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Research Article

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Analysis between Endoscopic Sinus Surgery and Ostiodilatation in Patients with Chronic Sinusitis

Uday Kumar Panigrahi[1*], Simi Simon[2], Vignesh N[3], Zeeshan Ali[4]

[1]Senior Molecular Biologist, Enigma Genomics, Department of Molecular Genetics, Dammam, Saudi Arabia
[2]Assistant Professor, Krupanidhi College of Physiotherapy, Bangalore, India,
[3]PhD Scholar, Biotechnology, Mansarovar Global University, Bhopal, MP, India
[4]Assistant Professor of Physiology, Krupanidhi college of physiotherapy, Bangalore, India

***Address for Correspondence:** Uday Kumar Panigrahi, Senior Molecular Biologist, Enigma Genomics, Department of Molecular Genetics, Dammam-34265, Saudi Arabia
E-mail: udaypanigrahi1998@gmail.com

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ABSTRACT

Background: With symptoms such as nasal congestion and facial discomfort, chronic sinusitis, which is a persistent inflammatory illness that lasts for at least a year, becomes a considerable burden. Through comparative analysis for informed decision-making in the treatment of chronic sinusitis, this study evaluates the efficacy of Endoscopic Sinus Surgery (ESS) and ostiodilatation. The research takes into consideration the advantages and disadvantages of each technique. This study assesses the effectiveness of ESS and ostiodilatation in treating chronic sinusitis to make well-informed treatment choices.

Methods: The prospective experiment compared ESS and balloon sinuplasty for chronic sinusitis was conducted at a tertiary care centre in India from January 2023 to December 2023. Oral methyl-prednisolone was standardized for all 100 individuals before surgery. Under general anesthesia, one group had ESS and the other had balloon sinuplasty. Patients received antibiotics and nasal wash post-surgery. Tomography and other follow-ups ensured medical continuity. The methodology allows a reliable comparison and provides vital information for chronic sinusitis treatment.

Result: This study compares chronic sinusitis treatment with Balloon Sinuplasty with Classical FESS. According to the data, there are no discernible gender or age disparities between the categories. Overall, especially in Group 1, Balloon Sinuplasty shows superior results than FESS. It shows sinus condition scores with time, illustrating Balloon Sinuplasty's benefits. According to the results, it may be more effective than classical FESS in relieving chronic sinusitis.

Conclusion: This study revealed balloon sinuplasty as efficacious as FESS for moderate sinusitis.

Key-words: "Endoscopic sinus surgery (ESS)," Nasal congestion, Facial discomfort, Chronic sinusitis

INTRODUCTION

Chronic sinusitis, an enduring inflammatory ailment, persists with nasal and sinus mucosa inflammation for at least 12 consecutive weeks. This condition manifests through various distressing symptoms, including nasal congestion, facial discomfort or pressure, postnasal drip, and a diminished sense of smell.

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Classifiable into distinct subtypes dependent on the presence or absence of nasal polyps and other specific factors, chronic sinusitis remains enigmatic regarding its precise etiology. Its origins are believed to stem from a complex interplay involving infections, allergic reactions, and potential dysfunction within the immune system [1,2].

Chronic sinusitis profoundly impacts individuals, disrupting their daily functionality and reducing overall productivity. The substantial economic ramifications endured by society and affected individuals underscore the urgent need for effective management strategies to elevate patients' quality of life and restore their productivity [3-7]. Efficient treatment modalities are pivotal in mitigating symptoms and enhancing the quality

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of life in individuals contending with chronic sinusitis. This prevalent inflammatory condition is typified by persistent inflammation within the nasal and sinus mucosa, giving rise to distressing manifestations, including nasal congestion, facial discomfort, postnasal drip, and reduced olfactory perception. These symptoms collectively impose substantial challenges on daily functioning and the holistic well-being of affected individuals, underscoring the pressing need for effective therapeutic interventions [1,7,8].

Medical interventions for chronic sinusitis include saline irrigation, topical corticosteroids, systemic corticosteroids, and oral doxycycline. Conventional therapies like antibiotics and antihistamines are also employed. Nasal sprays hydrate passages and reduce inflammation. Lifestyle adjustments such as humidifier use and trigger avoidance complement treatment. Collaboration with healthcare professionals is crucial for tailored plans. [9,10].

ESS is an operative remedy for chronic sinusitis, employing an endoscope—an illuminated, slender tube housing a camera. This instrument is delicately inserted into the nasal passages by the surgeon to obtain a visual of the sinuses, inspecting for obstructions or irregularities. The primary objective of this surgical intervention is to enhance sinus drainage, diminish inflammation, and alleviate the symptoms associated with chronic sinusitis [11,12].

Ostiodilatation serves as a therapeutic approach for chronic sinusitis, involving the expansion or widening of the sinus ostia—these are the passageways connecting the sinuses to the nasal cavity. The primary goal of this procedure is to enhance the sinuses' drainage and ventilation capabilities, facilitating efficient mucus clearance and mitigating inflammation. Various methods are employed for ostiodilatation, among which balloon sinoplasty stands out, utilizing a balloon catheter to enlarge the sinus ostia. Studies have demonstrated the efficacy of this technique in ameliorating symptoms and enhancing the quality of life for individuals affected by chronic sinusitis [13-15].

This research endeavors to scrutinize and appraise the efficacy of endoscopic sinus surgery and ostiodilatation in managing chronic sinusitis. The principal aim is to conduct a comparative analysis, delving into these distinct surgical interventions' nuanced advantages, limitations, and ultimate outcomes. Emphasizing the significance lies in the comprehensive understanding gleaned from comparing the therapeutic merits, potential drawbacks, and respective clinical outcomes associated with both procedures. This study seeks to provide valuable insights into the relative effectiveness of endoscopic sinus surgery and ostiodilatation, contributing to informed decision-making in the treatment landscape of chronic sinusitis.

MATERIALS AND METHODS

Research Design- The study was conducted at a tertiary care centre in India from January 2023 to December 2023. This prospective, randomized, and comparative study aimed to evaluate the effectiveness of ESS and balloon sinuplasty in treating chronic sinusitis. The 100 participants received a standardized preoperative regimen involving five days of daily oral methyl-prednisolone. A single radiologist performed and interpreted paranasal sinus tomography to ensure consistency across all individuals. Chronic sinusitis severity was determined using the Lund-Mackay scoring system, which was used for participant grouping. Surgeries were performed under general anesthesia, and two distinct groups were established. One group underwent standard ESS procedures, including frontal sinus ostium removal, bunionectomy, and ethmoidectomy. The other group received balloon sinuplasty post-polypectomy to dilate the maxillary, anterior-posterior ethmoid, frontal, and sphenoid sinuses. Post-surgery, all patients received antibiotics and underwent pressure nasal wash for one week before being discharged on the first day after surgery. Follow-up visits included intranasal aspirations one week post-surgery and paranasal sinus tomography 13–17 months later. The same radiologist who conducted the preoperative tomography assessed the postoperative images, ensuring continuity of care.

This methodology was designed to facilitate a trustworthy comparison between ESS and balloon sinuplasty outcomes in patients with chronic sinusitis. The study's results provided valuable insights into the relative benefits of these treatments, contributing to their application in clinical practice.

Selection of Patients- The 100 patients who participated in the trial were systematically categorized and subcategorized, as shown in Fig. 1. Total 50 patients,

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each comprised Group 1 and Group 2, the two main groups that were first established. Two further subgroups were formed within Group 1: one that underwent Classical FESS and another that underwent Balloon Sinuplasty. Group 2 patients were then separated into two subgroups: those undergoing balloon sinuplasty and those undergoing classical FESS. This flowchart shows the study's participants' organized structure and the treatments each subgroup received during the endoscopic sinus surgery effectiveness evaluation.

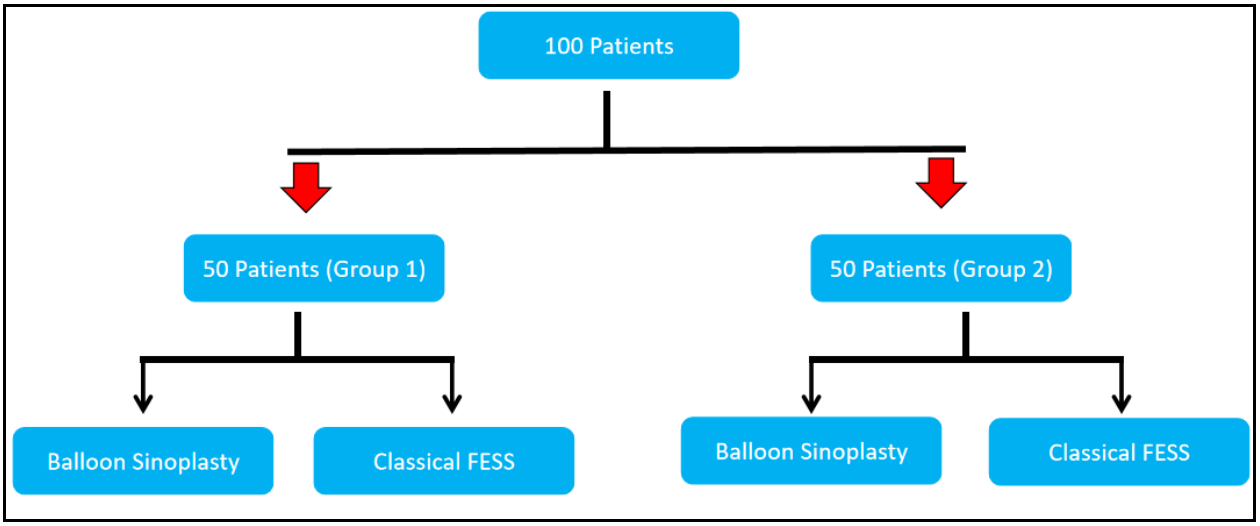

Fig. 1: Flowchart showing the grouping and sub-grouping made in this study

Inclusion Criteria

- The patients who visited the tertiary care centre during the study time from January 2023 to December 2023, were only included.
- All participants must fall between the age bracket of 18 to 65.
- Patients must have chronic sinusitis to participate.
- Participants should not have had chronic sinusitis surgery before the trial.

Exclusion Criteria

- Excluded were those under 18 and over 65.
- Patients who did not give informed consent or were not in the ethics committee-approved trial were excluded.
- This study excluded those having a history of chronic sinusitis surgery to evaluate primary treatments.
- Patients with cystic fibrosis, ciliary dyskinesia, diabetes, or hypertension were excluded since they may affect wound healing.

Statistical analysis- The statistical analysis was conducted using SPSS v. 23.0 for Windows (SPSS, Chicago, IL). Statistical significance was evaluated at a p-value of less than 0.05. The student's t-test was employed to assess the mean Lund-Mackay scores of the sinuses. The gender variable was assessed using a chi-square test, whereas the age variable was evaluated using a Student's t-test across the groups.

Ethical Approval- Approval for this study was obtained from the relevant ethical committee (JNMA/2023/99/7622), ensuring that all research procedures adhered to ethical standards and guidelines for protecting participants' rights and confidentiality.

RESULTS

Table 1 presents the baseline characteristics of the study sample, comparing two groups (Group 1 with n=50 and Group 2 with n=50) across various parameters. The mean age in Group 1 was 29.9±6.8, while in Group 2, it was 30.9±5.9, with a p-value of 0.09, indicating a non-significant difference. Gender distribution showed that 60% of Group 1 was male, compared to 70.00% in Group 2, though the p-value was 0.79, indicating no significant difference. The chief complaints were categorized, and no significant differences were observed between the two groups for complaints such as headache (p=0.085), nasal obstruction (p=0.094), aural problems (p=0.092), throat irritation (p=0.079), facial pain (p=0.082), and nasal discharge and bleeding (p=0.069).

DOI: 10.21276/SSR-IIJLS.2024.10.3.3

History of chronic diseases, including hypertension, tuberculosis, rhinitis, diabetes, Staphylococcus infection, and asthma, showed no significant differences between the two groups, with p-values ranging from 0.061 to 0.084. Clinical features, both major and minor symptoms, were compared between the groups. Noteworthy observations included no significant differences in symptoms such as facial pain/pressure (p=0.094), facial congestion/fullness (p=0.085), nasal obstruction/blockage (p=0.077), nasal discharge/purulence, discolored postnasal drainage (p=0.088), hyposmia/anosmia (p=0.062), headache (p=0.069), halitosis (p=0.094), fatigue (p=0.063), cough (p=0.06), ear pain/pressure/fullness (p=0.068), and dental pain (p=0.083). Overall, the baseline characteristics of both groups demonstrated no significant differences in age, gender distribution, chief complaints, history of chronic diseases, or clinical features.

Table 1: The baseline characteristics of the study sample

Parameter	Group 1 (n=50)	Group 2 (n=50)	p-value
Age	29.9 ± 6.8	30.9 ± 5.9	0.09
Gender			0.79
Male	30 (60.00%)	35 (70.00%)	
Female	20 (40.00%)	15 (30.00%)	
Chief complaints			
Headache	36	39	0.085
Nasal Obstruction	29	28	0.094
Aural Problems	29	32	0.092
Throat Irritation	28	36	0.079
Facial Pain	24	28	0.082
Nasal Discharge and Bleeding	21	22	0.069
H/O Chronic Disease			
Hypertension	33	31	0.078
Tuberculosis	28	29	0.084
Rhinitis	27	30	0.079
Diabetes	26	27	0.061
Group A Staphyloccus	25	23	0.069
Asthma	23	21	0.085
Clinical Features (Major and Minor Symptoms)			
Facial pain/pressure	26	25	0.094
Facial congestion/fullness	25	26	0.085

DOI: 10.21276/SSR-IIJLS.2024.10.3.3

Nasal obstruction/blockage	26	23	0.077
Nasal discharge/purulence, discolored post nasal drainage	23	28	0.088
Hyposmia/anosmia	28	21	0.062
Headache	24	26	0.069
Halitosis	25	22	0.094
Fatigue	23	20	0.063
Cough	24	21	0.06
Ear pain/pressure/fullness	20	19	0.068
Dental pain	19	22	0.083

Fig. 1 displays data that compares the results of two sinus treatments, specifically "Balloon Sinoplasty" and "Classical FESS," performed on two separate groups referred to as "Group 1" and "Group 2." The table includes measures taken before and after each procedure, with numerical values indicating specific outcomes. The data shows that these measurements, which may be linked to sinus-related factors, were collected for both groups before and following the relevant surgeries. Furthermore, a distinct collection of numerical numbers is supplied toward the conclusion, but the context or precise correlation with the groups or procedures is not explicitly stated. The table is a quantitative data repository for evaluating the efficacy or influence of the two sinus therapies on various populations.

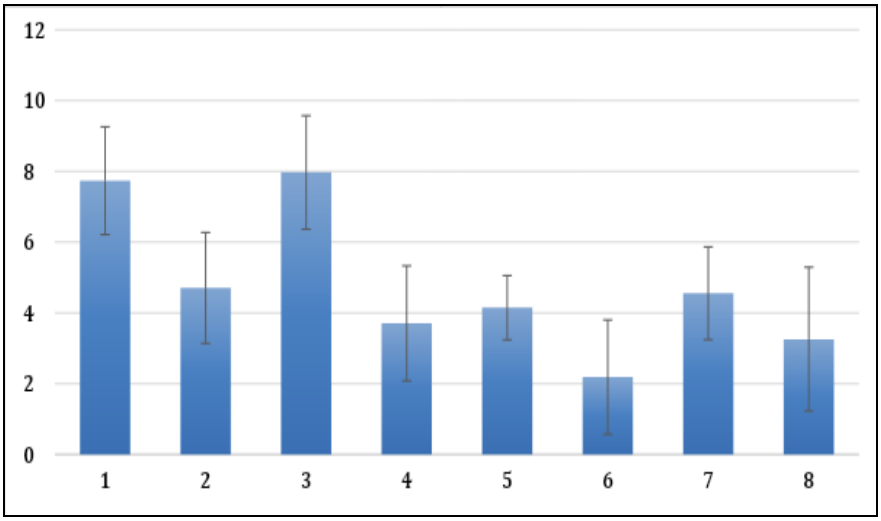

Fig. 1: Before and after surgery Lund–Mackay grading of Groups 1 and 2 patients

Table 2 compares 100 cases of Balloon Sinuplasty with FESS. Balloon Sinuplasty outperforms FESS by a moderate margin, with mean scores of 5.01 and 3.99, respectively. The standard deviation values, 2.30 for Balloon Sinuplasty and 2.01 for FESS indicate significant score variability within each group.

The mean score difference is not statistically significant since the p-value is 0.19. In this study, the difference in mean scores between Balloon Sinuplasty and FESS may be attributed to random chance rather than a therapeutic effect. Table 2 shows no clear advantage of either treatment strategy in this patient sample.

DOI: 10.21276/SSR-IIJLS.2024.10.3.3

Table 2: Comparing balloon sinoplasty and traditional FESS scores across all patients

Patients group	n	Mean	Std. deviation	p-value
Balloon	50	5.01	2.30	0.19
FESS	50	3.99	2.01	

Table 3 compares Balloon Sinuplasty and FESS in 48 instances each. The mean scores for Balloon Sinuplasty and FESS are 3.01 and 2.99, indicating similar treatment outcomes. The standard deviation values for Balloon Sinuplasty and FESS, 2.01 and 1.99, suggest moderate score variability within each group. Importantly, the p-value of 0.59 indicates that the mean score difference between groups is not statistically significant. This implies that Balloon Sinuplasty's and FESS's results are not significantly different in this study. The consistency in mean scores and lack of statistical significance show that both therapies in Group 6 are equally effective in this patient subset. The study also compares Balloon Sinuplasty and conventional FESS in Group 1, with 50 cases per technique. The mean scores represent the average treatment outcomes, with Balloon Sinuplasty scoring 6.1 and FESS 5.1. Balloon Sinuplasty has slightly less score variability (1.49) than FESS (1.59). Since the two groups have a statistically significant difference in mean scores, the observed variation is unlikely to be random chance. The higher mean score and statistical significance suggest that Balloon Sinuplasty may perform better than classical FESS in Group 1.

Table 3: Group 2 balloon sinoplasty vs. conventional FESS scores

	Group 1			Group 2				
	n	Mean	Std. deviation	n	Mean	Std. Deviation	p1	p2
Balloon	25	6.1	1.49	25	3.01	2.01	0.01	0.59
FESS	25	5.1	1.59	25	2.99	1.99		

p1, significance between Balloon Sinoplasty and FESS within group 1; p2, significance between Balloon Sinoplasty and FESS within group 2

Fig. 2 shows the sinus condition scores at various time points for Group 1 (Balloon Sinuplasty and Classical FESS sides) and Group 2. The preoperative scores of the four subgroups are very similar: 61 for Group 1 Classical FESS, 63 for Group 1 Balloon Sinuplasty, and 61 for Group 2 Balloon Sinuplasty. After the procedures, there is a clear improvement in the Group 1 Balloon Sinuplasty side, with a decrease from 48 at the postoperative time to 32 at 12 weeks. However, results are more mixed for Group 2 Classical FESS, with scores dropping from 51 immediately following surgery to 39 after 12 weeks. This indicates that, over the 12 weeks, Balloon Sinuplasty in Group 1 may have a more consistent and better outcome than Classical FESS in Group 2.

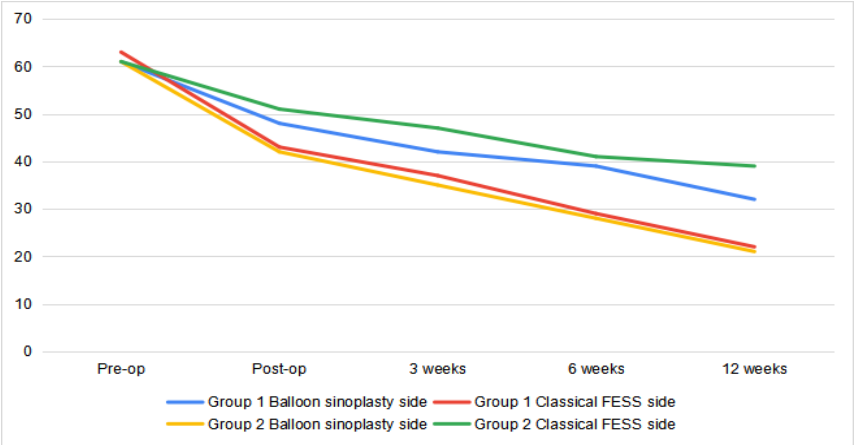

Fig. 2: Sinus condition scores at various time points for Group 1 and Group 2

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DISCUSSION

In a survey by Bunzen *et al.* [16] involving 24 participants, 11 had CRS, while 13 had CRS alongside nasal polyps. CRS notably impacted the quality of life of all participants, with a significant improvement seen in 54.2% of cases. FESS had unanimous support, and every participant recommended it to others with similar nasal issues. Only three respondents were hesitant about undergoing the surgery again. Symptom relief was substantial: nasal obstruction (83.3%), cacosmia/halitosis (80%), hyposmia/anosmia (63.15%), and headaches (62%). Patients with polyps experienced better relief than those with solely CRS. However, outcomes slightly fell short of expectations, influenced by factors like allergic rhinitis, limited nasal spray use, and environmental control. Patients with polyps consistently reported better relief and quality of life, highlighting the surgery's benefits for this group [16].

In a study by Lavigne *et al.* [17] involving 20 patients with treatment-resistant chronic rhinosinusitis, a specialized treatment approach utilized selective sinus mucosa irrigation over 21 to 30 days. Significant improvements were noted in all symptom scores, including rhinorrhea, nasal congestion, smell ($n=20$; $p<0.001$), and facial pain ($n=20$; $p<0.01$), both before and approximately 18 months post-treatment. Computed tomography scans revealed a marked reduction in staging, from 14.6 +/- 1.1 to 5.6 +/- 1.1 ($p<0.001$). This approach demonstrated high patient tolerance, with only three requiring further surgical intervention. These findings indicate promise for selective sinus irrigation as an alternative intervention in challenging chronic rhinosinusitis cases, offering effective symptom relief and staging improvement. Additionally, balloon sinuplasty, known as ostiodilatation, emerged as a less invasive yet effective alternative, improving symptoms and overall quality of life for chronic sinusitis patients [17].

ESS and ostiodilatation effectively alleviate symptoms, enhance quality of life, and reduce recurrence rates in chronic sinusitis. These surgeries improve symptoms like nasal congestion, facial pain, and headaches by addressing impaired sinus drainage and ventilation. Research demonstrates significant symptom improvement and enhanced quality of life through diverse assessments, with minimal complications reported. Moreover, these interventions notably reduce the recurrence of chronic sinusitis. However, they're generally considered after unsuccessful medical therapies [18-22].

ESS presents distinct advantages, including its minimally invasive nature, enabling access to and treatment of the sinuses without external incisions, and reducing tissue damage and scarring. It also offers improved visualization for precise identification and tailored treatment of affected tissues, aiming for comprehensive disease management and potentially better symptom relief and quality of life enhancement. Conversely, ostiodilatation via balloon sinoplasty emerges as a minimally invasive alternative with a shorter recovery period and lower complication rates. Both procedures aim to restore sinus function but carry inherent risks, including complications like bleeding, infection, and recurrence of symptoms. The selection between ESS and ostiodilatation often hinges on individual patient factors, such as the severity of sinusitis and specific nasal or sinus conditions, influencing their suitability and effectiveness [13,21,23].

Several studies have delved into each surgical procedure's potential risks and adverse effects for chronic sinusitis. One study by Chaaban *et al*. revealed a comparative complication rate of 5.26% for balloon sinuplasty against 7.35% for traditional ESS, noting revision rates of 7.89%, 16.85%, and 15.15% for each, respectively. Major complications with balloon sinuplasty included cerebrospinal fluid leaks, pneumocephalus, orbital issues, and severe bleeding [24]. Another analysis by Suzuki *et al.* [25] of various ESS types unveiled an overall complication rate of 0.50%, encompassing diverse complications like cerebrospinal fluid leaks, orbital injuries, hemorrhage, blood transfusions, and rare occurrences of toxic shock syndrome. Ethmoidectomy combined with sphenoidotomy showed a relatively higher overall complication rate of 1.40%. Moreover, a meta-analysis by Re *et al.* [26] comparing ESS with traditional and microscopic sinus surgeries suggested that major complications were notably higher with traditional approaches than ESS. In comparison, microscopic surgery had significantly more complications than ESS.

A holistic evaluation and tailoring of treatment plans are pivotal in determining the most suitable course of action. Individual factors, including disease severity, gauged through symptoms and imaging, significantly influence surgical choices. Anatomical considerations like nasal

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polyps or structural irregularities might lean towards favouring ESS. Incorporating patient preferences and treatment objectives into the decision-making process is imperative. Additionally, the presence of comorbidities, such as asthma or immunodeficiency, is a critical determinant influencing treatment strategies and overall outcomes. A personalized approach, thoughtfully integrating these multifaceted elements, is paramount for optimizing chronic sinusitis patient care [27-30].

Future research in endoscopic sinus surgery entails diverse avenues, including comparative studies exploring surgical techniques like natural ostiodilatation, balloon sinoplasty, and FESS for varied severities of chronic sinusitis. Long-term follow-ups are essential to gauge surgical durability and efficacy over time, informing success rates and potential complications. Advancements in surgical methodologies, instrumentation, and imaging modalities present promising areas for improving outcomes and minimizing risks. These findings have implications for treatment decisions, patient education on surgical benefits, and the formulation of healthcare policies. Understanding the nuances of surgical efficacy aids practitioners in tailored treatment choices, empowering patients to comprehend surgery's positive impact on quality of life. These research insights inform healthcare policies, shaping guidelines and resource allocation, with broad-reaching effects on chronic sinusitis management and care [31-33].

CONCLUSIONS

This study concluded that the efficacy of balloon sinoplasty in individuals with mild sinusitis is equivalent to standard FESS. The comparative efficacy of ESS and balloon sinuplasty for chronic sinusitis is useful. However, several areas remain unknown. A complete study of long-term outcomes and potential problems for each treatment approach is lacking in research. The study does not examine patient-specific characteristics affecting therapy efficacy, such as health problems or anatomical differences. The study highlights a research gap in comparing ESS and balloon sinuplasty for chronic sinusitis, emphasizing the need for long-term follow-up and patient profile considerations.

Future studies should include long-term follow-ups to assess therapy durability and chronic sinusitis recurrence. Patient preferences and traits may inform tailored treatment. Exploring cost-effectiveness and patient-reported outcomes would enhance understanding and enable evidence-based chronic sinusitis therapy decisions. These elements would improve clinical relevance and the application of findings in guiding appropriate therapy methods. Future research should incorporate patient-reported outcomes and cost-effectiveness analysis for a comprehensive understanding and personalized treatment approach.

CONTRIBUTION OF AUTHORS

Research concept- Uday Kumar Panigrahi
Research design- Simi Simon, Zeeshan Ali
Supervision- Uday Kumar Panigrahi
Materials- Uday Kumar Panigrahi, Vignesh N
Data collection- Uday Kumar Panigrahi, Zeeshan Ali
Data analysis and Interpretation- Vignesh N, Zeeshan Ali
Literature search- Simi Simon, Vignesh N
Writing article- Uday Kumar Panigrahi, Vignesh N, Zeeshan Ali
Critical review- Uday Kumar Panigrahi, Vignesh N
Article editing- Simi Simon
Final approval- Uday Kumar Panigrahi

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