Relationship between the endoscopic, radiological, and operative findings in sinonasal polyposis
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Introduction
The history of nasal polyps goes back over 4000 years to ancient Egypt [1]. According to European paper on rhinosinusitis, chronic rhinosinusitis [with or without sinonasal polyposis (SNP)] is characterized by the presence of two or more symptoms, one of which should be nasal blockage/obstruction/congestion or nasal discharge (anterior/posterior nasal drip), or facial pain/pressure, or reduction or loss of smell for a period of greater than or equal to 12 weeks. Allergic symptoms (i.e. sneezing, watery rhinorrhea, nasal itching, and itchy watery eyes) are also to be considered. Chronic rhinosinusitis with nasal polyposis is defined as above with bilateral, endoscopically visualized polyps in the middle meatus [2]. The etiology of nasal polyposis is mainly unknown, although it has been connected with many causes like allergy, infections (bacterial and fungal), diseases associated to nasal polyps like Samter’s triad, environmental pollutants, and local host factors like deviated septum [3].

Materials and methods
A total of 30 patients with sinonasal polyposis underwent preoperative endoscopic assessment using the Meltzer staging system, radiologic evaluation using the Lund–Mackay staging system, and operative evaluation during functional endoscopic sinus surgery using the Meltzer staging system, and findings in each sinus (polyp, fungal mud, mucous, and normal) were recorded. The inclusion criteria were SNP not responding to a full course of medical treatment in the form of systemic and local corticosteroids, and cases with allergic fungal sinusitis. Exclusion criteria were patients with simple chronic sinusitis (without nasal polyposis), antrochoanal polyp, patients who had previous functional endoscopic sinus surgery (FESS), or patients with complicated sinusitis. Patients presenting with a concomitant septal deviation were included in the study and listed for a combined approach. The study received ethical committee.
approval of Kasr Al Ainy College of Medicine, and all patients gave their signed informed consent.

All 30 patients underwent

(1) endoscopic evaluation using grading of polyp system proposed by Meltzer et al. [4] (Table 1 and Fig. 1),
(2) radiological evaluation using Lund–Mackay [5] scoring system (Table 2 and Fig. 2), according to which a score of 0 = no abnormality, 1 = partial pacification, 2 = total pacification, and 0 or 2 for the ostiomeatal complex. Thus the maximum score was 24 and each side was considered separately,
(3) FESS: All patients underwent FESS, and the correlation was in two points.
(a) Endoscopic assessment using Meltzer staging system during operation.
(b) Specific correlation with finding of each sinus alone (polyp, fungal mud, mucous, and normal) (Fig. 3).

Data were then transferred to the statistical package of social science software program, version 21 (SPSS Inc., Chicago, Illinois, USA) to be statistically analyzed.

Data were summarized using mean and SD for quantitative variables, and frequency and percentage for qualitative ones.

Comparison of different scores as regards sex was performed using the independent sample $t$-test.
have a normal sinus. The frontal sinus was found to be normal in 40% of the cases, polyps were found in 30% of the cases, discharge in 15% of the cases, and fungal mud in 15%. The sphenoid sinus was found to be normal in 35% of the cases, polyps were found in 30% of the cases, followed by fungal mud in 20% and discharge in 15%.

### Discussion

In the present study, there was a highly significant positive correlation between preoperative computed tomography (CT) and operative findings [right (RT) side $r=0.731$ and left (LT) side $r=0.814$, $P<0.001$]. In agreement with our findings, Jiannetto and Pratt [6] and Stanojković [7] in their studies also showed a positive correlation between preoperative CT and operative findings ($r=0.791$, $P<0.001$; $r=0.831$, $P<0.001$), respectively. In addition, Zojaji et al. [8] and Duarte et al. [9], in their studies, showed the same results. However, there was another endoscopic staging system (Lund–Mackay endoscopy staging system) used in their study. There was a highly significant positive correlation between the preoperative endoscopic and CT staging scores (RT side $r=0.768$ and LT side $r=0.782$, $P<0.001$).

The majority of previous studies – for example, studies conducted by Casiano [11], Rosbe and Jones [12], and Deepthi et al. [10] – showed a high degree of

| CT | FESS (%) |
|----|----------|
| Lund–Mackay score | Normal | Discharge | Polyps | Fungal mud | Total |
| 0  | 15      | 0     | 0      | 0       | 15     |
| 1  | 0       | 10    | 10     | 5       | 25     |
| 2  | 0       | 15    | 35     | 10      | 60     |
| Total | 15  | 25    | 45     | 15      | 100    |

CT, computed tomography; FESS, functional endoscopic sinus surgery.

**Figure 2**

Computed tomography nose, paranasal sinuses, coronal cut, bone window of sinonasal polyposis. Lund–Mackay score (5).

**Figure 3**

Endoscopic view of right nasal cavity with a polyp extending from the middle meatus (Meltzer 2), but, during operative examination, polyps from sphenoid recess were found (Meltzer 3).
Figure 4

There was a highly significant positive correlation between preoperative endoscopic and Lund–Mackay staging scores with a $P$ value of less than 0.001, and the ($r$) Spearman correlation coefficient was (right side=0.768 and left side=0.782).

Figure 5

There was a highly significant positive correlation between preoperative endoscopic (Meltzer) and operative staging scores with a $P$ value of less than 0.001, and the ($r$) Spearman correlation coefficient was (right side=0.892 and left side=0.827).

Figure 6

There was a highly significant positive correlation between operative endoscopic and Lund–Mackay staging scores with a $P$ value of less than 0.001, and the ($r$) Spearman correlation coefficient was (right side=0.731 and left side=0.814).
agreement with our results, as they also showed a positive correlation between preoperative endoscopic and CT staging scores. However, Stankiewicz [13] reported poor correlation between the preoperative endoscopic and CT staging scores. The discrepancy between these studies regarding the correlation between the preoperative endoscopic and CT staging scores could be due to co-operation of patients during endoscopic examination, quality of tools used for examination, pre-examination, preparation, and quality of CT images. In this study, the correlation between preoperative endoscopic and operative staging scores (RT side, \( r = 0.892 \) and LT side, \( r = 0.827 \)) was slightly greater than the CT Lund–Mackay and operative staging scores (RT side, \( r = 0.731 \) and LT side, \( r = 0.814 \)). In agreement with our results, in a study conducted by Duarte et al. [9], four out of 20 cases of nasal polypus were evidenced by preoperative endoscopic examination and not by CT scan, and the patients who had negative CT scan showed sepal deviation, mucosa edema involving the middle meats, as well as adenoid and turbinate hypertrophy by preoperative endoscopic examination. Pizzichetta et al. [14], in a similar study, did not consider the CT findings in most of the studied cases to explain the symptoms of nasal obstruction, considering the endoscopic exam enough for that purpose. Preoperative endoscopic examination and CT scan can be considered complementary techniques for effective demonstration of nasal anatomy and paranasal sinuses, according to Morra et al. [15]. Such a statement can be added to the theory that the CT scan would be more specific for the assessment of paranasal sinuses, whereas, according to Pinheiro and Freitas [16], sinonasal endoscopy would have better accuracy to assess nasal fossa.

Contrary to our results, Deepthi et al. [10] found that CT Lund–Mackay and operative staging scores correlate more than does preoperative endoscopic and operative staging scores. We presume that it could be because of the difference in the used endoscopic staging systems. In the present study, Meltzer preoperative endoscopic staging system was used, whereas in the study conducted by Deepthi et al. [10], Lund–Mackay preoperative endoscopic staging system was used.

**Conclusion**

There was a highly significant correlation between the CT and the preoperative endoscopic findings with those findings observed during the operation. The degree of correlation between the preoperative endoscopic and operative findings was slightly higher than that between the CT findings and the operative findings. In the present study, it was found that both preoperative endoscopy and CT are good preoperative indicators, but there is no single procedure that can accurately diagnose SNP, and that both the preoperative CT and the preoperative endoscopic examination are complementary to each other.

### Conflicts of interest

There are no conflicts of interest.

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