Studying the Relationship between the Lund Mackay Score and Response to Medical Treatment in Patients with Chronic Sinusitis

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Abstract

The present study was conducted to investigate the relationship between the Lund Mackay score and response to medical treatment in patients with chronic sinusitis. The present study was performed cross-sectionally on 150 patients referred to Khatam-ul-Anbia Hospital in Zahedan for whom the diagnosis of chronic sinusitis was confirmed and met the study criteria. Demographic data and clinical signs of patients were recorded and for based on CT scan, The Lund Mackay score was evaluated. Patients were treated for 4 to 6 weeks and finally re-evaluated for symptoms and response to treatment. Data were analyzed using SPSS software version 24, McNemar test, Mann-Whitney and other necessary tests for descriptive statistics. A significance level of 0.05 was considered. 3.55% of patients were male (83 patients) and 7.44% were female (67 patients). The mean score of the Lund Mackay in the present study was 92.11 with a standard deviation of 2.3. Symptoms of olfactory dysfunction, sinus pain, nasal obstruction and nasal discharge showed significant improvement after treatment ($p < 05.0$). Based on the results obtained at the end of the study, the presence of nasal polyps ($p = 001.0$) and nasal obstruction ($p = 003.0$), after the end of the treatment period, showed a significant relationship with the response to treatment. In general, this study suggested that the mean score of The Lund Mackay had a significant positive relationship with the severity of patients' clinical symptoms and the severity of sinusitis. Therefore, it can be considered as a suitable criterion in diagnostic and therapeutic evaluations of patients.

Keywords: *Chronic Sinusitis, the Lund Mackay Score, Medical Treatment*

Introduction

Sinusitis Inflammation of one or more cavities of the paranasal sinuses, most often caused by viral infections of the upper respiratory tract [(1)]. One of the most common reasons for patients to visit a doctor is Sinusitis. About 25 million people in the United States impose nearly $2 million directly to the medical system each year. Failure to correctly diagnose the disease and its causes or not paying attention to the patient's underlying health problems which can be a contributing factor to this disease and also prescribing inappropriate drugs against sinusitis has led to the chronic type of the disease which means symptoms such as sinus tenderness. Or post-nasal drip for more than 12 weeks [(2, 3)]. In cases of chronic sinusitis, its treatment requires more expensive antibiotics, and in some cases it does not respond to medical treatments and requires more aggressive treatments, such as endoscopic sinus surgery.

Due to the variety of treatment methods and the variable response of chronic sinusitis to treatment, it

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seems necessary to follow the treatment process of patients and their response. Despite the centrality of clinical diagnosis in sinusitis, many physicians use CT scans to confirm the diagnosis of chronic sinusitis and determine the severity of the disease. CT scans are also used to determine anatomical abnormalities and to determine the roadmap for surgery. Therefore, CT scan is used as an essential component in the diagnosis and treatment of chronic sinusitis [4, 5].

It is often assumed that the symptoms in patients are related to objective scores obtained from the severity of the disease. However, the relationship between radiological findings and symptoms in sinusitis is discussed. Also in the treatment of chronic sinusitis, the predictive value of radiological scores in the description of symptomatic progression after surgery is still unknown. There are different *staging systems* in chronic sinusitis. Many studies in these cases have been performed using conventional radiography, CT, MRI, which have disadvantages, including superimposition of maxillary and facial structures on conventional radiography, the high - dose risk of radiation in CT; Lack of cortical bone imaging with MRI, therefore, this modality is not sufficient to show the sinus drainage system alone. In addition, it has disadvantages such as high price and insufficient access [6, 7].

The Lund Mackay scoring system became popular as a simple evaluation tool to facilitate treatment decisions in the mid-1980s [8]. Considering the contradictory results of previous studies on the relationship between symptom severity and Lund Mackay radiological score, the present study attempts to find out the exact dimensions of the use of this scoring system in chronic sinusitis by examining this relationship in a significant population of chronic sinusitis patients.

Material and Method

Participants: The statistical population of this study includes patients who referred to Khatam Al-Anbia Hospital in Zahedan for treatment due to chronic sinusitis during 2016 to 2018 and met the necessary criteria. Ethical principles in accordance with the general guideline of ethics in medical sciences research with human subjects in the Islamic Republic of Iran were observed. Patients who had been treated for chronic sinusitis by an otolaryngologist were included. The patients must had had no structural abnormality in their CT scan such as retention cysts or nasal deviation. Exclusion criteria include patients with clinical symptom of acute sinusitis, patients with CT scans of symptoms such as retention cysts and patients with deviated septum without sinusitis and treatment protocol.

Data collection: Before beginning study, a questionnaire was completed that included questions about the patient's history including age, gender, clinical symptoms of chronic sinusitis, and a history of illnesses. Then, this study was performed on 150 patients with chronic sinusitis who met the criteria of the study. CT scan of the paranasal sinuses was done for all patients. Based on the CT scan findings, The Lund Mackay score was calculated for each patient. In radiological sinusitis examination, considering the Lund Mackay score, a slight and severe increase in the thickness of the anterior and posterior Ethmoid sinuses, sphenoid, frontal, maxillary, and Ostiomeatal complex obstruction or air fluid surface as diagnostic signs and symptoms such as retention cyst and deviated septum without obvious sinusitis is considered as negative CT scan. Then, according to the Lund Mackay score, each scan with a score = 0 is normal and each scan with a score> 0 is abnormal [9]. Also, at the beginning of the study, in addition to CT scan, DOTS score, which is a valid criterion for evaluating clinical symptoms, was calculated for patients. Then, patients were treated for 4 to 6 weeks, and re-examined for response to treatment and DOTS criteria. Ultimately, based on the treatment results, patients who did not respond well to treatment were recommended to do surgery.

Statistical analysis: All statistical analyzes were performed using SPSS software version 24. Shapiro-Wilk test was used to examine the normal distribution of data. Considering the abnormal distribution, appropriate non-parametric tests were used in the relevant results. Patients were divided into three age groups: 1 (8 to 18), 2 (18 to 40) and 3 (over 40) years, and the Lund Mackay scoring was divided into 5 categories: 1 (8-5), category 2 (9-12), category 3 (13-16), group 4 (17-20) and group 5 (21-24) were divided.

Findings

Patient baseline features: The frequency distribution of age, gender and score of The Lund

Mackay is shown in Table 1. As shown in the table, 3.55% of patients were male (83 patients) and 7.44% were female (67 patients). 3.51% (77 people) were in the age group of 8 to 18 years, 30% (45 people) were in the age group of 18 to 40 years and 7.18% (28 people) were over 40 years old. Finally, the highest frequency distribution in terms of The Lund Mackay score is related to the score range 9 to 12 and includes 3.45% (68 patients) of patients. In this study, no cases of Wegener, immunodeficiency and migraine were found. Patients were divided into two groups: people with a history of allergies (67 people) and people with a negative history of the disease (83 people).

Table 1: Frequency distribution of studied variables

Variable			Number	Percentage
Sex	Male		83	55.3
	Female		67	44.7
Age (year)	8-18		77	51.3
	18-40		45	30.0
	Over 40		28	18.7
The Lund Makay score	1	5-8	10	12.7
	2	9-12	68	45.3
	3	13-16	54	36.0
	4	17-20	8	5.3
	5	21-24	1	0.7
Total			150	100

The effect of treatment on DOTS clinical criteria: The frequency of clinical criteria (DOTS criteria) before and after treatment is shown in Table 2. Changes in studied clinical variables, except nasal polyps, before and after treatment, showed a statistically significant difference ($p < 05.0$). Considering the information mentioned in the table, this difference in all these variables was a significant decrease in the frequency of the relevant symptom, but in the case of nasal polyps, the changes before and after treatment were not significant ($p = 0.005$).

Table 2: Frequency distribution of patients' clinical symptoms before and after treatment

Variable			Before treatment		After treatment		P-value
			Number	percentage	Number 39	Percentage	
DOTS Clinical Criteria	Olfactory dysfunctions	Have	51	34.0		26.0	0.001
		Occasionally	54	36.0	13	8.7	
		Don't have	45	30.0	98	65.3	
	Nasal polyps	Have	56	37.3	54	36.0	0.500
		Don't have	94	62.7	96	64.0	
	Sinus pains	Have	59	39.3	26	17.3	0.002
		Occasionally	61	40.7	65	43.3	
		Don't have	30	20.0	59	39.3	
	Nasal obstructions	Have	78	52.0	31	20.7	0.001
		Occasionally	60	40.0	74	49.3	
		Don't have	12	8.0	45	30.0	
	Nasal discharges	Have	123	82.0	26	17.3	0.001
		Occasionally	18	12.0	79	52.7	
		Don't have	9	6.0	45	30.0	
Total			150	100	150	100	

The relationship between The Lund Mackay score and response to drug therapy in different age groups: According to the findings shown in Table 3, in the age group of 18 to 40 years, the relationship between response to drug therapy and The Lund Mackay score was statistically significant (p =0.002). Therefore, the average score of The Lund Mackay, in Patients who did not respond well to medication (requiring surgical treatment) (13.29±3.40) were significantly more likely than patients who responded well to medication (10.05±2.50). No significant relationship was found in the other 2 age groups.

Table 3: Correlation between The Lund Mackay score and treatment response in patients considering age

Age	Response to treatment	The Lund Mackay score		P-value
		Mean	Standard deviation	
8-18 years	Appropriate response to drug therapy	11.50	2.87	0.737
	Requires surgery	11.90	4.20	
18-40 years	Appropriate response to drug therapy	10.05	2.50	0.002
	Requires surgery	13.29	34.40	
Over 40	Appropriate response to drug therapy	13.00	1.41	0.963
	Requires surgery	12.30	2.66	

The relationship between The Lund Mackay score and response to drug therapy in different genders: According to the findings shown in Table 4, the relationship between drug response and The Lund Mackay score in men was statistically significant (p =0.006). Therefore, the mean score of The Lund Mackay, in those patients who did not respond well to medication (requiring surgical treatment) (13.25 ± 3.09) were significantly higher than patients who responded well to medication (11.26±2.64). As can be seen in Table 4, the difference in scores in terms of response to treatment among women was not significant (p =0.109).

Table 4: Relationship between The Lund Mackay score and response to treatment considering gender

Sex	Response to treatment	The Lund Mackay score		P value (Mann-Whitney)
		Mean	Standard deviation	
Male	Appropriate response to drug therapy	11.36	2.64	0.006
	Requires surgery	13.25	3.09	
female	Appropriate response to drug therapy	11.05	3.11	0.109
	Requires surgery	12.50	3.38	

Relationship between The Lund Mackay score and response to drug therapy based on considering allergies: According to the findings shown in Table 5, in patients who did not report a specific disease history, unlike patients with allergies, the relationship between drug response and The Lund Mackay score was statistically significant (p = 0.026). Therefore, the mean score of The Lund Mackay was significantly higher in those patients who did not respond well to medication (requiring surgical treatment) (12.93±3.18) than in patients who responded well to medication (11.30±2.86).

Table 5: Relationship between The Lund Mackay score and response to treatment in patients considering disease type

Type of disease	Response to treatment	The Lund Mackay		P value
		Mean	Standard deviation	
History of Allergy	Appropriate response to drug therapy	11.21	2.84	0.594
	Requires surgery	11.66	4.93	
Negative disease history	Appropriate response to drug therapy	11.30	2.86	0.026
	Requires surgery	12.93	3.18	

Relationship between The Lund Mackay score and response to drug therapy based on medical history: Patients who did not report previous treatment, the relationship between response to drug therapy and the Lund Mackay score was statistically significant (p = 0.010), with the mean score of The Lund Mackay was significantly higher in patients who did not respond well to medication (requiring surgical treatment) (13.41 ±3.42) than in patients who responded well to medication (11.10 ±2.95). Therefore, in patients with a history of drug therapy (p = 0.163) or surgical treatment (p = 0.281), the difference in The Lund Mackay score with response to treatment was not statistically significant.

The relationship between The Lund Mackay score and disease outcome status after the treatment: All remaining symptoms at the end of the study are significantly correlated with the average score of The Lund Mackay. So, for all outcomes, the mean score of The Lund Mackay showed a significant increase in proportion to the severity of the clinical symptom (from high to low: permanent symptom, occasional symptom and no symptom, respectively) (P<0.05).

Discussion

Almost all studied clinical variables, before and after treatment, show a statistically significant difference. Symptoms of olfactory dysfunction, sinus pain, nasal obstruction and nasal discharge showed significant improvement after treatment, although in the case of nasal polyps, the changes before and after treatment were not significant. Patients who experienced outcomes such as sinus pain, nasal polyps, nasal obstruction, nasal discharge, and olfactory dysfunction had a higher mean, according to The Lund Mackay score, resulting in more severe sinusitis.

Also, all the remaining symptoms at the end of the study showed a significant relationship with the average score of The Lund Mackay. For all outcomes, the mean score of The Lund Mackay showed a significant increase in proportion to the increase in clinical symptom severity. For all outcomes the mean score of The Lund Mackay showed a significant increase in proportion to the increase in severity of clinical symptom.

Limited studies have been performed on the relationship between clinical findings and the Lund Mackay score. For instance, a study conducted by Safavi Naeini et al. on the diagnostic value of clinical signs and symptoms in the sinusitis diagnosis of 198 patients. This study was done according to the results of CT scan and considering the Lund Mackay system. In this study, it was found that patients suffering from nasal congestion and recurrent coughs had more severe sinusitis based on Lund Mackay score than those who did not [(10)]. This finding is consistent with the results of the present study, which suggests the value of The Lund Mackay score in assessing the severity of sinusitis in patients. In a study by Hopkins et al. (2007), The Lund Mackay score was assessed in patients with chronic rhinosinusitis. In this

multicenter study, it was suggested that those patients who had a higher mean score based on The Lund Mackay system were more likely to be candidates for surgery, and the higher the score, the more invasive surgery was used [11]. Also in the above study, patients were divided into two groups based on the status of nasal polyps: sinusitis patients with polyps and patients who had only sinusitis. In sinusitis patients without polyps, this CT scan score was significantly lower. According to a recent study that confirms our previous results and findings, The Lund Mackay score can be a good predictor of the severity of clinical symptoms and patients' quality of life [12].

However, studies have reported the results of the weakness of The Lund Mackay criterion in CT scan and also reported the Lund Mackay criterion`s weakness in predicting the patients` clinical status with chronic rhinosinusitis, which highlights the importance of further studies for a more accurate view. For instance, in a study by Peter H. Hwang et al. on the association between the symptoms of chronic rhinosinusitis and the results of CT scans using the Lund Mackay, we found that out of 125 patients in the study, 115 patients had symptom criteria for CRS. However, 40 out of 115 patients had negative scans (Lund-Mackay = 0) despite having diagnostic criteria for rhinosinusitis. Out of 115 people, 75 had positive scans (Lund-Mackay> 1). Indicating poor convergence between chronic positive rhinosinusitis and CT positive [13].

Limitations of this study are: Similar studies should be performed at longer time periods and with larger sample sizes for greater results certainty of evaluating changes in the Lund Mackay score in sinusitis patients. Second, it seems useful to evaluate the outcomes after surgery and compare it with the remaining outcomes after medical treatment. Third, the use of the Lund Mackay score classification in order to predict the response to treatment in patients and determine the appropriate treatment method in future studies seems necessary.

Conclusion

In summary, our study showed that there is a significant relationship between the Lund Mackay score based on CT scan findings and patients' clinical status and treatment response. Therefore, this evaluation system can be used as an effective way to predict the prognosis of patients with chronic rhinosinusitis. However, current findings in this area are limited and further studies` approval is needed. Another finding of this study, which seems to be new and important in its kind, is the great power of predicting clinical status with the help of CT scan in the age group of 18-40 years, male patients without a history of allergies, and without prior treatment.

Ethical Clearance: Obtained from institutional ethical committee

Source of Funding: Self

Conflict of Interest: Nil

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