Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Middle Ear Pressure Changes Following Endoscopic Sinus Surgery in Chronic Rhinosinusitis with Nasal Polyposis: An Observational Cohort Study

Devyani Jha

devyanijha29@gmail.com

Kasturba Medical College, Manipal

K Devaraja

Kasturba Medical College, Manipal

Rohit Singh

Kasturba Medical College, Manipal

Kishan Madikeri Mohan

Kasturba Medical College, Manipal

Research Article

Keywords: Chronic Rhinosinusitis with nasal polyposis, middle ear, endoscopic sinus surgery, Tympanometry, Eustachian tube dysfunction

Posted Date: February 17th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-8189994/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background: Chronic rhinosinusitis with nasal polyposis (CRSwNP) can alter sinonasal physiology and influence Eustachian tube (ET) function, yet postoperative changes in middle ear pressure (MEP) after functional endoscopic sinus surgery (FESS) remain poorly studied, particularly in asymptomatic patients. This study aims to evaluate the pre- and postoperative middle ear function in CRSwNP patients undergoing FESS and examines whether polyp severity or residual disease affects middle ear ventilation. This observational cohort study was conducted at a tertiary care center in South India between September 2022 and August 2024. Patients (> 18 years) diagnosed with CRSwNP and scheduled for FESS were enrolled. Tympanometry was performed using a calibrated ANSI 1991 GSI-TympStar immittance meter (226 Hz probe tone) preoperatively, at 1 week, and at 3 months postoperatively.

Results: Among the 30 patients (median age 48.5 years; 63% male), 63.3% of ears showed Type A tympanograms preoperatively. Median MEP improved significantly from –12.50 daPa to –10.00 daPa at 1 week ($p = 0.01$). At 3 months, MEP remained slightly improved (–11.00 daPa), though not statistically significant compared with baseline ($p = 0.07$). Residual disease was associated with markedly negative MEP (–34.00 daPa) compared with patients without residual polyposis (–10.00 daPa), showing a strong trend ($p = 0.06$). However, preoperative polyp grade did not correlate with MEP ($p = 0.167$).

Conclusion: The study shows that successful sinus clearance results in only a transient postoperative rise in MEP. This short-lived improvement underscores the need for continued monitoring

Background

Chronic rhinosinusitis (CRS) is among the most prevalent inflammatory disorders affecting the nose and paranasal sinuses, accounting for a substantial proportion of outpatient visits across various specialties, including otolaryngology, primary care, pediatrics, and pulmonology [(1)]. The global prevalence of CRS has been reported to range from 5.5% to 27.1% [(2)]. This condition broadly encompassed two sub-classes, CRS with nasal polyposis (CRSwNP) and CRS sans nasal polyposis (CRSsNP), both of which are known to significantly impact the patients' quality of life (QOL) [(3)]. CRSwNP is characterized by benign, bilateral growths within the sinonasal cavities, accounting for approximately 25–30% of all CRS cases [(4)].

CRS not only presents with nasal symptoms but also with otologic complaints, collectively exerting a significant negative impact on quality of life (QoL). Due to the anatomical and functional connection between the nasal cavity and middle ear via the Eustachian tube (ET), inflammation of the nose and paranasal sinuses can extend to the middle ear. Moreover, CRS may also involve the pharynx and lower airway, further contributing to overall QoL impairment [(5–7)]. Particularly, the effect of CRS on middle ear function via the ET and middle ear pressure (MEP) has gained significant attention in the recent times. Several studies have also found an association of CRS severity and middle ear problems [(8–10)], with some studies utilising patient related outcome measures to assess symptoms related to ET dysfunction [(11, 12)].

However, most existing studies have primarily examined symptoms of ET dysfunction in relation to the overall severity of CRS, while the specific impact of CRSwNP on ET function and middle ear health remains insufficiently explored. This study aims to address the existing gap by evaluating the impact of CRSwNP on ET function through changes in MEP before and after functional endoscopic sinus surgery (FESS). It examines variations in MEP among patients with CRSwNP pre- and post-surgery and compares values between those with residual or recurrent disease and those with complete disease clearance at one week and three months after surgery. The study hypothesizes that MEP correlates with polyp severity, reflecting the role of CRSwNP in middle ear pathology, and that FESS results in significant postoperative improvement in MEP, thereby enhancing the understanding of the link between sinonasal inflammation and middle ear function and informing better management strategies for CRSwNP and its sequelae.

Materials and Methods

Study design

This observational cohort study was conducted from September 2022 to August 2024 by the Department of Otorhinolaryngology, in collaboration with the Department of Speech and Audiology, at a tertiary care hospital in South India affiliated with a medical college. Ethical approval was obtained from the Institutional Ethics Committee (Approval No. 445/2022), and study was carried out in strict accordance with the ethical principles outlined in the Declaration of Helsinki and adhered to the standards of Good Clinical Practice (GCP). Informed written consent was obtained from each participant prior to enrolment and confidentiality of participant data was maintained throughout the study.

Study participants

The patients diagnosed with CRSwNP who were planned to undergo a surgical intervention in the form of FESS for clearance of the same, between June 2023 and April 2024 were considered for this study. The inclusion criteria were patients, above the age of 18 years, diagnosed with CRSwNP as per the diagnostic criteria of European position paper on rhinosinusitis and nasal polyps [(3)], and planned to undergo endoscopic sinus surgery at our centre. Patients with pre-existing middle ear pathologies, such as suppurative otitis media of any type, and those with perforation of tympanic membrane were excluded from this study. Also, those with previous history of any middle ear or mastoid disorder or related symptoms were also not considered. Finally, patients with known craniofacial anomalies and syndromes were also excluded (**Supplementary table 1**).

Procedure

The recruited patients were subjected to preoperative analysis of the nose and paranasal sinuses in the form of diagnostic nasal endoscopy using straight and 30 degree angled rigid endoscopes, during which the grading of polyposis was carried out as per the Meltzer grading system [(13)]. As per this system, nasal

polyposis was graded between 0–4 (0 = no polyps, 1 = polyps confined to the middle meatus, 2 = multiple polyps occupying the middle meatus, 3 = polyps extending beyond the middle meatus, 4 = polyps completely obstructing the nasal cavity). After the DNE, a tympanometry was done at the Department of Audiology, using a calibrated (ANSI 1991) GSI- Tympstar immittance meter. The patients were instructed not to swallow and move while testing. Each ear was tested separately by placing an airtight probe tip with 226Hz probe tone.

The patients were subjected to FESS under general anesthesia, which was performed as a standardized procedure in all the patients, with the following operative steps. After the detailed examination of the nose and paranasal sinuses by introduction of the straight and angled rigid endoscopes attached to a light source and camera, the excision of polyps from was carried out with cold steel instrumentation. All patients underwent middle meatal antrostomy, anterior and posterior ethmoidectomy, frontal recess clearance and sphenoidotomy. The excised polypoidal tissue sent for histopathological analysis. No routine intraoperative systemic steroids were administered.

The patients were discharged one to two days after surgery on antihistamines, saline nasal douches with steroid respules, and a steroid nasal spray, without routine postoperative systemic corticosteroids, to be continued until the first follow-up visit.

They were then reviewed postoperatively after one week for an endoscopic evaluation of the nasal cavity by DNE. The post operative cavities were assessed for crusting, discharge and residual polypoidal tissue. Once the nasal cleaning was done, patients were subjected to postoperative 1-week tympanogram. Similar endoscopic evaluation and cleaning of nasal cavity was done along with a tympanogram at three months` follow up. Between the follow up visits, patients were advised to use saline nasal douches with steroid respules and steroid nasal spray (Fig. 1).

Data collection

Data were collected on demographic, surgical, and clinical parameters. Demographic information included age, sex, and relevant medical history. Clinical data encompassed preoperative nasal endoscopy findings, grading of nasal polyps, and baseline middle ear function assessed by tympanometry. Surgical data included details of the FESS, intraoperative findings, and histopathological analysis of excised tissue. Postoperative follow-up assessments for one week and three months included endoscopic evaluation of the nasal cavity and repeat tympanometry to monitor middle ear pressures and residual or recurrent disease.

Outcomes

The primary outcome of the study was to evaluate changes in middle ear function before and after endoscopic sinus surgery in patients with sinonasal polyposis. Additionally, any significant differences

observed in tympanometry findings were intended to assess the impact of sinonasal polyposis on middle ear function.

Statistical analysis

Microsoft Excel and SPSS version 27.0 were used for data cleaning and statistical analysis. Tympanometry was performed for both ears; however, for statistical analysis, middle ear pressure (MEP) values from the right and left ears were averaged to obtain a single patient-level value, thereby avoiding violation of independence assumptions associated with bilateral measurements.

The sample size for this study was calculated using the formula given below.

$$N = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2 \times 2 \times (1-\rho)}{f^2 \times (m \times \epsilon)}$$

Wherein, Z1 − α/2: 1.96; Z1 − β: 0.84 (for 80% power); f: 0.35; ρ: 0.5; m: 3 (number of measurements); ϵ: 0.75 (sphericity correction factor). Accordingly, the sample size included in this study was (1.96 + 0.84)2 x 2 (1-0.5) / (0.35)2 x (3 x 0.75) = 7.84 / 0.2756 = 28.44 ~ 30

Categorical and continuous variables were reported in proportions and median and inter-quartile range (IQR), respectively. The Shapiro-Wilk test was used to assess the normality of the data. Accordingly, either a ‘t-test’ or Mann Whitney U Test was used to assess the change in the mean or median across the two time points. Changes in MEP across the three time points (preoperative, 1-week postoperative, and 3-month postoperative) were analyzed using the Friedman test. Chi-square was used to assess the association between pre-op, 1-week post-op op, and 3 months post-op. The statistical significance was determined at a 5% level of significance.

Results

A total of 30 patients were enrolled with median age of 48.5 years (IQR 38.75–55.5) and comprised 19 males (63%) and 11 females (37%). Nasal polyposis was predominantly moderate to severe, with Meltzer Grade 3 being the most common in both right (40%) and left (50%) nasal cavities. In the assessment of middle ear status using a calibrated ANSI 1991 GSI-TympStar immittance meter with a 226 Hz probe tone, all 30 participants were evaluated preoperatively. Tympanometry revealed that the majority of ears demonstrated normal middle ear function Type A (63.3% in both ears), while a smaller proportion exhibited other curve types (Ad, As, B, C, D), indicating mild preoperative middle ear involvement in some patients (**Table 1**).

Table 1: Baseline Demographic and Clinical Characteristics of Study Participants

Variables	
Age (IQR)	48.50 (38.75- 55.50)
Gender	
Male, n (%)	19 (63)
Female, n (%)	11 (37)
Meltzer nasal polyposis grading system	
Right nasal cavity, n (%)	
2	11 (36.7)
3	12 (40)
4	7 (23.3)
Left nasal cavity, n (%)	
2	7 (23.3)
3	15 (50)
4	8 (26.7)
Pre-operative Tympanogram	
Right - Curve type Preoperative, n (%)	
A	19 (63.3)
Ad	4 (13.3)
As	1 (3.3)
B	2 (6.7)
C	3 (10.0)
D	1 (3.3)
Left - curve type Preoperative, n (%)	
A	19 (63.3)
Ad	6 (20.0)
As	2 (6.7)
C	2 (6.7)
D	1 (3.3)

Abbreviation: IQR: Interquartile range

The median MEP improved from –12.50 daPa preoperatively to –10.00 daPa at 1 week, and this change was statistically significant (p = 0.01), indicating an early postoperative enhancement in middle ear aeration or Eustachian tube function. By the 3-month postoperative period, the median MEP remained slightly improved at –11.00 daPa, but the differences between preoperative vs 3 months (p = 0.07) and 1 week vs 3 months (p = 0.11) were not statistically significant.

Table 2: Changes in median middle ear pressure, 1 week and 3 months post operatively.

Time	Middle ear pressure, median (IQR), daPa	p value
Preoperative	-12.50 (-38.50 to -0.75)	0.01
1-week postoperative	-10 (-33.75 to -0.50)	
1-week postoperative	-10.00 (-33.75 to -0.50)	0.11
3 months postoperative	-11.00 (-30.00 to -2.50)	
Preoperative	-12.50 (-38.50 to -0.75)	0.07
3-month postoperative	-11.00 (-30.00 to -2.00)	

The patients with residual disease had a markedly more negative median MEP (–34.00 daPa, IQR: –111.50 to –9.50), indicating poorer middle ear ventilation. In contrast, those with no residual disease demonstrated a near-normal median MEP (–10.00 daPa, IQR: –26.25 to 0.25), reflecting better Eustachian tube function. However, p-value (0.06) is not statistically significant.

Table 3: Comparison of median middle ear pressure in the 3-month postoperative period in patients with residual disease and those who were free of disease

Time	Middle-ear pressure Median (IQR)	p value
3-month postoperative period		
Residual disease	-34.00 (-111.50 to -9.50)	0.06
No residual disease	-10.00 (26.25 to -0.25)	

The comparison of median middle ear pressure across different preoperative grades of polyposis showed no statistically significant association (p = 0.167). Although patients with Grade IV polyposis demonstrated the most negative middle ear pressures, followed by Grade II and Grade III, these differences did not reach statistical significance.

Table 4: Comparison of grade of polyposis and median middle ear pressure

Preoperative grade of polyposis	Middle ear pressure (IQR)	p value
II (n= 18)	-14.50 (-37.25 to -6.75)	0.167
III (n=27)	-6.00 (18.00 to 2.00)	
IV (n=15)	-31.00 (-64.0 to -5.00)	

Discussion

CRSwNP is a prevalent inflammatory condition frequently associated with systemic comorbidities and a substantial impact on quality of life [14,15]. Our study specifically evaluated changes in MEP) before and after FESS in a cohort of CRSwNP patients without otologic or ET-related symptoms, thereby differing from earlier studies that included mixed CRS subtypes when examining the influence of nasal obstruction on ET function [16-18].

The findings of this study indicate that middle ear pressure demonstrated an early postoperative improvement, with the median MEP increasing from –12.50 daPa preoperatively to –10.00 daPa at 1 week (p = 0.01). Although a statistically significant improvement in median middle ear pressure was observed at 1 week postoperatively, the absolute magnitude of change was small and remained within the physiological range. Therefore, these findings should be interpreted cautiously, as they may not represent a clinically meaningful improvement in middle ear function.

By 3 months, the median MEP was –11.00 daPa, and the comparisons between preoperative vs. 3 months (p = 0.07) and 1 week vs. 3 months (p = 0.11) were not statistically significant, suggesting that most functional recovery occurs within the first postoperative week. Patients with residual disease showed markedly negative MEP (median –34.00 daPa; IQR –111.50 to –9.50), reflecting poorer Eustachian tube function, whereas those without residual disease had near-normal pressures (median –10.00 daPa; IQR –26.25 to 0.25). Although this difference did not reach conventional statistical significance (p = 0.06), the observed trend suggests that ongoing sinonasal inflammation may negatively influence postoperative middle ear ventilation. Given the limited sample size, this finding should be regarded as exploratory and hypothesis-generating rather than confirmatory.

No statistically significant association was identified between preoperative nasal polyp grade and baseline MEP (p = 0.167). While patients with Grade IV polyposis tended to exhibit more negative pressures compared with those with Grades II and III disease, these differences were not statistically meaningful. This lack of association suggests that the severity of visible polyp burden alone may not be a reliable predictor of middle ear pressure alterations.

Our results align with earlier work emphasizing the otologic impact of CRS. Teo et al. reported significant improvement in otologic symptoms following FESS in both CRSsNP and CRSwNP groups, underscoring the prevalence of ET-related manifestations in CRS [19]. Similarly, Wuraola et al. documented abnormal tympanograms and higher mucosal inflammatory grades among CRS patients [20], while Ibrahim et al.

found abnormal middle ear function in adults with chronic nasal obstruction, although their cohort included a broader spectrum of obstruction etiologies [21]. Notably, these studies did not evaluate postoperative MEP changes, particularly in asymptomatic CRSwNP patients.

This study cohort did not show any association between baseline polyp severity and MEP values, indicating that factors such as underlying mucosal inflammatory profiles or individual host susceptibility may have a greater influence. However, previous studies consistently demonstrates that inflammatory sinonasal disease, particularly CRSwNP, can markedly impair ET function and increase susceptibility to middle ear pathology, likely through a combination of mechanical obstruction and peritubal inflammation. Chaudhry et al. first highlighted this interaction by reporting otitis media in 50% of patients with bilateral nasal polyposis [22] . Building on this, Bakhshaee et al. demonstrated that patients with sinonasal polyposis exhibit abnormal middle ear pressures, 13.6% type B tympanograms, and reduced success on Valsalva/Toynbee tests [23]. Their findings emphasized that allergy and infection, rather than mechanical obstruction, were the primary determinants of ET dysfunction. Further structural insights were provided by Patel et al., who identified notable ET ostial abnormalities in CRS patients: 61% had inflammatory Type II edema, and 9% showed tubal tonsil hypertrophy, changes likely contributing to tubal blockage and subsequent middle ear disease [24].

Taken together, the findings of this study suggest that subtle or subclinical alterations in middle ear ventilation may be present in patients with CRSwNP and that modest improvements can occur shortly after sinus surgery. However, these changes are small, may not persist long term, and should not be considered clinically transformative. Persistent negative MEP values in some patients following FESS may nonetheless warrant continued postoperative surveillance, particularly in those with residual disease. In addition, this study has limitations. It is a single-center study with a relatively small sample size and a limited follow-up duration, which may have reduced the statistical power to detect significant associations. Larger multicenter prospective studies with more homogeneous cohorts are required. Additionally, incorporating key comorbidities such as bronchial asthma which may influence the underlying pathophysiology will aid in understanding the comprehensive approaches to restoring middle ear ventilation and preventing long-term complications.

Abbreviations

CRSwNP
Chronic Rhinosinusitis with Nasal Polyposis
ET
Eustachian Tube
MEP
Middle Ear Pressure
FESS
Functional Endoscopic Sinus Surgery
CRS

Chronic rhinosinusitis
QoL
quality of life (QoL)

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Institutional Ethics Committee (Approval No. 445/2022) and study was carried out in strict accordance with the ethical principles outlined in the **Declaration of Helsinki** and adhered to the standards of **Good Clinical Practice (GCP)**. Informed written consent was obtained from each participant prior to enrolment and confidentiality of participant data was maintained throughout the study.

Consent for publication

Not applicable

Availability of data and material

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests:

The authors declare that they have no competing interests

Funding:

None received

Acknowledgements

The authors would like to express their sincere gratitude to their mentors and colleagues for their thoughtful feedback, which has greatly enhanced the quality of this manuscript.

References

1. Marple BF, Stankiewicz JA, Baroody FM et al (2009) Diagnosis and management of chronic rhinosinusitis in adults. Postgrad Med 121:121–139. https://doi.org/10.3810/pgm.2009.11.2081
2. Sanda AL, Adekoya VA, Fasina OA et al (2025) Impact of chronic rhinosinusitis on the audiological profile of patients attending Lagos State University Teaching Hospital. Egypt J Otolaryngol 41:111. https://doi.org/10.1186/s43163-025-00864-w

3. Fokkens WJ, Lund VJ, Hopkins C et al (2020) European Position Paper on Rhinosinusitis and Nasal Polyps 2020. Rhinology 58:1–464. https://doi.org/10.4193/Rhin20.600
4. Stevens WW, Schleimer RP, Kern RC (2016) Chronic Rhinosinusitis with Nasal Polyps. J Allergy Clin Immunol Pract 4:565–572. https://doi.org/10.1016/j.jaip.2016.04.012
5. Håkansson K, Bachert C, Konge L et al (2015) Airway Inflammation in Chronic Rhinosinusitis with Nasal Polyps and Asthma: The United Airways Concept Further Supported. PLoS ONE 10:e0127228. https://doi.org/10.1371/journal.pone.0127228
6. Frendø M, Håkansson K, Schwer S et al (2016) Asthma in ear, nose, and throat primary care patients with chronic rhinosinusitis with nasal polyps. Am J Rhinol Allergy 30:67–71. https://doi.org/10.2500/ajra.2016.30.4304
7. Teo NW, Mace JC, Smith TL, Hwang PH (2017a) Impact of endoscopic sinus surgery on otologic symptoms associated with chronic rhinosinusitis. World J Otorhinolaryngol - Head Neck Surg 3:24–31. https://doi.org/10.1016/j.wjorl.2017.03.001
8. Chen T, Shih MC, Edwards TS et al (2022) Eustachian tube dysfunction (ETD) in chronic rhinosinusitis with comparison to primary ETD: A systematic review and meta-analysis. Int Forum Allergy Rhinol 12:942–951. https://doi.org/10.1002/alr.22942
9. Wuraola OA, Afolabi AO, Ologe FE (2023a) Tympanometry and endoscopic diagnosis of eustachian tube dysfunction in patients with chronic rhinosinusitis. Niger Postgrad Med J 30:126–131. https://doi.org/10.4103/npmj.npmj_31_23
10. Calvo-Henriquez C, Di Corso E, Alobid I et al (2023) Pathophysiological Link Between Chronic Rhinosinusitis and Ear Disease. Curr Allergy Asthma Rep 23:389–397. https://doi.org/10.1007/s11882-023-01072-3
11. El-Anwar MW, Elnabtity NM, Nada E, Abdelmonem S (2022) Relationship between nasal polyposis and Eustachian tube function. Egypt J Otolaryngol 38:45. https://doi.org/10.1186/s43163-022-00233-x
12. Asghari M (2023) Effect of Polypectomy on Middle Ear Function in Nasal Polyposis Patients. Zahedan J Res Med Sci 25. https://doi.org/10.5812/zjrms-122560
13. Meltzer EO, Hamilos DL, Hadley JA et al (2006) Rhinosinusitis: developing guidance for clinical trials. J Allergy Clin Immunol 118:S17–61. https://doi.org/10.1016/j.jaci.2006.09.005
14. Gliklich RE, Metson R (1997) Effect of sinus surgery on quality of life. Otolaryngol Head Neck Surg 117:12–17. https://doi.org/10.1016/S0194-59989770199-2
15. Klonaris D, Doulaptsi M, Karatzanis A et al (2019) Assessing quality of life and burden of disease in chronic rhinosinusitis: a review. RHINOL 2:6–13. https://doi.org/10.4193/RHINOL/18.067
16. Maniakas A, Desrosiers M, Asmar MH et al (2018) Eustachian tube symptoms are frequent in chronic rhinosinusitis and respond well to endoscopic sinus surgery. Rhinology 56:118–121. https://doi.org/10.4193/Rhin17.165
17. Wu AW, Walgama ES, Higgins TS et al (2020) Eustachian Tube Quality of Life and Severity of Disease in Patients With Chronic Rhinosinusitis. Am J Rhinol Allergy 34:532–536.

https://doi.org/10.1177/1945892420912366

18. Lee M, Lee J (2023) Impact of Sinonasal Disease on Eustachian Tube Dysfunction. Curr Treat Options Allergy 10:1–14. https://doi.org/10.1007/s40521-023-00327-8
19. Teo NW, Mace JC, Smith TL, Hwang PH (2017b) Impact of endoscopic sinus surgery on otologic symptoms associated with chronic rhinosinusitis. World J Otorhinolaryngol Head Neck Surg 3:24–31. https://doi.org/10.1016/j.wjorl.2017.03.001
20. Wuraola OA, Afolabi AO, Ologe FE (2023b) Tympanometry and endoscopic diagnosis of eustachian tube dysfunction in patients with chronic rhinosinusitis. Niger Postgrad Med J 30:126–131. https://doi.org/10.4103/npmj.npmj_31_23
21. Ibrahim SH (2020) Tympanometric Findings among Adults with Chronic Nasal Obstruction Due to Sinonasal Pathology. Indian J Forensic Med Toxicol 14:677–681. https://doi.org/10.37506/ijfmt.v14i2.2930
22. Chaudhry S, Ahmad Z, Khan FB, Afzal M (2010) Frequency of otitis media in patients of nasal polypi. J Ayub Med Coll Abbottabad 22:83–85
23. Bakhshaee M, Ardakani HP, Ghazizadeh AH et al (2016) Middle ear function in sinonasal polyposis. Eur Arch Otorhinolaryngol 273:2911–2916. https://doi.org/10.1007/s00405-015-3812-5
24. Is Chronic Rhinosinusitis and Status of Pharyngeal End of Eustachian Tube Link-Up All Smoke No Fire? Seema Patel, Kalpana Dasgupta, Arfath Mustafa, Ridhi Sood

Figures

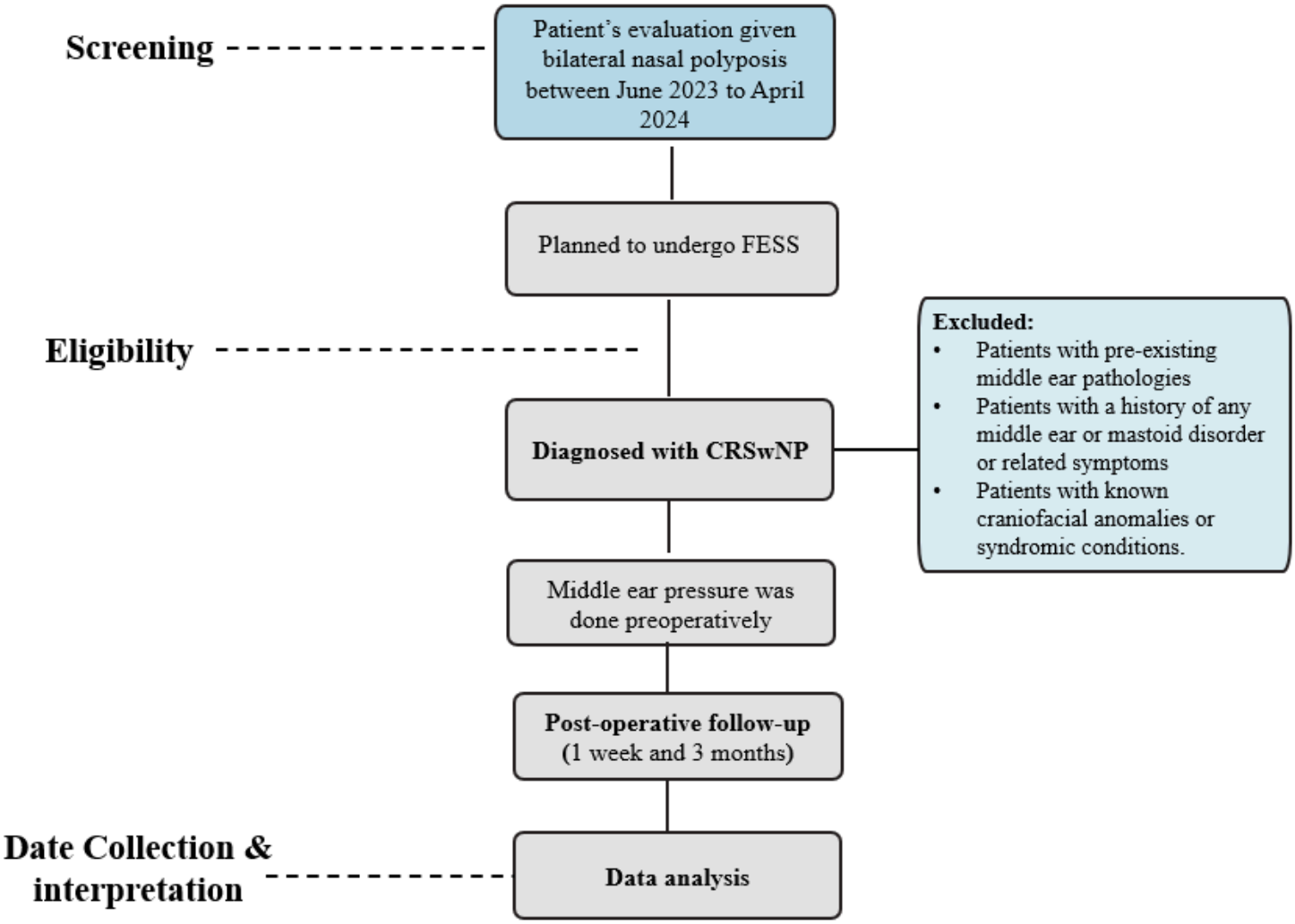


Figure 1

The study flow