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Prevalence of Anatomical Abnormalities of Nose & Paranasal Sinuses in Cases of Rhinogenic Headache Among Sohag University Students

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Abstract

Objective: to determine the prevalence of anatomical abnormalities of nose and PNS in cases suffering from rhinogenic headache among Sohag University students seeking health services in the ENT outpatient clinic of the Student Hospital in Sohag University along the period starting Oct. 2017 till June 2019.

Study design: Across sectional study Results: 104 students -(59.6 %) females- were enrolled in the study, inhabiting rural and/or slum areas of Sohag (69.2 %). They had a narrow range of ages; 19 – 23 years; X` = 20.13 ± 1.25 years. Frontal site of headache predominated, then the nasal site. These followed by periorbital, tempo parietal, temporal and scalp regions respectively in 32.7, 25, 17.3, 11.5, 7.7 and 5.8 % of the rhinogenic cases. Each attack lasted 3.27± 1.76 days duration with maximum 7 days. Prevalence of rhinogenic headache due to anatomical abnormalities was (26.9 %). over the frontal, glabellar and periorbital regions. A highly significant statistical difference between cases of rhinogenic headache with anatomical abnormalities and those without anatomical abnormalities (p = .004) regarding how the headache was presented; Heaviness (16.2 %), pressure (81 %) and dullness (2.7 %) were the type of such headache. It was found that most of the cases have combined abnormalities. DNS affected 16 cases (43.2 %), a manifestation of concha bellosa in 9 cases(24.3%), bilateral inferior turbinate hypertrophy appeared in 10 cases(27%) . Haller cells was detected in about (1.9 %)of the anatomical abnormalities also.

Keywords: Nose and PNS, Anatomical abnormalities, Prevalence.

Introduction

Headache is a symptom of pain anywhere in the region of the head or neck, and it can occur as a result of many conditions whether serious or not. **Rhinogenic headache** is a common complaint in the general population as facial pain syndrome 2ry to mucosal contact points in the nasal/sinus cavities in the absence of sino-nasal inflammatory conditions; increases with sudden movements of the head, bending forward, straining, starts in the morning, worsen at mid-day and gets better at night. It has multiple synonyms used frequently in the literature which includes rhinopathic headache, sinogenic headache.

It must be **differentiated** from sinus headache which is 2ry to a viral or bacterial sinus infection[1].Strict criteria from the **ICHD** were used to tell the difference between headache types [2].

Etiology of rhinogenic headache is multifactorial. It was demonstrated that, besides contacted mucosa, various anatomical

variations or abnormalities can cause a headache.

Anatomical variations of nose & PNS include:- Deviated nasal septum (DNS) & septal spurs, Haller's cells, Inferior turbinate hypertrophy (ITH), Concha bellosa (CB), paradoxical curvature of the middle turbinate, pneumatization of the uncinate process and Onodi cells, all may be accused in causing rhinogenic headache[3].

The prevalence of these findings is needed to determine their clinical relevance *and to guide its management* [4]. Many patients with headache, resolved after correction of nasal or sinus anatomical abnormalities[5].

Computerized (CT) scanning was the investigation of choice as it is very helpful in detecting bony anatomical .variations and mucosal abnormalities. Prevalence of these findings is needed to determine their clinical relevance *and to guide its management*[4].

Aim of the study:

Is to determine the prevalence of nose and paranasal sinuses (PNS) anatomical abnormalities in cases suffering from rhinogenic headache among Sohag University students.

Patients and methods:

A cross-sectional study over a period of 2 academic years; from Oct 2017 forward till end of June 2019; involved all patients who presented with chronic headache to ENT out-clinic at Sohag University Health Management for Students were interviewed by the researcher; if they were satisfying the following inclusion criteria: **Complaining of headache**; rhinogenic in nature;Pressure-like pain in one specific area of the face or head for example over sinus or behind the eyes (bymedical history, clinically and by investigations), being the principal or only c/o, whereas other sino-nasal symptoms were vague or absent of long term duration and not responding to medical treatment. Also, the student accepted to be a participant in the study, with full cooperation. Sino-nasal abnormalities were confirmed by CT scan. A total of 104 patients were enrolled in this study out of 111. According to a multi-item questionnaire; all cases were subjected to**:-**

- **History taking** for personal data(name, age, gender, residence, marital status, special habits, faculty, and phone number).
- **Complaint analysis**: Headache; (type, location, duration, referral, what aggravates or even evokes the condition, medication, recurrence after medication) and other associated conditions, weather nasal or extra-nasal.
- **past medical history and family history**.
- **General clinical examination**in particular, ophthalmic + neurological examination.
- **Otolaryngological examinations**(ear ,pharynx ,larynx and neck).
- **CT scans** of the nose and PNS were undertaken in all patients with long-term, refractory headache to define the existence of anatomical abnormalities or other nasal diseases. In patients that had no sinus diseases and did not respond to medical treatment; radiographic findings of sino-nasal anatomical anomalies were presumed to have etiologic significance. CT scanning was carried out in Sohag University Hospital; Diagnostic Radiology Departmentby (Siemens 32 slice perspective CT) machine, bone, and soft tissue window, axial & coronal views taken without contrast, 3 mm slice thickness to determine if there are anatomical abnormities in either the nose, PNS or both

-Data & information handling: (SPSS) statistical program, version 16 was used for data entry, verification,and analysis.

Simple frequencies used for data checking. Descriptive statistics used for data summarization. Graphs used to illustrate information. Tests of significance as X^2 was used when needed. The statistical significance level will be taken at p-value ≤ 0.05.

Results:

1- Characteristics of the studied population: Most of the sufferers were females 62 (59.6 %), while male students were 42 (40.4 %), both were inhabiting the rural and slum areas (69.2 %), and urban residence in (30.8 %) of the cases. The habit of smoking reported only in 6 cases (14.2 %) of males only. Students were found to belong to 7 faculties; law, arts, commerce, pharmacy, technical education, education, and nursing. Most of the students were in the first grade; 48 (46.2 %), second grade 18 (17.3 %), third grade 24 (23.1 %) and least 14 (13.5 %) in the latest grades.

Rhinogenic headache and time differentials:

Character: range (x ± SD)	
Age (years)	19-23 (20.13 ± 1.25), median 20
Period of suffering (months)	0 – 72 (21.96 ± 17.75)
Long lasting of each attack (days)	1- 7 (3.27± 1.76)
No. of sinusitis attack \ year	0 – 8 (3.37 ± 2.787)

Table (1): Time differentials of headache

Table 1 shows that the studied population had a narrow range of age in years [19 – 23], with a mean age of 20.13 ± 1.25 years. The period of suffering was prolonged in some cases up to 6 years passed since the first attack; with a mean duration of 21.96 ± 17.75 months i.e. approximating 2±1.5 years. Each attack lasted 3.27± 1.76 days duration with maximum of 7 days.

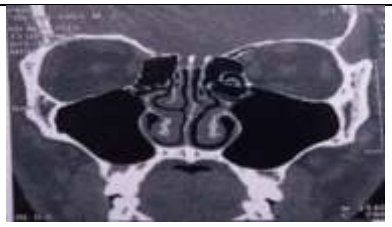
II- Characteristics of Rhinogenic headache cases with anatomical abnormalities

a- Etiology of rhinogenic headache: It was found that rhinogenic headache was due to anatomical abnormalities only in 28 patients (26.9 %), and to causes other than anatomical abnormalities in 76 patients (73.1 %) of the cases. Table 2 demonstrates the distribution of the anatomical abnormalities which were ascertained by CT scanning as it was discovered in 28 cases; representing 26.9 % of overall 104 rhinogenic headache cases. It was a single abnormality in some cases and combined in most cases. The total number of abnormalities were counted 37 in 28 patients. DNS predominates; in 16 patients (57.1 %), as a single anomaly in 4 cases (14.2 %), and combined with ITH alone, concha with ITH and with concha per se in an equal number of patients; 3 cases (10.7 %) for each finding as seen in table 2. DNS was discovered in 2 patients (7.14 %) associated with nasal polyps and in 1 case only (3.5 %) with chronic sinusitis. Although concha bullosa was found in 9 cases; (32.1 %), yet it's single only in 3 (10.7 %). Haller cells were in 2 cases (7.14 %) and inferior turbinate hypertrophy (ITH) affected 10 patients; (35.7 %) of the cases.

There were female predominance in suffering anatomical abnormalities when complaining of rhinogenic headache; they constituted about two thirds; 64.3 %. The same results was seen regarding the rural inhabitant which represents; 57.1 % of cases with anatomical abnormalities. It was noticed that none of the concha cases inhabited the urban residence. Smoking habit associated with 16.7 % of total cases.

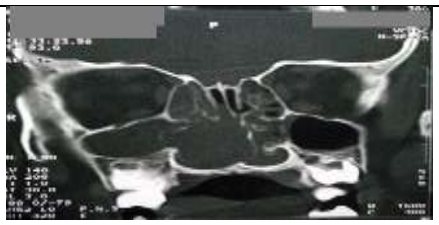
Abnormalities (n = 28 cases)	No.	%
DNS	4	14.2
DNS + ITH	3	10.7
DNS + Concha bullosa	3	10.7
DNS + nasal polyps	3	10.7
DNS + Concha bullosa + ITH	1	3.5
DNS + chronic sinusitis	2	7.14
ITH	2	7.14
ITH + chronic sinusitis	1	3.5
ITH + polyps	1	3.5
Concha bullosa	2	7.14
Haller cells	3	10.7
Total	28	100

Table(2): Main anatomical abnormalities in rhinogenic headache cases



CT nose &PNS, coronal section showing C- shaped DNS to the left with bilateral ITH.

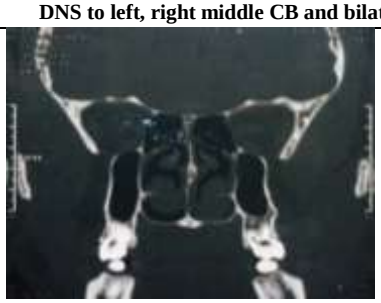
CT nose &PNS, coronal section showing, C-shaped DNNS, unilateral right middle CB



CT nose &PNS, coronal section showing nasal polyps and DNS to the left

CT nose &PNS , coronal section, showing , C-shaped DNS to left, right middle CB and bilateral ITH

CT nose &PNS, coronal section showing C- shaped DNS to the left with chronic sinusitis



CT nose &PNS, coronal section showing bilateral ITH

Item, no. (col. %)		DNS	CB	Haller cells	ITH	Total
		16	9	2	10	37
Type	Dull				1	1 (2.7 %)
	Heaviness		3 (33.3 %)		3	6 (16.2%)
	Pressure	16 (100%)	6 (66.7 %)	2 (100%)	6	30 (81%)
Significance: P .032						
*Site of pain	Frontal	10	2		3	15 (42.9%)
	Glabellar		5		6	11 (29.7%)
	Periorbital	6	2	2	1	11 (29.7%)
# All cases had gradual onset and stationary course. * No statistically significant difference						

Table (3): Rhinogenic headache; type, site, onset and course in anatomical abnormalities cases

b-

c- Characteristics of the rhinogenic headache due to anatomical abnormalities as regarding its type, site, onset, and course:

Pressure like symptoms were the complaint in all cases of DNS and hallar cell deformities (100 %), while presents in two-thirds of concha cases; 6 out of 9; (66 %). Heaviness is the case in 3 cases of CB (33.3 %) and also in 3 cases of ITH (30 %). It was dull in one case only which is suffering from ITH. Statistically, there is a significant difference between the three types of distribution (p = .032), but it is not the case in the site of the presenting pain for the anatomically abnormal cases. It was noticed that all cases had a gradual onset and a stationary course.

d- Associated symptoms in anatomically abnormal rhinogenic headache cases:

Table 4 demonstrates that itching is reported in about 2 (5.4%) of overall anatomical abnormalities; one in the concha and another one in ITH cases. Sneezing occurred in 14 (37.8%) of the overall anatomical abnormalities, 5 with the DNS and 4 with CB, another 4 with ITH in addition to one of hallar's.

Running nose practiced by 10 (27%); mostly (60 %) with DNS and it is found that nasal occlusion and congestion predominates in 23(62.1%) and 20 (54%) respectively. Most cases of DNS and ITH suffer from nasal occlusion and congestion as demonstrated in table 7. Postnasal discharge and a diminished sense of smell come after; in hurting the anatomical abnormalities cases as it affects 8 (21.6%) and 6 (16.2%) respectively but nasal bleeding is the least as a complaint about the anatomical

abnormalities cases in 2 (5.4%) which is the same as nasal itching.

In table 5, it is noticed that bad mouth odor is practiced by 8 (21.6%); half of the counted in CB cases. Sore throat and chronic cough are suffered by 2 (5.4%); both are DNS cases.

Item No. (%)	Total	DNS	concha	hallar	ITH	*p
	37	16	9	2	10	
Nasal itching						
Present	2 (5.4%)		1		1	.082
Sneezing						
Present	14 (37.8%)	5	4	1	4	.433
Running nose						
Present	10 (27%)	6	2	1	1	. 487
Nasal congestion						
Present	20 (54%)	8	3		9	.446
Nasal occlusion						
Present	23(62.1%)	11	2		10	.446
Bleeding nose						
Present	2 (5.4%)		1		1	.082
Post nasal discharge						
Present	8 (21.6%)	5	2		1	.575
Diminished sense of smell						
Present	6 (16.2%)	1	1		4	.516

Table (4): Associated nasal symptoms in anatomical abnormalities rhinogenic headache cases

*P-value was > 0.05 in either raw; as there were statistically insignificant differences between absence and presence of the studied associated symptoms in the anatomical abnormalities rhinogenic headache cases.

Item No. (%)	Total	DNS	concha	hallar	ITH	*p
	37	16	9	2	10	
Sore throat						
Present	2 (5.4%)	2				.994
Bad mouth odor						
Present	8 (21.6%)	2	4		2	.271
Chronic cough						
Present	2 (5.4%)	2				.994

Table (5): Associated extra nasal symptoms in anatomical abnormalities rhinogenic headache

*P-value was> 0.05 in either raw; as there were statistically insignificant differences between absence and presence of the studied associated extra nasal symptoms in the anatomical abnormalities rhinogenic headache cases.

Discussion:

A wide range of regional differences in the prevalence of nose and PNS anatomic variation exists as detected in comparing the current study with some other studies (table 6).

Complete history taking, scrupulous evaluation, and diligent follow-ups are mandatory for not only accurate diagnosis but also for promising management of rhinogenic headache

Detection of anatomic variations is vital for treatment especially in cases where surgical planning is a must and prevention of complications is assumed. Understanding the CT scan is substantially important because it is the road map for the management.

***Prevalence of anatomical abnormalities* of nose and PNS responsible for rhinogenic headache:** There was no anatomical abnormalities identified in 37 (48.1%) of scanned images of[6], a study in Pakistan, which is far beyond this study results where 76 (73.1 %) of the cases were presented with rhinogenic headache without anatomical abnormalities. While it prevailed in 28 cases (26.9 %). It is noticed that the present study depends on current diagnosis while Pakistan's study depended upon reviewing the case records in a retrospective manner. In spite of the wide variations in sino-nasal anatomy reported times in literatures, yet in our study, we

noted the different frequency of these variations compared to previous reports. Genetic and environmental factors seem to be the best explanation for these variations.

Type of anomalies: We are agreeing with all relevant studies where DNS constituted the bulk of the symptomatizing cases; (15.3 %) of all our rhinogenic headache cases, and it constitute 16 patients out of 28 with abnormality; and 43.2 % of the total represents of anatomical abnormalities in the current study. In other studies, these findings ranged from 14.1% to even 100% as seen in table 6.In this clinical and endoscopic examination; it was found that various and usually combined anatomical variations had been implicated as a possible cause of rhinogenic headache in the absence of sinusitis. In this respect, deviated nasal septum (75%) was the commonest cause in **Rai** study[7]. This comes in agreement with **Madsen**[8] and **Clerico**[9] **s**tudieswho reported most patients with headache were secondary to septal deviation**.**

CB is found in (8.6 %) of rhinogenic headache patients in the present study. Concha bullosa were encountered in 9 patients out of 28 with anatomical abnormalities (32.1 %), while most literature reported that the incidence in the normal population is 10%. This shows that concha bullosa plays a significant role in mucosal contact causing a headache. This comes in agreement with findings of ***Stammberger***[10]. Similarly, **Mustafa and Mohammed**[11] reported CB in 11 patients (27.5 %). while **Kanitha** [12] found it in 21 patients (44 %).

This study confirmed that concha bullosa may predispose to headache. This matches with **Stammbergerand Wolf**[10]; where they said thatlarge concha bullosa could produce headache by narrowing the infundibulum. However, ***Yousem***[13] denied this conclusion and reported that the presence of a concha bullosa did not increase the risk of sinus headache.

In the present study, ITH was found in 10 cases represents (9.6%) of total rhinogenic headache cases, whereas other authors have reported prevalence rates of 6.3% and 5%. **Mokbel et al., 2010** reported ITH in 45 patients (37 %) [14]

In our study, the prevalence of hallar's cell is 7.1% (2 cases)of anatomical abnormalities cases presenting with rhinogenic headache. In other studies, this finding ranged from 1% to 36% as seen in table (6). Haller's cells (Infraorbital ethmoid cell) are the anterior ethmoid cells that project along the medial roof of the maxillary sinus and the most inferior portion of the lamina papyracea. They are closely related to the infundibulum. Due to their proximity to the natural ostium of the maxillary sinus, one study demonstrated a significant increase in maxillary sinus mucosal disease in patients with medium or large haller's cells (45.8%) versus those with small cells (28.9%; $p < 0.05$). Other studies, however, found no significant correlation between haller's cell and chronic sinus disease.

The incidence of Haller cell in the general population is variably reported as 7% **in Zinreich et al., (2010)**[15]**,** 10% **reported by Kennedy (2006)**[16]**,** 20% **by Earwaker (2000)**[17]**,** and 45.1% by **Bolger et al. (2010)**[18]**.**

Duration of headache: The period of suffering was prolonged in some cases up to 6 years lapsed since the first attack; with a mean duration of 21.96 ± 17.75 months i.e. approximating 2± 1.5 years and this agrees with the other studies. **Mokbel et al., 2010** reported that the average duration of headache was 2.5 years[14], while **Hazem et al., 2014** observed that the duration of headache ranged from 1 to 8 years and in **Rai et al., 2018 study;** the duration of headache ranged from 1 to 10 years with

mean duration 6.4 years[7].**Aleksandar P. et al in 2016** reported that on comparing the duration of headache (number of hours with headache during 24 hours), they found that it is longer in patients with septal spur compared with patients with septal deviation ($p = 0.000$) and in patients with concha bullosa compared with patients with septum deviation ($p = 0.000$). There was no statistically significant difference when they compared the patients with septal spur and those with concha bullosa ($p = 0.099$). On comparing the frequency of pain (the number of days with headache in a month), we observed that it is higher in the group of patients with concha bullosa in comparison to those with septal deviation ($p = 0.001$) [19].

On the other hand, no difference was found in the frequency of headache between the patients with concha bullosa and septal spur ($p = 0.068$). the result of the current study are 1-7 (3.27± 1.76)days as long-lasting of each attack (days) versus9.76 ± 3.07 [4-15] hours with headache for 24 hours.

The difference in Sohag student perception as they may make their condition aggravated for family, colleague and physician sympathy or they are not aware of time during suffering.

The study	*Country*	*year*	*S.*	*DNS*	*CB*	*Hallar*	*ITH*
Tonai et al.[20]	*Japan*	*1996*	*75*	*28*	*25*	*36*	*Not reported*
Pérez et al.[21]	*Spain*	*2000*	*110*	*58.2*	*24.5*	*45*	*Not reported*
Mamatha H.et al.[22]	*India*	*2010*	*40*	*65*	*15*	*17.5*	*Not reported*
Dutra et al.[23]	*Brazil*	*2005*	*71*	*14.1*	*4.2*	*1.4*	*Not reported*
Mazza D et al.[24]	*Italy*	*2007*	*100*	*29*	*11*	*5*	*Not reported*
Talaiepour A.R.et al.[25]	*Iran*	*2005*	*143*	*63*	*35*	*3.5*	*30*
Mohammad A. et al.[6]	*Pakistan*	*2015*	*77*	*26*		*9.1*	*24*
Mostafa H. Mohamed G.[1]	*Egypt; Minia*	*2012*	*40*	*50*	*27.5*	*12.5*	*Not reported*
Rashid A. et al.,[26]	*Oman Sultan.*	*2014*	*40*	*60*	*49*	*24*	*28*
Mokbel et al.,[14]	*Pakistan*	*2010*	*120*	*100*	*NR*	*NR*	*37*
Rai U.L. et al .,[7]	*India*	*2018*	*50*	*100*	*NR*	*NR*	*Not reported*
Kanitha MS et al.,[12]	*India*	*2017*	*65*	*26*	*44*	*NR*	*25*
Sudip[27]	*India*	*2013*	*40*	*56*	*NR*	*NR*	*20*
Current study	*Egypt; Sohag*	*2019*	*104*	*57.1*	*32.1*	*7.1*	*35.7*

table (6): % of prevailed anatomical abnormalities in some studies

Location of headache: The most common location of referred headache was the frontal area (71%), followed by glabellar/nasal (30%) in **Mostafa H., andMohammed A. G.,2012** study in Minia, being in line with the rank that had been noticed in the current study. It was frontal in 32.7 %, Glabellar in 25 % of all rhinogenic headache cases and in 42.9 % frontal, 35.7 % glabellar in cases with anatomical abnormalities. This may be explained by similarities between Minia and Sohag's social environmental and lifestyle circumstances. Periorbital site of pain is noticed in 21.4 % in cases of rhinogenic headache with anatomical abnormalities in the current study[11].**Kanitha MS et al., 2017** reported that the location of headache was in the frontal area 32% followed by temporal area 24%[12], **Rai UL et al., 2018** reported headache in the frontal

region in 82%, Periorbital region 34% and nasal region 32%[7].

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