Conclusion: Endoscopic surgery offers a minimally invasive approach for the management of sinonasal inverted papilloma. Comparative evaluation with conventional open surgery may help define the optimal surgical approach according to tumour characteristics and patient outcomes.

Keywords: Sinonasal inverted papilloma; Endoscopic surgery; Open surgery; Medial maxillectomy; Lateral rhinotomy; Recurrence..

INTRODUCTION

Sinonasal inverted papilloma (IP) is an uncommon benign epithelial neoplasm arising from the Schneiderian mucosa of the nasal cavity and paranasal sinuses. Although histologically benign, it demonstrates aggressive local behaviour, a marked tendency for recurrence, and an established association with synchronous or metachronous squamous cell carcinoma. Inverted papilloma accounts for approximately 0.5–4% of all primary nasal tumours and predominantly affects males during the fifth and sixth decades of life.

Patients commonly present with unilateral nasal obstruction, nasal discharge, epistaxis, facial pressure, hyposmia, or recurrent sinusitis. Computed tomography (CT) and magnetic resonance imaging (MRI) play complementary roles in defining tumour extent, identifying hyperostosis that indicates the attachment site, and facilitating surgical planning.

Complete excision of the tumour along with its site of attachment is the primary objective of treatment. Historically, external procedures such as lateral rhinotomy and medial maxillectomy were considered the gold standard because they provided excellent surgical exposure. However, improvements in endoscopic instrumentation, image guidance, and surgical expertise have enabled endoscopic surgery to become the preferred treatment for most cases.

Multiple studies have demonstrated that endoscopic surgery provides comparable or lower recurrence rates while reducing operative morbidity, postoperative discomfort, hospital stay, and cosmetic deformity. Nevertheless, open surgery continues to play an important role in selected patients with extensive disease, involvement of inaccessible anatomical sites, or malignant transformation.

Despite increasing adoption of endoscopic techniques, evidence comparing outcomes between endoscopic and open surgery remains limited in many centres. Therefore, the present prospective comparative study was undertaken to evaluate operative complications, postoperative outcomes, and recurrence following endoscopic and open surgical management of sinonasal inverted papilloma.

AIM

To compare the efficacy of endoscopic and open surgical approaches in the management of sinonasal inverted papilloma.

OBJECTIVES

To compare intraoperative complications between endoscopic and open surgery.

To compare postoperative complications following both surgical approaches.

To compare tumour recurrence following surgery.

To evaluate overall surgical outcomes between the two treatment modalities.

MATERIALS AND METHODS

This prospective comparative study was conducted in the Department of Otorhinolaryngology, Vydehi Institute of Medical Sciences and Research Centre, Bengaluru, after approval from the Institutional Ethics Committee. Patients aged 18–65 years with radiologically and histopathologically confirmed sinonasal inverted papilloma were enrolled after obtaining informed written consent.

MATERIALS AND METHODS

Study Design: Randomised controlled trial

Study Area: ENT outpatient department, Vydehi Institute of Medical Sciences and Research Centre, Bengaluru

Study Duration: from January 2024 to January 2026 (two years)

Study Population: study was conducted among patients with histopathologically confirmed and radiologically supported inverted papilloma, admitted in ENT inpatient department, vydehi Institute of Medical Sciences and Research Centre, Bengaluru after getting informed consent for the surgery under general anesthesia and briefly explaining the patient in the language he/she understands

Randomization- stratified block randomisation

Inclusion Criteria:

- Patients above 18 -65 years of age, of both male and female sex.
- Cases of definite INVERTED PAPILLOMA according to krouses staging guidelines
- Inverted Papilloma confirmed by hist CT or MRI and confirmed with histopathological examination

Exclusion criteria-

- Evidence of malignancy on histology or radiology
- Patients who have undergone nasal surgery before for the same diagnosis
- Patients with contraindications to undergo surgery like bleeding diathesis, uncontrolled hypertension and blood glucose levels

Methodology

Patients presenting with complaints such as nasal obstruction, epistaxis, and related symptoms were evaluated clinically after detailed history taking and thorough ENT examination.

All suspected cases of inverted papilloma were subjected to diagnostic nasal endoscopy and radiological investigations, including CT scan and/or MRI of the nose and paranasal sinuses, for confirmation of diagnosis and staging. Histopathological examination was done to confirm the diagnosis.

Patients fulfilling the inclusion criteria were counselled regarding the nature of the disease and the surgical procedures. Informed written consent was obtained from all patients prior to the study. And After obtaining approval from the Institutional Ethics Committee of Vydehi Institute of Medical Sciences and Research Centre.

Patients were divided into two groups:

Group A: Patients undergoing endoscopic surgery

Group B: Patients undergoing open surgical procedures (lateral rhinotomy, Denker's approach, or midfacial degloving)

Patients were followed up postoperatively and evaluated for outcomes including recurrence and complications such as CSF leak, epiphora, infection, external disfigurement, and intraoperative blood loss.

Strengths of the paper

Prospective comparative design

Equal sample size in both groups

Histopathological confirmation in all cases

Clinically relevant comparison of two commonly performed surgical approaches

Clear outcome measures (complications and recurrence)

OBSERVATIONS AND RESULTS

Group A – Endoscopic surgery under general anaesthesia

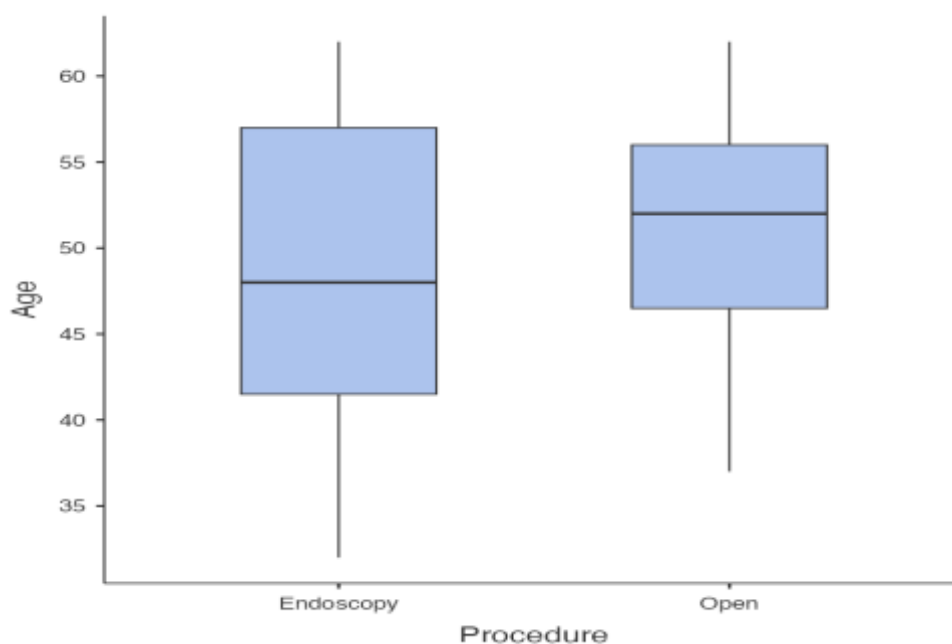
Group B- open surgeries -Medial maxillectomy or lateral rhinotomy under general anaesthesia

Table 01: Comparison between Age in Group A VS Group B

	Group	N	Mean	Median	SD	p value
Age	Endoscopy	15	48.1	48.0	9.78	0.444
	Open	15	50.6	52.0	7.47	

$$\chi^2 = 0.00 \quad p = 0.999$$

The table compares the age distribution between the endoscopy and open procedure groups. The mean age in the endoscopy group was 48.1 ± 9.78 years, with a median of 48.0 years, while the open surgery group had a slightly higher mean age of 50.6 ± 7.47 years and a median of 52.0 years. Although patients in the open group appear marginally older, statistical analysis using an independent t-test yields a $p = 0.444$, indicating that this difference is statistically not significant. This suggests that the two groups are comparable in terms of age distribution.



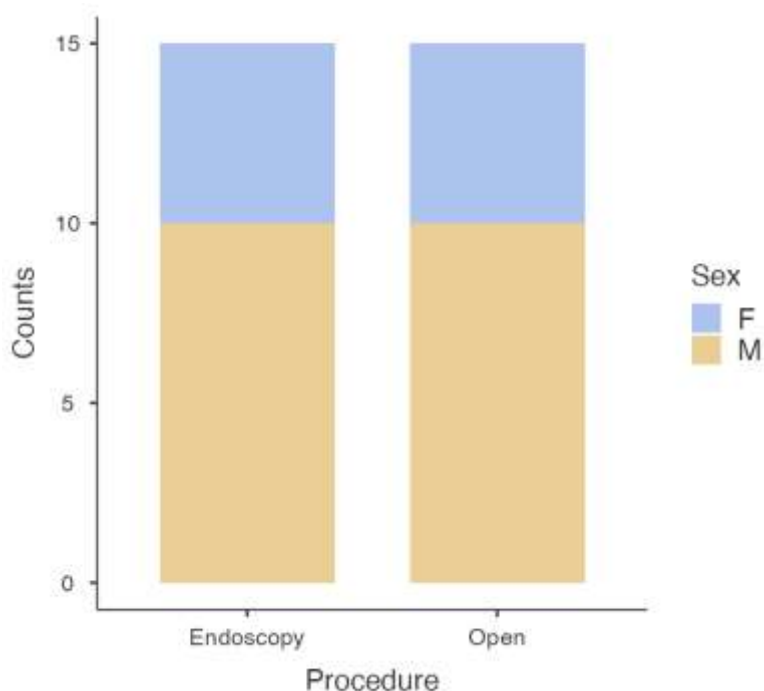
Graph 1: Bar Graph showing age distribution among Group A and Group B

Table 02: Comparison between Sex in Group A VS Group B

Sex	Endoscopy		Open		Total	
	Count	%	Count	%	Count	%
F	5	33.3	5	33.3	10	33.3
M	10	66.7	10	66.7	20	66.7
Total	15	100	15	100	30	100

$p < 0.001$ $\chi^2 = 30.0$

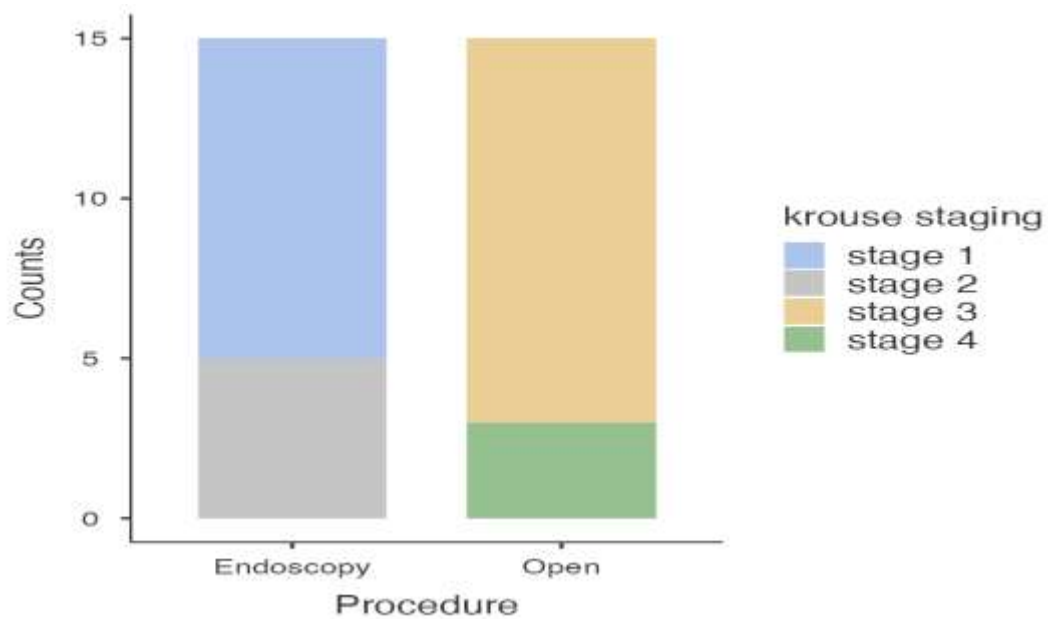
The table shows the distribution of sex between the endoscopy and open procedure groups. Both groups have identical distributions, with 5 females (33%) and 10 males (67%) in each group. This indicates that the groups are perfectly matched in terms of sex. Statistical analysis (Chi-square) yields a $p = 0.999$, demonstrating no significant difference in sex distribution between the two groups. This suggests that sex is unlikely to act as a confounding factor in comparing outcomes between the procedures.

**Graph 2: Bar Graph showing sex distribution among Group A and Group B****Table 03: comparison of approaches according to krouse staging**

krouse staging	Endoscopy		Open		Total	
	Count	%	Count	%	Count	%
stage 1	10	66.7	0	0.0	10	33.3
stage 2	5	33.3	0	0.0	5	16.7
stage 3	0	0.0	12	80.0	12	40.0
stage 4	0	0.0	3	20.0	3	10.0
Total	15	100	15	100	30	100

$\chi^2 = 30.0$ $p < 0.001$

The table shows the distribution of Krouse staging between endoscopy and open procedure groups. All patients in the endoscopy group were in early stages, with 10 (67%) in stage 1 and 5 (33%) in stage 2, while none were in advanced stages. In contrast, all patients in the open surgery group were in advanced stages, with 12 (80%) in stage 3 and 3 (20%) in stage 4, and none in stages 1 or 2. This demonstrates a clear separation in disease severity between the two groups. Statistical analysis (Chi-square test) yields a $p < 0.001$, indicating a highly significant difference in Krouse staging between endoscopy and open procedures. This suggests that the choice of procedure is strongly associated with disease stage, with endoscopy used for early-stage disease and open surgery for more advanced cases.



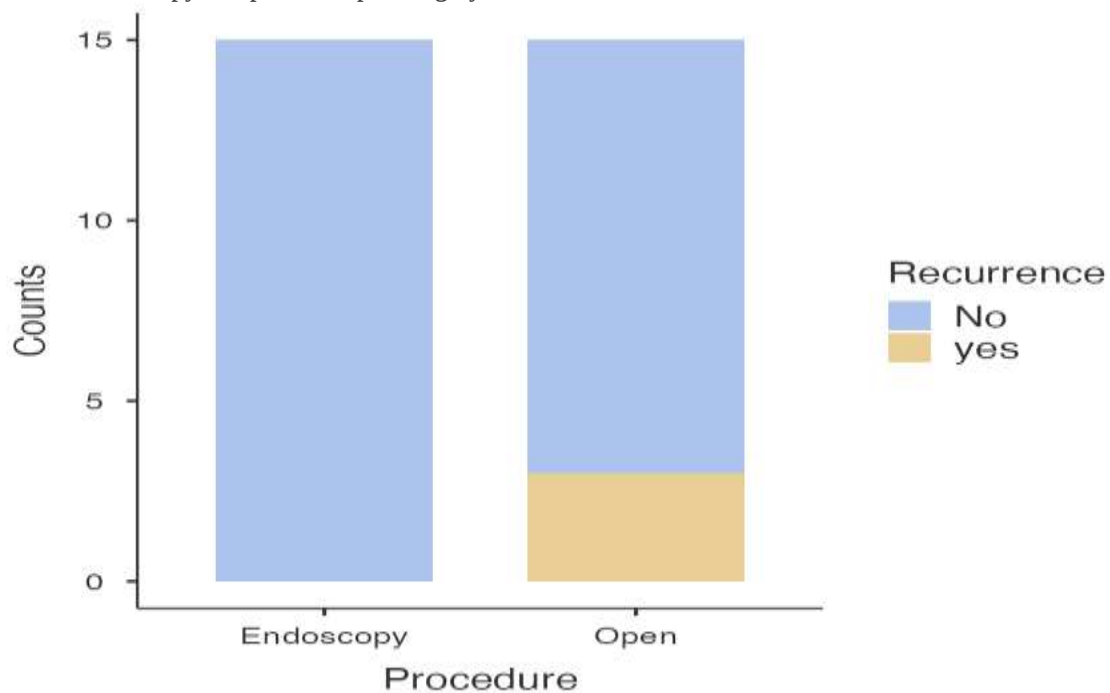
Graph 3: Bar Graph showing Comparison of staging in Group A VS Group B

Table 04: Comparison of recurrence in Group A VS Group B

Recurrence	Endoscopy		Open		Total	
	Count	%	Count	%	Count	%
No	13	86.6	12	80.0	27	90.0
yes	2	13.3	3	20.0	3	10.0
Total	15	100	15	100	30	100

$$p = 0.224 \quad \chi^2 = 3.33$$

The table compares recurrence rates between endoscopy and open procedures. 2 out of 15 patients in the endoscopy group (13.3%) experienced recurrence, whereas 3 out of 15 patients (20%) in the open surgery group had recurrence. The majority of patients in both groups remained recurrence-free. Statistical analysis using Fisher's exact test gives a $p = 0.224$, indicating that this difference is statistically not significant. However, the findings suggest a trend toward lower recurrence with endoscopy compared to open surgery.



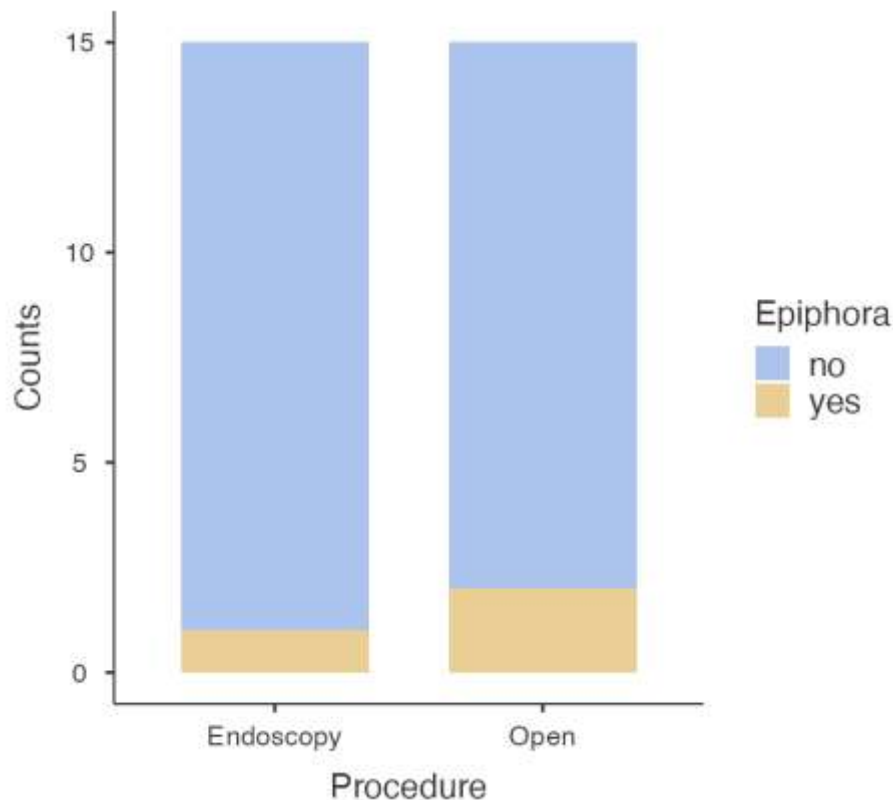
Graph 4: Bar Graph showing Comparison of recurrence in Group A VS Group B

Table 05: Comparison of Epiphora in Group A VS Group B

Epiphora	Endoscopy		Open		Total	
	Count	%	Count	%	Count	%
no	14	93.3	13	86.7	27	90.0
yes	1	6.7	2	13.3	3	10.0
Total	15	100	15	100	30	100

$$p = 0.543 \quad \chi^2 = 2.14$$

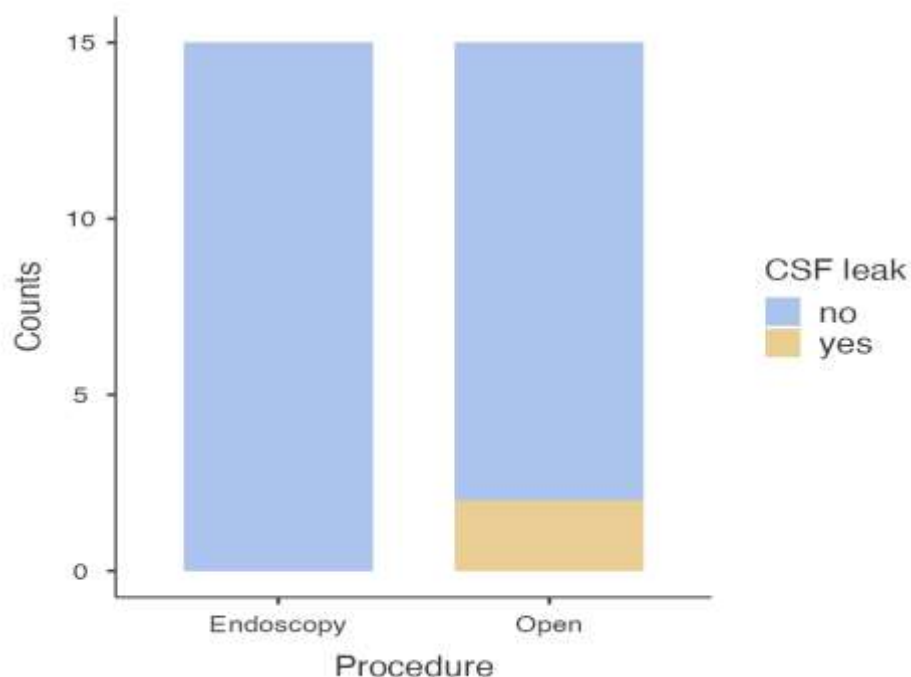
The table compares the occurrence of epiphora between endoscopy and open procedures. Most patients in both groups did not experience epiphora, with 14 out of 15 (93%) in the endoscopy group and 13 out of 15 (87%) in the open group reporting no symptoms. Epiphora was observed in a small number of cases, occurring in 1 patient (7%) in the endoscopy group and 2 patients (13%) in the open group. Overall, epiphora appears to be an uncommon complication in both procedures, with a slightly lower frequency in the endoscopy group, suggesting a marginal advantage in terms of this outcome.

**Graph 5: Bar Graph showing Comparison of Epiphora in Group A VS Group B****Table 06: Comparison of CSF leak Group A VS Group B**

CSF leak	Endoscopy		Open		Total	
	Count	%	Count	%	Count	%
no	15	100	13	86.7	28	90.3
yes			2	13.3	2	6.7
Total	15	100	15	100	30	100

$$p = 0.143 \quad \chi^2 = 0.143$$

The table shows the occurrence of cerebrospinal fluid (CSF) leak in patients undergoing endoscopy versus open procedures. None of the patients in the endoscopy group (0 out of 15) experienced a CSF leak, whereas 2 out of 15 patients (13%) in the open surgery group did. The majority of patients in both groups did not have this complication, but CSF leaks were observed only in the open procedure group. This suggests that endoscopy may be associated with a lower risk of CSF leak compared to open surgery, although the overall number of events is small.



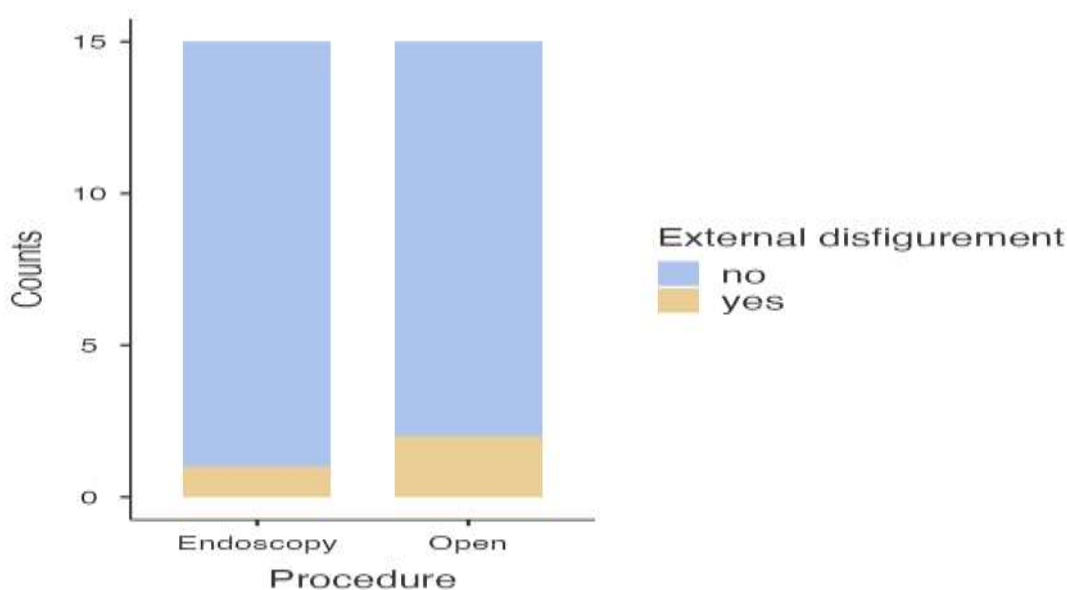
Graph 6: Bar Graph showing Comparison of CSF leak Group A VS Group B

Table 07: Comparison of external disfigurement in Group A VS Group B

External disfigurement	Endoscopy		Open		Total	
	Count	%	Count	%	Count	%
no	15	100	13	86.7	27	90.0
yes	0		2	13.3	3	10.0
Total	15	100	15	100	30	100

$$p = 0.143 \chi^2 = 0.543$$

The table compares the occurrence of external disfigurement between endoscopy and open procedures. Most patients in both groups did not experience disfigurement, 13 out of 15 (87%) in the open group showing no disfigurement. whereas 2 out of 15 patients (13%) in the open surgery group did. The majority of patients in both groups did not have this complication, but CSF leaks were observed only in the open procedure group. This suggests that endoscopy may be associated with a lower risk of external disfigurement compared to open surgery, suggesting comparable cosmetic outcomes is an advantage for endoscopic surgery



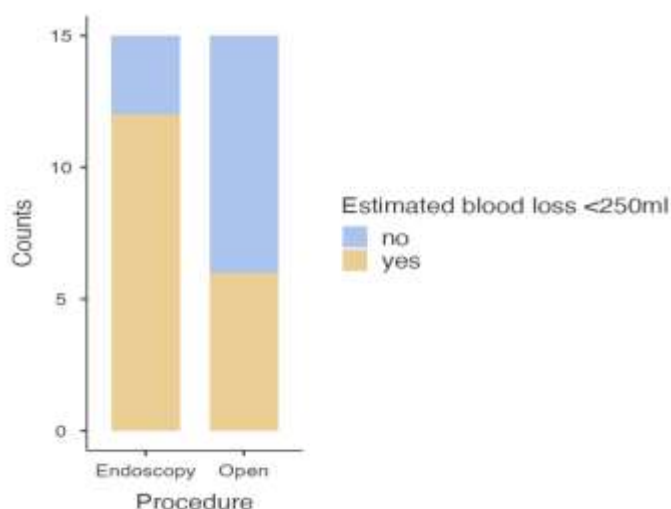
Graph 7: Bar Graph showing Comparison of external disfigurement in Group A VS Group B

Table 08: Comparison between estimated blood loss in in Group A VS Group B

Estimated blood loss <250ml	Endoscopy		Open		Total	
	Count	%	Count	%	Count	%
no	3	20.0	9	60.0	12	40.0
yes	12	80.0	6	40.0	18	60.0
Total	15	100	15	100	30	100

$$p = 0.025 \quad \chi^2 = 5.0$$

The table shows significant relationship between procedure type and blood loss. Among patients undergoing endoscopy, 80% (12 out of 15) had estimated blood loss less than 250 ml, compared to only 40% (6 out of 15) in the open surgery group. Conversely, higher blood loss (≥ 250 ml) was more common in open procedures. This difference is statistically significant ($p = 0.025$), suggesting that endoscopy is associated with significantly lower blood loss than open surgery.

**Graph 8: Bar Graph showing Comparison of estimated**

DISCUSSION

This prospective randomized controlled study compared endoscopic and open surgical approaches for the management of sinonasal inverted papilloma in 30 patients. The study evaluated demographic characteristics, disease stage, recurrence, postoperative complications, and intraoperative blood loss.

The demographic profile observed in our study is consistent with the established epidemiology of inverted papilloma. Most patients were middle-aged males, with a male predominance of 66.7%, similar to previous reports by Baser et al. and other published series, confirming that inverted papilloma predominantly affects men in the fifth and sixth decades of life.

A significant association was observed between Krouse stage and the choice of surgical approach. Patients with Stage I and II disease were managed endoscopically, whereas Stage III and IV lesions predominantly underwent open surgery. This reflects current surgical practice, where endoscopic techniques are preferred for localized disease, while open procedures remain valuable for extensive tumours involving inaccessible anatomical sites. Consequently, the higher proportion of advanced-stage disease in the open surgery group should be considered when interpreting postoperative outcomes.

The overall recurrence rate in the present study was 16.7%, with recurrence occurring in 13.3% of patients undergoing endoscopic surgery and 20% undergoing open surgery. Although recurrence was numerically higher in the open surgery group, the difference was not statistically significant. Most recurrences occurred in patients with Stage III disease, suggesting that tumour extent rather than surgical approach is the principal determinant of recurrence. These findings are consistent with studies by Li et al., Minni et al., and Delaine et al., which identified advanced Krouse stage, difficult tumour attachment sites, and incomplete excision as the major predictors of recurrence.

Postoperative complications were infrequent. Epiphora occurred in a small number of patients and was more common

following open surgery, likely because of greater manipulation of the nasolacrimal drainage system. This finding agrees with previous reports demonstrating better preservation of the nasolacrimal duct during endoscopic surgery.

Cerebrospinal fluid leak was observed only in patients undergoing open surgery. As these patients had advanced-stage disease, the complication is more likely attributable to tumour extent and skull base involvement than to the surgical approach itself. Similar observations have been reported in previous studies evaluating skull base involvement in inverted papilloma surgery.

External facial disfigurement was more frequent after open procedures because of external incisions required for lateral rhinotomy and medial maxillectomy. In contrast, endoscopic surgery provided excellent cosmetic outcomes by avoiding external scars, consistent with recent literature supporting minimally invasive management whenever feasible.

Intraoperative blood loss was significantly lower in the endoscopic group, with most patients losing less than 250 mL of blood. Improved visualization, enhanced magnification, and precise dissection during endoscopic surgery probably contributed to better haemostasis and reduced tissue trauma. This finding is consistent with previous reports demonstrating lower intraoperative morbidity with endoscopic techniques.

CONCLUSION

Overall, the findings of this study suggest that endoscopic surgery provides outcomes comparable to open surgery while offering the advantages of lower intraoperative blood loss, fewer cosmetic concerns, and a trend towards lower recurrence. Nevertheless, open surgery remains an important option for patients with advanced tumours in whom complete endoscopic excision may not be feasible. Careful patient selection and complete removal of the tumour attachment site remain the most important factors influencing long-term outcomes.

LIMITATIONS OF THE STUDY

The notable shortcomings of this study are

- Small sample size (n = 30)
- Unequal staging distribution between groups
- Short follow-up period (6 months) for recurrence assessment
- Non-uniform surgical indications (stage-based selection bias)
- The study has been conducted in a single centre.

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