

Original Article

Outcome of Endoscopic Sinus Surgery in Inflammatory Sinonasal Patients: A Descriptive Study

S. Hashemi MD*, M. Rostami MD*, S. Abtahi MD*

ABSTRACT

Background: Various systems of Computerized Tomographic (CT) staging and scoring have been applied to define the extent of sinus abnormality and the degree of mucosal thickening. Functional Endoscopic Sinus Surgery (FESS) has been used with considerable success rate to treat chronic sinonasal patients unresponsive to medical therapy. This study was designed to investigate the relationship between the result of CT scoring and staging and the outcome of surgery.

Methods: The one year outcome of FESS together with preoperative CT staging and scoring were determined and compared with each other.

Results: Compared to those with higher stages (III and IV), patients with lower preoperative CT stages (I and II) had a significantly higher successful outcome of surgery. CT staging and scoring were obviously correlated.

Conclusions: The results of this study show that preoperative CT staging and scoring are two useful means for better prediction of the long-term outcome of surgery one year after FESS.

Keywords: Endoscopic Sinus Surgery, Chronic sinusitis, Computerized Tomography

Computerized Tomographic (CT) scan of sinonasal structures is the mainstay of diagnosis in chronic sinusitis¹. Various systems of CT staging and scoring have been proposed to define the extent of sinus abnormality and the degree of mucosal thickening. Although Functional Endoscopic Sinus Surgery (FESS) has been used as a relatively less invasive procedure than its older counterparts in the surgical management of chronic sinonasal patients, the results of this procedure have not always been desirable^{1, 2}. This technique is mainly used in case of chronic recurrent sinusitis unresponsive to a 3–6 week course of appropriate medical therapy³.

Estimating the outcome of FESS may help recognizing the patients who require more invasive procedures than FESS for the treatment of their chronic sinonasal inflam-

matory process. Determining the correlation between CT staging and scoring on one hand and the results of FESS on the other hand may help estimating the outcome of surgery. In fact CT scan of sinuses provides a virtual view of the surgical field in patients undergoing FESS. These benefits are hardly met by traditional X-ray views (e.g. Water's, Caldwell, submentovertex, and Rhese views) especially for evaluation of posterior ethmoid cells⁴. Preoperative coronal CT scan of paranasal sinuses facilitates studying important infrastructures of sinonasal area including the infundibulum, carotid artery, optic nerve, ostiomeatal complex, and the base of skull^{5, 6}.

To what extent could we rely on CT findings to nominate a patient for surgical therapy, has been the subject of many

* Department of Ear, Nose, and Throat, Isfahan University of Medical Sciences, Isfahan, Iran.

Correspondence: Dr Seyed Mostafa Hashemi, Kashani medical center, Isfahan, Iran.

This work is from the Department of Ear, Nose, and Throat, Isfahan University of Medical Sciences, Isfahan, Iran.

studies. CT staging and scoring methods have been adopted for this purpose, but there are still some shortcomings. Some authors believe that most patients remain clinically asymptomatic before sinus mucosal thickening reaches 3 mm⁷.

This study was designed to assess the relationship between the results of CT scoring and staging and patients' symptoms to decide which patient will get most benefit by FESS.

Materials and Methods

The study involved 162 patients who underwent FESS for their chronic sinonasal inflammatory process unresponsive to a 3–6 week course of medical therapy in a University hospital between 2000 and 2002. The long-term success rate of FESS was analyzed with respect to preoperative CT stage and score. Data were extracted from the patients' hospital records and completed during follow-up visits. CT staging was performed according to the Metson and Gliklich⁸ (Table 1). In addition, CTs were scored using the method proposed by Thawley and Piccirillo⁹ as:

$$\text{Total CT Score} = 2 \times X_{\text{LEFT}} + Y_{\text{LEFT}} + Z_{\text{LEFT}} + 2 \times X_{\text{RIGHT}} + Y_{\text{RIGHT}} + Z_{\text{RIGHT}}$$

in which:

X = number of sinuses with opacification.

Y = number of sinuses without opacification but with mucosal thickening.

Z = 2 (if there is mucosal thickening in ostiomeatal complex).

LEFT and RIGHT subscripts stand for left and right sides respectively.

Patients were visited postoperatively every two month for three times and then at 6 months and one year postoperatively. During follow-up visits they were asked whether any symptoms remained. Eventually after the last visit, the outcome of FESS was evaluated as complete improvement (class 1), partial improvement (class 2), no change (class 3), and deterioration (class 4). Classes 1 and 2 were labeled as successful while classes 3 and 4 were regarded as unsuccessful.

Data were presented as n (%). Percentages were rounded to the nearest

integer. Round off error was $\leq 1\%$. Data were compared between low (I and II) and high (III and IV) stages of preoperative CT using Fisher exact test. Correlations between CT stages and scores and between CT stages and outcome were assessed by Spearman correlation. A Pvalue < 0.05 was considered as statistically significant. Data were analyzed using SPSS 10.0.

Results

The frequencies and percentages of different anatomic variations in preoperative CT of paranasal sinuses evaluated as follows:

Significant septal deviation 32 (19.7%) cases, concha bullosa 8 (5%) cases, Haller cell 6 (3.7%) cases, agger nasi cell 19 (11.7%) cases, onodi cell 3 (1.8%) cases, paradoxical middle turbinate 2 (1.2%) cases, maxillary sinus hypoplasia 5 (3%) cases, anterior clinoid process pneumatization 11 (6.8%), variation of ansate process 3 (1.8%). In 12 (7.4%) cases more than two variations were seen. Thirty one (19%) patients had significant septal deviation on CT but only 12 (7.4%) needed septoplasty.

Proportion of patients with successful surgical outcome (classes 1 and 2) was significantly higher in patients with lower preoperative CT stages (I and II) compared to those with higher stages (III and IV) (83 (98%) vs. 66 (86%) in higher stages, $P = 0.007$; Table 2).

Frequency distribution of preoperative CT scores is depicted in Figure 1. CT staging and scoring were interrelated as follows:

In patients with stage I, 16 (38%) had scores 0 – 4, 23 (54.8%) scored 5 – 9, 2 (4.8%) scored (10 – 14) and one patient had a score of 16. In patients with stage II, 9 (21%) had scores 5 – 9, 16 (37%) scored 10 – 14, 17 (39.5%) scored 15 – 19, and one patient had a score of 22. In patients with stage III, 6 (12.5%) had scores 10 – 14, 20 (41.7%) scored 15 – 19, and 22 (45.8%) scored 20 – 24. All patients with stage IV had CT scores ≥ 20 . CT stages were significantly correlated with surgical outcome ($r = 0.4$; $P < 0.05$). There was a very strong and significant correlation

between CT stages and scores ($r = 0.88$; $P = 0.000$).

Discussion

In this study proportions of different preoperative CT stages were assessed and correlated with their corresponding outcome after one year of FESS. There is a strong correlation between CT stage and surgical outcome, which is evident from the high proportion of patients in lower CT stages that have successful surgical outcome. In addition there is a high correlation between CT stages and scores which means higher stages of preoperative CTs were associated with higher CT scores.

Metson & Gliklich introduced a new system of CT staging for diagnostic and prognostic purposes in chronic rhinosinusitis patients¹⁰. In a review of their patients they found that in limited pathologies, surgical success rate was high. In the study by Sobol et al¹¹ on 393 patients it was shown that extension of disease, massive polyposis and pan rhino sinusitis which were the most important adverse prognostic factors were prevalent among patients with high preoperative CT stages.

Coronal CT of sinuses can identify many anatomic variations and obstruction, which have significant impacts upon surgical approach and outcome^{12,13}.

The benefits of FESS were also documented in previous reports^{14,15}. The results of this study show that only one third of patients who have significant septal deviation on preoperative CT need surgical correction during FESS.

Incidence of agger nasi cell was reported in previous studies to be 3 – 80%^{14 - 16}. In this study the incidence was relatively low (11.7%). Pneumatization of anterior clenoid process, which may be associated with vulnerability of optic nerve, was seen in 6.8% of cases in the present study, which is comparable to previous reports¹⁶.

One year outcome analysis shows that, sinonasal symptoms in patients with higher preoperative CT stages diminish more slowly than in those with lower stages. In other

words, in advanced cases, complete disappearance of symptoms is relatively lower compared to those in lower stages.

In conclusion, CT staging and scoring are two useful means for prognostic purposes in chronic sinonasal patients. They have a very strong correlation with each other. In addition CT staging has remarkable correlation with one year surgical outcome following FESS.

Table 1. Computerized Tomographic Staging used in this study⁹.

Stage	Finding
0	Normal findings, mucosal thickening below 2 mm
I	Any unilateral abnormality or disease
II	Bilateral disease, limited to ethmoid or maxillary sinus
III	Bilateral disease, at least in frontal or sphenoid sinus
IV	Pan Rhino sinusitis

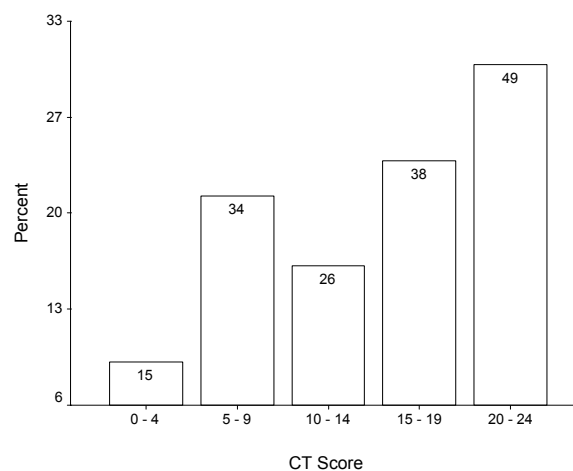


Figure 1. Distribution frequency of different CT scores in this study. Numbers on bars are count.

Table 2. Frequencies of different classes of functional endoscopic sinus surgery outcome against different stages of preoperative CT findings after one year postoperatively.

CT Stage	Total	Class			
		1	2	3	4
I	42 (26)	37 (88)	4 (9.6)	1 (2.4)	0 (0)
II	43 (27)	33 (76.6)	9 (21)	0 (0)	1 (2.4)
III	48 (30)	23 (48)	20 (42)	1 (2)	4 (8)
IV	29 (18)	12 (41.4)	11 (38)	3 (10.3)	3 (10.3)
Total	162 (100)	105 (65)	44 (27)	5 (3)	8 (5)

Refer to the text and Table 1 for the definition of different classes and stages

References

- Allen WE. Radiologic Anatomy of paranasal sinuses. In: Allen WE. English GM(ed). Otolaryngology. Vol 2, WB Lippincott, Philadelphia, 1994: 136.
- Kainz J, Stammberger H. Danger areas of the posterior rhinobasis. An endoscopic and anatomical-surgical study. *Acta Otolaryngol.* 1992; 112(5): 852–61.
- Harnsberger HR. Head & Neck imaging. In: Hajek PC. Handbook in radiology: Chicago, Mosby, 1990: 165.
- Najaffi M. Sinonasal endoscopic surgery. In: Najaffi M. Radiologic evaluation, Allavi Publication, Tehran, 1376: 89.
- Babbel R, Harnsberger HR, Nelson B, Sonkens J, Hunt S. Optimization of techniques in screening CT of the sinuses. *Am J Neuroradiol.* 1991; 12(5): 849–54.
- Zinreich SJ, Kennedy DW, Rosenbaum AE, Gayler BW, Kumar AJ, Stammberger H. Paranasal sinuses: CT imaging requirements for endoscopic surgery. *Radiology*, 1987; 163(3): 769–75.
- Rak KM, Newell JD 2nd, Yakes WF, Damiano MA, Luethke JM. Paranasal sinuses on MR images of the brain: significance of mucosal thickening. *AJR Am J Roentgenol.* 1991; 156: 381-4.
- Gliklich RE, Metson R. CT staging systems for outcomes research. *Am. J. Rhinology*; 1998; 8: 291–297
- Piccirillo JF, Thawley SE, Haiduk A, Kramper M, Wallace M, Hartman JM. Indications for sinus surgery: how appropriate are the guidelines? *Laryngoscope*, 1998; 108(3): 329–5.
- Kane K. Australian experience with functional endoscopic sinus surgery and its complication. *Ann. Otol Rhinol Laryngol.* 1993; 102 (8 pt 1): 613–4.
- Sobol SE. Long-term results of ethmoid & other sinuses surgery. *J. Otolaryngolgy.* 1998; 27: 252–7.
- Yousem DM. Imaging of sinonasal inflammatory disease. *Radiology* 1993; 188(2): 303–14.
- Scribano E, Ascenti G, Loria G, Cascio F. The role of the ostiomeatal unit anatomic variations in inflammatory disease of the maxillary sinuses, *Eur J Radiol* 1997; 24(3): 172-4
- Terrel J. Primary sinus surgery. In: Cummings CW. Otolaryngology, Head & Neck Surgery: Philadelphia, Mosby, 1998: p1181
- Laine FJ, Smoker WR. The ostiomeatal unit and endoscopic surgery: anatomy, variations, and imaging findings in inflammatory diseases. *Am J Roentgenol.* 1992 ; 159(4): 849-57
- Lloyd GA. CT of the paranasal sinuses: study of a control series in relation to endoscopic sinus surgery. *J Laryngol Otol.* 1990; 104(6): 477-481.