



GLOBAL JOURNAL OF MEDICAL RESEARCH: J
DENTISTRY & OTOLARYNGOLOGY
Volume 23 Issue 3 Version 1.0 Year 2023
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4618 & Print ISSN: 0975-5888

The Role of Classification of Endoscopic Sinus Surgery in Surgical Planning

By Dr. Nanda Kishore G., Dr. Satish Chandra Tripuraneni,
Dr. Sravanthi K. K. & Dr. Sameera G

Dr. Pinnamaneni Siddhartha Institute of Medical Sciences & Research Foundation

Abstract- Endoscopic sinus surgery being an approach, there is no proper classification system to address the extent of surgery required for Sinonasal pathologies. The current study attempts to propose and evaluate the role and efficacy of a classification system for endoscopic sinus surgery in addressing various Sinonasal and skull base pathologies.

Materials and methods: It's a prospective study that included 50 patients. We classified ESS into six types based on the extent of surgery. After thorough evaluation, depending on the extent of the disease, all 50 patients were planned and treated according to the classification. Patients were followed for one year.

Keywords: endoscopic sinus surgery, sino nasal pathologies, CRS, ESS.

GJMR-J Classification: NLM: WV 29, WF 300



Strictly as per the compliance and regulations of:



© 2023. Dr. Nanda Kishore G., Dr. Satish Chandra Tripuraneni, Dr. Sravanthi K. K. & Dr. Sameera G. This research/review article is distributed under the terms of the Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0). You must give appropriate credit to authors and reference this article if parts of the article are reproduced in any manner. Applicable licensing terms are at <https://creativecommons.org/licenses/by-nc-nd/4.0/>.

The Role of Classification of Endoscopic Sinus Surgery in Surgical Planning

Extent of Surgery for Sino Nasal Pathologies

Dr. Nanda Kishore G. ^α, Dr. Satish Chandra Tripuraneni ^σ, Dr. Sravanthi K. K. ^ρ & Dr. Sameera G ^ω

Abstract- Endoscopic sinus surgery being an approach, there is no proper classification system to address the extent of surgery required for Sinonasal pathologies. The current study attempts to propose and evaluate the role and efficacy of a classification system for endoscopic sinus surgery in addressing various Sinonasal and skull base pathologies.

Materials and methods: It's a prospective study that included 50 patients. We classified ESS into six types based on the extent of surgery. After thorough evaluation, depending on the extent of the disease, all 50 patients were planned and treated according to the classification. Patients were followed for one year.

Results: The average symptom score improvement was 95.6 % in all the 50 patients we treated. Only in 2 cases, we deviate from the pre-planned procedure.

Conclusion: So, the current study with the analysis of the technique and results, supports this classification of endoscopic sinus surgery into six types can be helpful but may require a multi-center study for further evaluation.

Keywords: endoscopic sinus surgery, sino nasal pathologies, CRS, ESS.

I. BACKGROUND

Functional endoscopic sinus surgery is a concept to approach sinus pathology, although the term was coined by Kennedy in 1985. It came into existence through the pioneering work of Messerklinger and Stammberger in 1978. It is the primary treatment modality in chronic rhinosinusitis patients who failed with maximal medical therapy. The FESS technique is based on the hypothesis that the osteomeatal complex (OMC) is the critical area in the pathogenesis of chronic rhinosinusitis. The removal of mechanical obstruction in the OMC area leads to proper ventilation, drainage, and resolution of secondary mucosal changes without touching the mucosa in these sinuses.

Author α ω: Associate professor, Department of otorhinolaryngology & Head and neck surgery, Dr. Pinnamaneni Siddhartha institute of medical sciences & Research Foundation.

<https://orcid.org/0000-0001-5739-0554>,

<https://orcid.org/0000-0001-8582-5797>

Corresponding Author σ: Professor, Department of otorhinolaryngology & Head and neck surgery, Dr. Pinnamaneni Siddhartha institute of medical sciences & Research Foundation.

e-mail: sctripuraneni@yahoo.com

<https://orcid.org/0000-0002-1813-4758>

Author ρ: Senior resident, Department of otorhinolaryngology & Head and neck surgery, Dr. Pinnamaneni Siddhartha institute of medical sciences & Research Foundation.

<https://orcid.org/0000-0002-7640-0436>

The term FESS is generalized and applied to any technique used to treat Sinonasal pathology irrespective of the group of sinuses involved, the extent of the disease, and even the type of the pathology. Furthermore, contemporary surgeons, following the work of the pioneers of rhinology, expanded the limits beyond the nose and paranasal sinuses with a nasal endoscopic approach to treat. Areas of the skull base were also accessed and different types of procedures amenable to this approach revolutionized the field of endoscopic sinus surgery. However, there is a lack of a standardized classification system that accurately describes the procedure to be performed. The surgical technique needs rationalization which helps in individualizing the technique for documentation and for comparing the results and outcome. This study attempts to propose and evaluate the role and efficacy of the classification system for endoscopic sinus surgery in addressing various Sinonasal and skull base pathologies. The classification is based on the symptoms, clinical findings, diagnostic nasal endoscopy, and CT scan findings. In this study, we want to standardize the surgical steps required for addressing the specific pathology and anatomical variations with maximal benefit and minimal alteration of the mucociliary clearance pathways

II. METHODS

This is a prospective study performed in a tertiary care center. The present study includes the evaluation of 50 cases of endoscopic sinus surgery with a follow-up period of one year. The study group constituted of patients with Sino-nasal pathologies who required surgical intervention.

Ethical approval: This is an observational study. The institutional ethics committee has confirmed that no ethical approval is required. (Ref: 33/IEC/20)

Informed consent: Written informed consent of patients was obtained following a detailed explanation that their data will be used for publication purposes. We haven't performed any new procedure only used the data obtained from their treatment process.

Inclusion criteria: Patients of age (5-70 years) and both sexes with various Sinonasal and skull base pathologies who require ESS were included.

All the patients were evaluated clinically, endoscopically, and radiologically. Based on these clinical, endoscopic, and radiological findings the type of endoscopic sinus surgery to be done is decided. Further by correlating the intraoperative findings with the preoperative findings any deviation from the predecided type of surgery was documented.

The classification system for ESS adopted was:

Type 1

Septoplasty+/-, partial uncinectomy, middle meatal antrostomy, with or without concha bullosa reduction

Possible indications: Localised maxillary antrum disease – cysts/polyps, Antro choanal polyp, Fungal ball in the maxillary antrum

Type 2

Type 1 plus bullectomy, ethmoidal clearance anterior to basal lamella, frontal

Clearance (including Draf 1 and 2 – endoscopic frontal sinusotomy)

Indications: Isolated frontal, anterior ethmoidal, and maxillary disease, Frontoethmoidal mucocoele/pyocoele, Frontoethmoidal Osteomas

Type 3

Type 2 plus opening basal lamella, posterior ethmoidal cell clearance with or without Sphenoidotomy.

Symptoms Distribution

Indications: Sinonasal polyposis, Allergic fungal sinusitis, Pan sinusitis

Type 4

Type 3 plus skull base/lamina identification with mucosal stripping, with or without Draf 3 procedure

Indications: Extensive Sinonasal polyposis, Fungal rhinosinusitis, Benign tumors

Type 5

Nonsinus disease

As an approach

Normal nasal and sinus anatomy

Indications: Endoscopic dacryocystorhinostomy, Skull base surgeries, Juvenile nasopharyngeal angiofibroma, Orbit and optic nerve decompression, Pituitary lesions

Type 6

Revision surgery

Indications: Recurrent disease, Distorted anatomy, Mucociliary disorders, Malignant tumors

III. OBSERVATIONS AND RESULTS

A total of 50 patients with various Sino nasal pathologies were included. Of the 50 patients, 33 had bilateral disease and 17 were with unilateral disease so finally making a tally of 83 sides.

Table 1

Symptom	Number of patients	Percentage
Nasal obstruction	46	92
Nasal discharge	41	82
Postnasal drip	35	70
Headache/Facial pain	43	86
Epistaxis	4	8
Disturbance of smell	18	36
Swelling/Deformity	3	6
Snoring	12	24
Change in speech	8	16

Table 2: Distribution of pathology in different sinuses

Pathological findings	Number of sides (/100)
Maxillary sinus	
Mucosal thickening	35
OMC block	15
Sinonasal Polyps	4
Allergic Fungal rhinosinusitis	5
Retention sinusitis	12
Antro choanal polyp	4
Sinonasal tumor	1
Total	76
Anterior ethmoid sinus	
Mucosal thickening	37

Sinonasal polyposis	16
Allergic Fungal rhinosinusitis	5
Sinonasal tumor	1
Total – 59	
Posterior ethmoids	
Mucosal thickening	16
Sinonasal polyposis	16
Allergic Fungal rhinosinusitis	5
Sinonasal tumor	1
Total – 38	
Frontal sinus	
Mucosal thickening	29
Sinonasal polyposis	4
Allergic fungal rhinosinusitis	4
Air fluid level	12
Sinonasal tumor	1
Total -50	
Sphenoid sinus	
Mucosal thickening	14
Sinonasal polyposis	4
Allergic Fungal rhinosinusitis	4
Air fluid level	15
Sinonasal tumor	1
Total - 38	
Polyps	
Sinonasal polyposis	4
Ethmoidal polyposis	12
Antro choanal polyp	4
Allergic Fungal rhinosinusitis	4
Total - 24	
Sinonasal tumor	1

A total of 83 diseased sides were identified. Maxillary sinus involved in 76 sides. The unilateral disease was seen in 17 patients and bilateral disease in 33 patients. Fungal sinusitis was seen only on 5 sides. Bilateral Fungal rhinosinusitis was seen in 2 patients accounting for 4 sides. Unilateral fungal sinusitis involving maxillary and ethmoids is seen in one patient.

Other unilateral diseases are Antro choanal polyp (4), odontogenic maxillary sinusitis (4), CSF rhinorrhoea (2), inverted papilloma (1), and chronic rhinosinusitis (5). Two patients are with extensive Sinonasal polyposis accounting for 4 sides. Bilateral ethmoidal polyps were seen in 6 patients. The remaining 23 patients are having bilateral pansinusitis.

Surgical Management: Planned Type

Table 3: Distribution of various Sino nasal pathologies under types of ESS

Type & indication	Unilateral	Bilateral	total
Type 1			
Antro choanal polyp	2		
Odontogenic maxillary sinusitis	4		
Isolated OMC block	2	2(4)	
Isolated maxillary sinusitis	2	3(6)	20
Type 2			
Anterior group sinusitis	1	10(20)	21
Type 3			
Fungal sinusitis	1		
Ethmoidal polyposis		6(12)	
Pan sinusitis		6(12)	25
Type 4			
Inverted papilloma	1		
Extensive Sinonasal polyposis		2(4)	
Allergic fungal rhinosinusitis		2(4)	9
Type 5			
CSF rhinorrhoea	2		2
Type 6			
Recurrent Antro choanal polyp	2		
Recurrent pansinusitis		2(4)	4

*Type of ESS Performed**Table 4:* No. of patients under different types of ESS performed

Type	No. of sides	Unilateral	Bilateral	Percentage
Type 1	18	8	5(10)	21.6
Type 2	23	3	10(20)	27.7
Type 3	25	1	12(24)	30.1
Type 4	9	1	4(8)	10.8
Type 5	2	2		2.40
Type 6	6	2	2(4)	7.22
	Total -83	Total - 17	Total - 33	

The deviation from the planned type was seen between type 1 and 2, i.e., two sides with unilateral disease that were originally under type 1 are converted to type 2.

*Surgical Outcome**Table 5:* Preoperative & postoperative symptoms- the percentage of improvement

Symptom	Pre-op percentage	Post-op percentage	Percentage improvement
Nasal obstruction	92	2	97.8
Nasal discharge	82	6	92.6
Postnasal drip	70	10	85.7
Headache / facial pain	86	4	95.3
Snoring	24	0	100
Change in speech	16	0	100
Disturbance of smell	36	2	94.4
			Average improvement – 95.1

The overall subjective improvement of 95.1% was seen regarding the symptoms. With respect to specific symptoms, improvement was noted in 85 to 100% of individuals. The greatest improvement was seen among patients with nasal obstruction accounting for about 97.8 %

The post-operative endoscopic results showed a patent maxillary ostium in 81 cases out of 83 sides performed. There was a circumferential narrowing of the maxillary ostium on two sides in which type 1 surgery was performed. This was due to the encroachment of anterior ethmoidal cells. There was mucosal edema

around the frontal ostium on 4 sides, of which 2 were under type 2 and 2 were under type 3. Polyps were present in the maxillary sinus cavity on 5 sides, two were under type 3 and 3 were under type 4. Polyps in the anterior ethmoids were on 4 sides, two were under type 3 and two were under type 4 which are also the same in posterior ethmoids. Mucosal edema in the ethmoids was present on 6 sides, 2 were under type 3 and 4 were under type 4. The sphenoid ostium showed mucosal edema on two sides under type 3. In both type 5 and 6, endoscopies were unremarkable.

*a) Percentage improvement for different types**Table 6:* Outcome in different types of ESS

Type	Planned	Performed	Successful outcome	Percentage of success
1	20	18	16	88.8
2	21	23	23	100
3	25	25	25	100
4	9	9	9	100
5	2	2	2	100
6	4	4	4	100

IV. DISCUSSION

The primary objective of FESS is to re-establish the physiological pattern of ventilation and clearance. The osteomeatal complex (OMC) and sphenoethmoidal recess (SER) are often the primary targets. In treating CRS, the basic concept of FESS should always be adhered to, i.e., to remove the diseased mucosa and bony septa in the vital areas (OMC, SER) with preservation of normal tissue and widening the true natural Ostia. Uninvolved sinus should be left alone. More extensive surgery may be necessary for complicated rhinosinusitis, extensive fungal or polyp disease, and tumors. Each patient should be individually assessed to determine the site of pathology and obstruction, and surgery is tailored to address them¹.

In this regard, we want to establish a classification for functional endoscopic sinus surgery based on the clinical, endoscopic, and CT scan findings to accurately determine the extent and type of pathology.

One such attempt was made by Panje and Anand^{2,3}, in 1993 who developed a classification system for CRS based on the preoperative extent of sinus disease as determined by CT imaging.

Type 1: Uncinectomy with or without agger nasi exenteration

Type 2: Uncinectomy, bulla ethmoidectomy, removal of the sinus lateralis mucous membrane, and exposure of the frontal recess or frontal sinus.

Type 3: Type 2 plus maxillary sinus antrostomy through the natural sinus ostium

Type 4: Type 3 plus complete posterior ethmoidectomy

Type 5: Type 4 plus sphenoidotomy and stripping of the mucous membrane

In 2013, the Japanese Rhinologic Society proposed a simple classification for endoscopic sinus surgery (ESS)⁴. This classification consists of five procedures

Type I: Fenestration of the osteomeatal complex, with uncinectomy and widening of the natural ostium;

Type II: Single-sinus procedure, with manipulating the inside of the sinus;

Type III: Polysinus procedure;

Type IV: Pan sinus procedure;

Type V: Extended procedure beyond the sinus wall).

The classification proposed in the current study is

A formal septoplasty was done whenever endoscopic access to the middle meatus is difficult irrespective of the type of surgery performed.

Type 1

Extent: uncinectomy and middle meatal antrostomy with or without concha bullosa reduction

Indications: Antro choanal polyp, odontogenic maxillary sinusitis, chronic rhinosinusitis (isolated maxillary sinusitis).

The disease in the above conditions is mainly confined to the infundibulum. Resection of the uncinate process and widening the natural ostium of the maxillary sinus by removing the mucosa in the fontanelle anteriorly and inferiorly is sufficient to remove this mechanical obstruction without touching the adjacent structures. In patients with an Antro choanal polyp which usually comes out through the accessory ostium, removing the uncinate process and joining the accessory and natural ostium must be sufficient to provide proper ventilation. In the current study, the results of more than 92% cure rate have been proved that. Daniel Simmen et al⁵ suggest infundibulotomy (partial uncinectomy) with or without maxillary sinusotomy for the above pathological conditions.

Type 2

Extent: type 1 plus bullectomy, ethmoidal clearance anterior to the basal lamella, frontal clearance including endoscopic frontal sinusotomy (Draf 1 and 2) procedures.

Indications: Isolated anterior group sinusitis, frontal recess disease. The technique includes uncinectomy, middle meatal antrostomy, ethmoidal clearance anterior to the basal lamella, removal of Haller cells, and frontal recess surgeries (Draf1 and 2 frontal sinusotomies). The patients with isolated frontal sinusitis, combined maxillary and frontal sinusitis, anterior group sinusitis, and Frontoethmoid mucocoele, Osteomas are included. In these cases, in addition to clearing the disease from the maxillary sinus drainage pathway, the ethmoid air cells anterior to basal lamella are addressed with bullectomy, removal of Haller cells where they encroach upon the posterior part of the maxillary ostium to create wider antrostomy. The block in the frontal recess is cleared by addressing the agger nasi, frontal cells, and mucosal disease. As the drainage pathways for the anterior and posterior groups of sinuses are different, removing the mechanical obstruction and addressing the anatomical variations contributing to the disease process in these sinuses is sufficient without touching the uninvolved posterior group. In the current study, the postoperative success rate of 100% for type 2 fess supports this. Daniel Simmen et al⁵ suggest that frontoethmoidectomy with or without frontal sinusotomy for patients with frontal sinusitis, mucocoele, osteoma, and partial anterior ethmoidectomy for isolated anterior ethmoid and or maxillary/frontal sinus disease.

Type 3

Extent: type 2 plus ethmoidal clearance posterior to basal lamella and sphenoidotomy

Indications: fungal rhinosinusitis, ethmoidal polyposis, chronic rhinosinusitis involving all sinuses

In type 3, the technique includes uncinectomy, MMA, anterior ethmoidectomy, frontal recess surgery, posterior ethmoidectomy, and sphenoidotomy. The patients with pansinusitis, bilateral ethmoid polypoidosis with retention sinusitis, and allergic fungal sinusitis are included. This technique is aimed at reversible mucosal changes in paranasal sinuses because of the poor ventilation, creating wider sinusotomies, and removing the mechanical obstruction without radical stripping off all the mucosa is sufficient for proper ventilation, drainage, and resolution of secondary mucosal changes. In the current study, postoperative results of 100% support our classification.

Type 4

Extent: type 3 plus skull base/lamina identification, stripping of the mucosa, with or without Draf 3 or modified Lathrop procedure

Indications: inverted papilloma, extensive Sinonasal polypoidosis, allergic fungal rhinosinusitis.

In type 4, the technique involved is radical or extensive removal of all the diseased mucosa and allergic fungal mucin up to the skull base and lamina papyracea. The patients with extensive Sinonasal polypoidosis, allergic fungal rhinosinusitis, and benign Sinonasal tumors are included. This is aimed at the long-standing sinus pathologies that lead to irreversible mucosal damage. The aim of this procedure is to create wide sinusotomies without any obstructions and remove all the irreversibly damaged mucosa rather than conservatively targeting the specific drainage pathways. In the current study results nearing 100% support our classification

Histopathological evaluation of these patients' mucosa shows irreversible changes with subepithelial basement membrane thickening due to collagen deposition, myofibroblasts accumulation with subsequent deposition of extracellular matrix molecules, and pseudocyst formation in nasal polyps. This clinical evidence supports a surgical philosophy that a radical or extended surgical approach (rather than conservatively targeting OMC obstruction) may lead to improvement⁶.

Type 5

In this category, endoscopic sinus surgery is used as an approach to access areas beyond the nose and paranasal sinuses like the skull base, Orbit, and Sella with normal Sinonasal anatomy.

In type 5, patients with non-sinus pathology in whom the endoscopic approach is used to access areas like skull base, angiofibroma, pituitary, orbit, and optic nerve were included. The endoscopic approach to these areas requires comprehensive knowledge about the endoscopic skull base and even radiological anatomy along with expertise in handling the instruments beyond what is required for the conventional functional endoscopic sinus surgery, which

makes it into an entirely different leap. So, we included them in a separate group.

Type 6

Any revision endoscopic sinus surgery as most of the time there will be distorted anatomy or loss of landmarks so the surgeon has to be very cautious.

In type 6, patients with a recurrent disease requiring revision surgery, those with mucociliary disorders are included. Revision surgery in these cases with distorted anatomy needs a clear knowledge to identify the remaining anatomical landmarks (middle turbinate, skull base) before proceeding to clear the disease. Through endoscopic examination before and on the table during the surgery along with CT scan evaluation is a must. Revision surgeries are most commonly known for intraoperative complications. So, in our classification, we included them in group 6.

The proposed classification for ESS adheres to the basic principle of mucosal preservation⁸.

Our study also substantiates the concept of limited resection, addressing the critical areas with more than 90% of consistent results.

The paranasal sinuses do have an intrinsic mucociliary clearance mechanism. The disturbance to that mechanism either by inflammatory pathology or mechanical obstruction leads to the development of rhinosinusitis ranging from acute reversible to chronic irreversible mucosal disease.

The treatment is a combination of medical and surgical modalities. The medical management is directed at the inflammatory process and surgery aims to remove the obstacles to the natural drainage pathways, but not strip all the inflamed mucosa

Our classification is based upon the above principles and our study has proved the concept of clearing the obstacles for the mucociliary clearance is sufficient in treating CRS along with medical management. Each patient should be individually assessed to determine the site of pathology and obstruction, and the surgical technique is tailored to address that specific pathology.

V. CONCLUSION

The modern endoscopes revolutionized the management of sinus diseases, replacing the most traditional mucosal stripping techniques to treat the pathology more functionally leading to the evolution of functional endoscopic sinus surgery (FESS). With the availability of all the contemporary investigations knowing the extent of the disease beforehand should help us in planning the extent of surgical treatment. The classification of endoscopic sinus surgery proposed in the study is useful in that regard as overdoing may lead to damage to the mucosa which is vital for the proper function of sinuses at the same time underdoing may result in recurrences.

So, the current study with the analysis of the technique and results proposes that this classification of endoscopic sinus surgery into six types can be useful but may require a multi-center study for further evaluation.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of Interest: The authors declare that they have no conflict of interest.

Declarations

Ethics approval and consent to participate: Not applicable

Consent for publication: Not applicable

Availability of data and material: All data generated or analyzed during this study are included in this published article

Competing interests: The authors declare that they have no competing interests

Funding: Not applicable

Authors' contributions:

- i. Dr. Nanda Kishore G, associate professor. the principal investigator who designed the study
- ii. Dr. Satish Chandra Tripuraneni, corresponding author
- iii. Dr. Sravanthi K K. the person who collected all the data and analysed the data
- iv. Dr. Sameera G, who helped in collecting and analysis of the data

Acknowledgments: Not applicable

REFERENCES RÉFÉRENCES REFERENCIAS

1. Deryani Lal, James A. Stankiewicz. Primary sinus surgery. Cumming's otolaryngology, Head and Neck Surgery, chapter 41, 5th ed, vol (2). 2010 p (739-758).
2. Panje WR, Anand VK. Endoscopic sinus surgery indication, diagnosis, and technique. In: Anand VK, Panje WR, eds. Practical Endoscopic Sinus Surgery. New York: McGraw-Hill, 1993; 68-86.
3. K. Marsot-Dupuch. Anatomic Variations of Paranasal Sinuses: Application to Functional Endoscopic Surgery Rivista di Neuroradiologia, Volume: 13 issue: 1_suppl, page(s): 221-229, May 1, 2000
4. Kengo Kanai, M.D., Mitsuhiro Okano, M.D. Evaluation of a new and simple classification for endoscopic sinus surgery, Allergy Rhinol 8: e118 – e125, 2017;
5. Daniel Simmen, Nick S. Jones. Manual of Endoscopic Sinus Surgery: and its extended applications. Ch 5. How? Operative Procedures: A step-by-step safe and Logical approach. Vol (1). 2nd ed. P (50).

6. Ahmed Bassiouni, Philip G Chen, Peter-John Wormald. Mucosal remodeling and reversibility in Chronic Rhinosinusitis. Curr Opin Allergy Clin Immunol. 2013; 13(1).