Predictive Value of Lund-Mackay Radiological Scoring System in Extent of Sinus Surgery for Nasal Polyposis

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Objective: to evaluate the possibility of using the Lund-Mackay radiological scoring system as a predictor of the extent of sinus surgery for nasal polyposis by assessing the correlation between findings detected by this system and the extent of the performed surgery.

Patients and methods: 116 patients, (222 nasal sides) were operated upon in this study. Preoperative CT scans were done within 48 hours prior to surgery, and interpreted by Lund-Mackay CT scoring system. Surgical procedures were done, and surgery score of the modified Lund-Mackay system was then applied and the relation between the two previous scores was evaluated after surgery.

Results: Uncinectomy was done in 219 nasal sides. Middle meatal antrostomy was done in 206 sides. Middle turbinate resection was done in 179 sides. Out of 214 sides for which anterior ethmoidectomy was done, 1 showed no sinus opacification in CT. While out of 8 sides for which anterior ethmoidectomy was not done, 1 showed partial opacification in CT. Posterior ethmoidectomy was done in 196 sides, 3 of them showed no sinus opacification in CT while 3 out of the 26 sides for which posterior ethmoidectomy was not done showed complete sinus opacification in CT. On the other hand, 5 of 138 sides for which sphenoidotomy was done showed no sinus opacification in CT. Out of 100 sides for which frontal sinusotomy was done, 7 showed no opacification in CT. A strong correlation was found between the surgical and the radiological score ($r = 0.8$, $p < 0.001$).

Conclusions: Lund-Mackay radiological scoring of paranasal sinuses can strongly predict the extent of surgery for nasal polyposis.

Keywords: Lund-Mackay radiological scoring, surgery for nasal polyposis

Abbreviations: Nasal polyposis, CT computed tomography, MTR Middle turbinate resection, MMA Middle meatal antrostomy, OMC osteomeatal complex

INTRODUCTION

Chronic rhinosinusitis (CRS) is a common and challenging problem in Otorhinolaryngology. It affects the quality of life and cost of health care all over the world. [1]

Diagnosis of CRS is based mainly on history and physical examination. Computerized tomography (CT) of the paranasal sinuses is indicated for patients with failed medical treatment before surgery. [2-4] Shahizon and his colleagues found that CT was more accurate in detecting ostiomeatal complex involvement and presence of variations while nasal endoscopy was superior in detecting polyps. [5]

Although many surgeons believe that treatment should be based on clinical findings, Anzai and his colleagues (2004) stated that CT had a significant impact on treatment decisions in patients assumed to have chronic sinusitis. Different studies indicated that variables predicting surgical treatment were slightly different among surgeons. Significant predictors related to CT were conformity of CT abnormality and mechanical ostiomeatal complex obstruction on CT. None of CT scoring systems, subclassifying the severity of mucosal thickening, was a significant predictor of surgical treatment. [4].

To understand these conditions, many investigators tried to define this disease based on CT scores and findings. [6] Several CT staging systems have been proposed for the evaluation of CRS. The American academy of Otolaryngology has recommended the Lund-Mackay system as the preferred method for staging of CRS as it is simple and easy to apply. [7]

Notably, the Lund-Mackay system is the only system recommended by the Task Force on Rhinosinusitis for outcomes research. This scoring system is based totally

on the CT findings. Subsequently, the Task Force on Rhinosinusitis has proposed modifications of this scoring system which incorporates the presence of anatomic variants, type of surgery performed, symptom scores and endoscopic scores in addition to the CT score. [8]

There was no absolute threshold for surgery, but patients with higher Lund-Mackay scores underwent more extensive surgery. The Lund-Mackay increased with increasing grade of polyposis. This increase was also associated with symptom reduction, complications, and revision rates. [9] The current study aim was to evaluate the possibility of using the Lund-Mackay radiological scoring system as a predictor of the extent of sinus surgery in nasal polyposis by assessing the correlation between findings found on this system and the extent of the performed surgery.

PATIENTS AND METHODS

This study was done in Assiut University Hospital during the period from March 2009 to December 2012, 116 patients (70 males, 46 females), 222 sides were operated. Written informed consent was obtained from all patients. The study protocol was approved by the local ethical committee. Patients younger than 18 and those with cystic fibrosis, immunodeficiency states, benign or malignant tumors of the paranasal sinuses and recurrent cases were excluded from the study.

All patients were subjected to history taking including otorhinolaryngologic symptoms, focusing on the presence of nasal obstruction, congestion, discharge and headache. Physical examination of patients was done, using nasal speculum and 30° 2.7 mm rigid telescope to detect the presence of nasal polyps, in addition to ear, throat, head and neck examination. CT scans of the nose and paranasal sinuses, were done for all patients within 48 hours prior to surgery using bone window, 3mm cut thickness, coronal, axial and sagittal cuts, without contrast after 2 weeks course of medical treatment in the form of antibiotic, steroid, mucolytic and nasal decongestant. The CT data was interpreted by using Lund-Mackay CT scoring system which grades each paranasal sinus (maxillary, frontal, sphenoid, anterior ethmoids, and posterior ethmoids) as follows: 0, no abnormality; 1, partial opacification; 2, complete opacification. The ostiomeatal complex was scored as 0 when there was no opacification and 2 when it was obstructed. The total score possible with this system ranged from 0 to 24. A score higher than 12 was considered abnormal. [10]

Endoscopic surgery was done for all patients under general anaesthesia through endotracheal intubation and surgery score of the modified Lund-Mackay system was applied, based on whether any of the following procedures was done. These procedures were uncinectomy, middle meatal antrostomy, anterior ethmoidectomy, posterior ethmoidectomy, sphenoidotomy, frontal recess surgery and reduction of middle turbinate. The score was 0 if no procedure was done, and 1 if procedure done. The total score could range from 0 to 14 (0 to 7 on each side). [7] The relation between the two previous scores was evaluated after surgery.

Statistical Analysis: Statistical package for social science (SPSS version 16) was used for data analysis. Pearson correlation was used to determine the association between the surgical and the radiological scores**.**

RESULTS

- **Surgical procedures done for the patients:**
  - **Uncinectomy:** Uncinectomy was done in 219 nasal sides (99%). The distribution of the number of nasal sides for which uncinectomy was performed in relation to the CT findings of the paranasal sinuses is summarized in Table 1.
  - **Middle meatal antrostomy (MMA):** MMA was done in 206 nasal sides (93%). The distribution of the number of nasal sides for which MMA was performed in relation to the CT findings of the paranasal sinuses is summarized in Table 1.
  - **Middle turbinate resection (MTR):** MTR was done in 179 nasal sides (81%). The distribution of the number of nasal sides for which MTR was done in relation to the CT findings of the paranasal sinuses is summarized in Table 1.
  - **Anterior Ethmoidectomy:** Anterior ethmoidectomy was done in 214 nasal sides (96%) of which 208 (97.2 %) showed complete opacification, 5 (2.3 %) showed partial opacification and 1 (0.5%) showed no anterior ethmoid sinus opacification by CT. While for the 8 nasal sides (4%) for which anterior ethmoidectomy was not done, 1 (12.5%) showed partial opacification and 7 (87.5%) showed no anterior ethmoid sinus opacification by CT. Results are summarized in Table 1.
  - **Posterior ethmoidectomy:** Posterior ethmoidectomy was done in 196 nasal sides (88%) of which 191 (97.5 %) showed complete opacification, 2 (1 %) showed partial opacification and 3 (1.5 %) showed no ethmoid sinus opacification by CT. While for the 26 nasal sides (12%) for which posterior ethmoidectomy was not done 3 (11.5%) showed complete opacification and 23 (88.5%) showed no posterior ethmoid sinus

opacification by CT. Results are summarized in Table 1.

- **Sphenoidotomy:** Sphenoidotomy was done in 138 nasal sides (62%) of which 114 (82.6%) showed complete opacification, 19 (13.8%) showed partial opacification and 5 (3.6%) showed no sphenoid sinus opacification by CT. On the other hand, sphenoidotomy was not done in 84 nasal sides (37.8%) which have no sphenoid sinus opacification on CT. Results are summarized in Table 1.

- **Frontal sinusotomy:** Frontal sinusotomy was done in 100 nasal sides (45%), of which 88 (88%) showed complete opacification, 5 (5%) showed partial opacification and 7 (7%) showed no frontal sinus opacification by CT. While frontal sinusotomy was not done for 122 nasal sides (55%) which revealed no frontal sinus opacification by CT. Results are summarized in Table 1.

- **Correlation between the surgical and the radiological score:**

  A strong correlation was found between the surgical and the radiological score ($r = 0.8$, $p < 0.001$).

Table 1 The distribution of the number of nasal sides for which uncinectomy, middle meatal antrostomy (MMA) and middle turbinate resection (MTR) were performed in relation to the CT findings of the paranasal sinuses

CT score	Surgery score													
	Uncinectomy		MMA		MTR		Anterior ethmoidectomy		Posterior ethmoidectomy		Sphenoidotomy		Frontal sinusotomy	
	0	1	0	1	0	1	0	1	0	1	0	1	0	1
Maxillary sinus														
0	3	13	16	3	11	5	-	-	-	-	-	-	-	-
1	0	7	0	7	5	2	-	-	-	-	-	-	-	-
2	0	199	0	196	163	36	-	-	-	-	-	-	-	-
Anterior ethmoid														
0	-	-	-	-	7	1	7	1	-	-	-	-	-	-
1	-	-	-	-	3	3	1	5	-	-	-	-	-	-
2	-	-	-	-	169	39	0	208	-	-	-	-	-	-
Posterior ethmoid														
0	-	-	-	-	7	1	-	-	23	3	-	-	-	-
1	-	-	-	-	3	3	-	-	0	2	-	-	-	-
2	-	-	-	-	169	39	-	-	3	191	-	-	-	-
OMC														
0	3	6	6	3	7	2	-	-	-	-	-	-	-	-
2	0	213	10	203	172	41	-	-	-	-	-	-	-	-
Sphenoid sinus														
0	-	-	-	-	75	14	-	-	-	-	84	5	-	-
1	-	-	-	-	14	5	-	-	-	-	0	19	-	-
2	-	-	-	-	90	24	-	-	-	-	0	114	-	-
Frontal sinus														
0	-	-	-	-	107	22	-	-	-	-	-	-	22	7
1	-	-	-	-	5	0	-	-	-	-	-	-	0	5
2	-	-	-	-	67	21	-	-	-	-	-	-	0	88

DISCUSSION

Diagnosis of CRS is based mainly on history and physical examination. [2] Variables predicting surgical treatment were slightly different among surgeons. While Shahizon et al. [5] found that CT was more accurate in detecting ostiomeatal complex involvement and presence of variations, others reported that CT scoring systems, subclassifying the severity of mucosal thickening, and there is no significant predicting system of surgical treatment. [4]

The current study revealed that the ostiomeatal complex is the most commonly affected area, followed by anterior ethmoid, and maxillary sinus. This is consistent with the study of Anzai et al., [4] who reported that the presence of OMC obstruction on CT is a significant predictor for the decision of surgery. On the other hand, it does not agree with study of Shahizon and his colleagues, [5] who stated that the maxillary sinus was the commonest sinus involved either alone or with involvement of other sinuses. In their study, OMC involvement was commonly associated with mucosal thickening in the maxillary, ethmoid and the frontal sinuses. They attributed the higher frequency of maxillary sinusitis to narrowing of maxillary ostia, while the current study explains the higher frequency of OMC affection by the fact that it is a common draining channel most commonly involved in chronic rhinosinusitis. The opposition of the mucosal layer with presence of minor swelling will lead to stenosis or obstruction to the flow of the complex and narrow passages. This will in response troubles the mucocilliary clearance and causes stagnation of secretion in the maxillary, ethmoid and frontal sinuses, making them liable to infection. [11-17]

In the current study, surgical scores were found to be consistent with the radiological scores in the majority of patients. On the contrary, in few patients for whom certain surgical procedures were done, the CT showed no opacification of the corresponding areas. This was consistent with the study of Vining et al. [18] that explained this by the fact that findings such as septal spur obstructing the middle meatus, nasal polyps, narrow middle meatus with mucosal contact between the middle turbinate and the uncinate process, and hypertrophied inferior turbinate significantly narrowing the nasal cavity, may all be appreciated on nasal endoscopy, but missed on inspection of the CT scans. Moreover, in a limited number of patients in spite of the positive findings on their CTs, there were no as much mucosal abnormalities in the corresponding areas and thereby, limited surgical procedures were done. This was matched with the studies of Glasier et al, [19] Diament et al., [20] Havas et al., [21] Bolger et al., [22] Flinn et al., [23] and Stewart et al., [24] who found incidental opacifications in asymptomatic patients.

Despite that the previously mentioned data could underscore the value of CT as a diagnostic tool, in agreement with Anzai [4] who stated that the CT stage or the severity of mucosal disease on the CT was not a significant predictor of surgery; the current study revealed that radiological scoring strongly correlated with the surgical scoring. This was matching with Pokharel et al., [25] who also found a significant correlation between the two previous scores ($p= 0.000$, $r= 0.46$). These data are supported by the American academy of Otolaryngology that recommended the Lund-Mackay system as the preferred method for staging of CRS. [7]

This also agrees with Bhattacharyya and Fried, [26] who concluded that CT scan of paranasal sinuses exhibits good sensitivity and above-average specificity for the diagnosis of CRS and adds to the diagnostic accuracy of CRS. Gardiner et al, [2] also stated that the Lund-Mackay system facilitated a high level of both inter-observer and intra-observer agreement, in comparison with other systems. They recommend it to be adopted as the standard method of measuring the extent of disease.

In conclusion, the current study concludes that Lund-Mackay radiological scoring of paranasal sinuses can strongly predict the extent of surgery for nasal polyposis.

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