Effectiveness of Office Nasal Endoscopy as Preliminary Diagnostic Tool: A Comparative Study versus CT Sinus Imaging

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Abstract: Objectives: To determine diagnostic effectiveness of office fiberoptic nasal endoscopy as preliminary examination tool during outpatient clinic examinations of patients with chronic rhinosinusitis (CRS). Patients & Methods: One hundred CRS UAE patients (Group A) and another 100 Egyptian patients (Group B). All patients were evaluated for impact of CRS on their quality of life (QOL) using the Sino-Nasal Outcome Test (SNOT-22 test) followed by endoscopic evaluation of the extent of the disease using Lund & Kennedy score (LKS) and CT scan of paranasal sinuses interpreted according to Lund-Mackay scale (LMS). All patients received bilateral sinonasal irrigation using ceftriaxone sodium 1 gm dissolved in 200 ml normal saline. Nasal irrigation using the same fluid was used twice daily for 6 weeks and reevaluated. Patients with persistent manifestations were prepared for functional endoscopic sinus surgery (FESS) and were re-evaluated 6 weeks after surgery. Patients' response to treatment as judged by SNOT-22 test evaluated at end of 6 weeks was used to verify outcome of preliminary investigation modality. Results: Baseline SNOT-22 score of group A was significantly higher than group B. SNOT-22 scores determined at end of treatment were significantly lower in both groups compared to their respective baseline scores. SNOT-22 score determined at end of treatment was significantly higher in group B compared to group A. Frequency of patients had secretions and mucosal edema in group A was significantly higher than in group B with significantly higher scoring and significantly higher total scoring in group A than in group B. Baseline SNOT-22 in both groups showed positive significant correlation with LKS and LMS scoring. However, the correlation was more significant between baseline SNOT-22 and LKS scoring than with LMS scoring. Cumulative risk for CRS of imposing high impact on patients' QOL was higher with high LKS scoring for endoscopic findings than with high LMS scoring for CT findings. Conclusion: Office nasal endoscopy is effective diagnostic modality for patients with CRS and could spare the need for CT for preliminary evaluation. For these advantages, office nasal endoscopy is recommended as routine examination tool for diagnosis and follow-up of patients presenting with manifestations of CRS.

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1. Introduction

Endoscopy is a minimally invasive, diagnostic medical procedure. It is used to examine the interior surfaces of an organ or tissue and allows visualization of body cavities not possible by standard examination **(Cohen & Pike, 2015)**.

Nasal endoscope is a medical device consisting of a thin, rigid tube with fiberoptic cables for illumination. The endoscope is then connected to a light source and a video camera to project the images on a monitor. These endoscopic images can be captured and recorded for documentation for each patient **(Tabaee et al., 2006)**.

In some nasal endoscopes, the goal is to look straight from the tip of the instrument into the nose; there are other endoscopes in which the desired view is at an angle from the tip of the telescope. These 'angled' endoscopes can be used to see around corners and into the curved sinus cavities **(Armstrong, 2005)**.

Nasal endoscope is so slender (only 2.7-4.0 mm in width), that it may be passed easily through the nostril to examine the nasal passages, structures and sinuses. While the traditional nasal examination with a speculum and a flashlight using anterior rhinoscopy allows a limited “key-hole” view of the front part of the nose, the endoscope allows a direct view of the deeper internal anatomy, central airway and posterior aspects of the nose and sinuses **(Melroy et al., 2007)**.

Office nasal endoscopy allows a detailed examination of the nasal and sinus cavities. It is currently the preferred initial method of evaluating medical problems such as nasal stuffiness and obstruction, sinusitis, nasal polyps, nasal tumors, and epistaxis. Endoscopy allows search for areas of swelling in the mucosal membranes; presence of purulent secretions draining from the sinus openings; enlargement of the nasal turbinates; crooked contouring to the nasal septum; presence of polyps; sites of nasal bleeding; and the presence of tumors. If pus is seen, it may be sampled and cultured with a fine swab to determine the causative organism **(Berger & Berger, 2011; Clary & Courey, 2013)**.

Aim of work

The current prospective double-blinded double-center study aimed to determine the feasibility and diagnostic effectiveness of office fiberoptic nasal endoscopy as preliminary examination tool during outpatient clinic examinations of patients with chronic rhinosinusitis (CRS).

2, Patients and Methods

The present study was conducted at Departments of Otorhinolaryngology, Miami Hospital, Abu Dabi, UEA and Benha University Hospital, Benha, ARE since Jan 2013 till March 2015. The study protocol was approved by The Local Ethical Committee at Benha University. All patients attended ENT outpatient clinic with symptoms suggestive of CRS and signed the proposed written fully informed patients' consent were enrolled in the study. Both otorhinolaryngologist and Diagnostic Radiologist were blinded about the findings obtained by CT examination and grading and clinical findings and staging, respectively. Findings were opposed, analyzed, and registered daily after the end of work day.

Collected patients were grouped according to the hospital into two groups: UEA patients (Group A) and ARE patients (Group B) and the limiting for end of the study was collection of 100 cases underwent evaluation per group. Then, finding in both hospital were collected to evaluate the diagnostic efficacy of endoscopy versus CT imaging, irrespective of locality of the hospital so as to get a final conclusion in the form of diagnostic efficacy of endoscopy as a preliminary outpatient examination tool.

All patients were clinically evaluated for their presenting symptom and its impact on their quality of life using the Sino-Nasal Outcome Test (SNOT-22 test) **(Hopkins et al., 2009)** to assess the quality of life related to sinonasal disease. Patients were asked to score a list of 22 symptoms, social and emotional consequences. Outcomes were graded as 0 (no problem), 1 (very mild problem), 2 (mild or slight problem), 3 (moderate problem), 4 (severe problem), or 5 (problem as bad as it could be). The list included: need to blow nose, sneezing, dripping nose, cough, postnasal drip, dense nasal drip, ear fullness, dizziness, ear pain, facial pain/pressure, difficulty falling asleep, wake up at night, lack of a good night's sleep, wake up tired, fatigue, reduced productivity, reduced concentration, frustrated/restless/irritable, sad, embarrassed, decrease in smell and taste, nasal obstruction.

All patients underwent complete otorhinolaryngological examination and endoscopic evaluation of the extent of the disease according to the endoscopic scoring proposed by **Lund & Kennedy (1995)** to assess 3 parameters: nasal mucosa edema, presence of secretion and presence of polyps; each parameter was scored 0 to 2. Assessment was performed bilaterally, with the total points corresponding to the sum of values obtained in both sides. Thus, the score ranged from 0-12, (Table 1).

Table (1): Lund-Kennedy score (LKS) of endoscopic assessment

	0	1	2
Polyp	Absent	Limited to the middle meatus	Extending into the nasal cavity
Mucosa edema	Absent	Mild/moderate	Polypoid degeneration
Secretion	Absent	Hyaline	Thick and/or mucopurulent

CT scan of paranasal sinuses was performed using sections at coronal and axial plans with continuous sections of 2.0 and 3.0 mm thickness. CT scans were assessed according to **Lund-Mackay scale (1993)**. Each paranasal sinus was graded from 0 to 2 depending on the level of opacification as follows: 0=no obstruction, 1=partial obstruction and 2=total obstruction. As regards scoring of ostiomeatal complex: 0=no obstruction and 2=obstructed. Assessment was conducted bilaterally for a total score range of 0-24 points, and the highest value corresponded to greater severity of the disease.

All patients received bilateral sinonasal irrigation using ceftriaxone sodium 1 gm (Rocephin, Co; USA) dissolved in 200 ml normal saline through an 18-gauge spinal needle attached to a collection trap via a 2-way stop to allow flushing with instantaneous sample collection. Needle flushing was performed under the inferior turbinate for each side **(Shindy & Ras, 2013)**. Nasal irrigation using the same fluid was used twice daily for 6 weeks and reevaluated. Patients with persistent manifestations were prepared for functional endoscopic sinus surgery (FESS) and were re-evaluated 6 weeks after surgery. Patients' response to treatment as judged by SNOT-22 test evaluated at end of 6 weeks was used to verify outcome of preliminary investigation modality.

Statistical analysis

Obtained data were presented as mean±SD, ranges, numbers and ratios. Results were analyzed using Wilcoxon (Z-test) test for unrelated ranked data and Chi-square test. Possible relationships were investigated using Pearson linear regression. Cumulative risk for having high SNOT-22 score was evaluated. Statistical analysis was conducted using the SPSS (Version 15, 2006) for Windows statistical

package. P value <0.05 was considered statistically significant.

3. Results

The study included 200 patients had CRS since a mean duration of disease of 2.5±1.1; range: 1-5 years. Mean age of enrolled patients was 29.9±7.4; range: 18-61 years. There were 127 females (63.5%) and 73 males (37.5%). Mean body mass index of enrolled patients was 31±2.7; range: 24.2-38.3 kg/m^2. There was non-significant (p>0.05) difference between studied groups as regards enrolment data as shown in table 2.

Mean baseline SNOT-22 score of studied patients was significantly (p<0.05) higher in group A compared to that of patients of group B. Mean SNOT-22 scores determined at the end of treatment were significantly (p<0.05) lower in both groups compared to their respective baseline scores. Mean SNOT-22 score determined at the end of treatment was significantly (p<0.05) higher in group B compared to that of patients of group A (Table 3, Fig. 1).

All studied patients had clinical manifestations of CRS. Endoscopic examination defined significantly (p<0.05) higher frequency of patients had secretions (Fig. 2) and mucosal edema (Fig. 3) among patients of group A compared to patients of group B with non-significantly (p>0.05) higher frequency of patients had polyps (Fig. 4). The frequency of patients had unilateral or a bilateral finding was non-significantly (p>0.05) different between both patients' groups (Table 4).

Endoscopic findings scoring showed non-significant (p>0.05) difference between scoring of both sides in either group. Endoscopic scoring of polyposis showed non-significant (p>0.05) difference between both groups on either side. However, endoscopic scoring of secretion and mucosal edema was significantly (p<0.05) higher among patients of group A compared to those of group B with significantly (p<0.05) higher total scoring as shown in figure 5 and table 5.

There was positive significant correlation between LKS scoring for endoscopic findings and LMS scoring for CT findings and baseline SNOT-22 in both groups. However, the correlation was more significant between baseline SNOT-22 and LKS scoring than with LMS scoring (Table 6).

Cumulative risk for CRS of imposing high impact on patients' quality of life (QOL) was higher with high LKS scoring for endoscopic findings (Fig. 6) than with high LMS scoring for CT findings (Fig 7).

Table (2): Patients enrolment data

			Group A	Group B	Statistical analysis
Age (years)	Strata	<20	10	8	X^2=0.128, p>0.05
		20-30	51	43	
		>30-40	33	41	
		>40-50	6	4	
		>50-60	0	3	
		>60	0	1	
	Mean (±SD)		31±8.1	28.8±6.6	Z=2.149, p>0.05
Gender	Males		59	67	X^2=1.888, p>0.05
	Females		41	33	
Body weight (kg)			91.1±6.8	89±7.8	Z=1.749, p>0.05
Body height (cm)			170.4±3.8	170.3±3.2	Z=0.892, p>0.05
Body mass index (kg/m^2)	Strata	<25	6	4	X^2=1.408, p>0.05
		25-29.9	65	54	
		30-34.9	29	40	
		>35	0	2	
	Mean (±SD)		31.4±2.5	30.6±2.8	Z=1.983, p>0.05
Duration of disease (months	Strata	≤2	55	58	X^2=1.15, p>0.05
		>2-4	45	36	
		>4	0	6	
	Mean (±SD)		2.4±0.9	2.5±1.2	Z=0.947, p>0.05

Data are presented as numbers & mean (±SD)

Table (3): Patients SNOT scores determined at baseline and at end of treatment in both groups

	Group A	Group B	Statistical analysis
Baseline	59.2±8.6	51.4±7.4	Z=5.816, p=0.0007
At end of 6-w	33.3±3.9	38.6±4.8	Z=3.253, p=0.001
Statistical analysis	Z=8.476, p=0.0001	Z=6.090, p=0.0004	

Data are presented as numbers & mean (±SD)

Table (4): Patients' distribution according to multiplicity of evaluated clinical manifestations

Endoscopic finding	Laterality	Group A	Group B	Statistical analysis
Polyp	Bi-lat	12	8	X^2=1.466, p>0.05
	Uni-lat	27	20	
	Free	61	72	
Secretion	Bi-lat	41	29	X^2=3.434, p<0.05
	Uni-lat	37	34	
	Free	22	43	
Mucosa edema	Bi-lat	44	31	X^2=3.557, p<0.05
	Uni-lat	31	26	
	Free	25	43	

Table (5): Patients' distribution according to laterality of evaluated clinical manifestations

Endoscopic finding	LKS	UAE		ARE		Statistical analysis
		Rt	Lt	Rt	Lt	
Polyp	0	90	79	85	81	X^2=1.709, p_1>0.05
	1	10	13	9	12	X^2=0.871, p_2>0.05
	2	0	8	6	7	
		X^2=1.155, p>0.05		X^2=0.576, p>0.05		
Secretion	0	38	31	62	58	X^2=8.156, p_1<0.05
	1	23	41	27	24	X^2=7.282, p_2<0.05
	2	39	28	11	18	
		X^2=2.1, p>0.05		X^2=0.185, p>0.05		
Mucosa edema	0	37	40	65	63	X^2=10.153, p_1<0.05
	1	49	52	16	14	X^2=27.452, p_2<0.05
	2	14	8	19	23	
		X^2=1.864, p>0.05		X^2=0.593, p>0.05		
Total score		4.36±1.56		2.65±1.53		Z=6.298, p=0.0009

Table (6): Correlation coefficient between baseline SNOT scores and LKS and LMS scores in both groups

	LKS scoring		LMS scoring	
	"r"	P	"r"	p
Group A	0.267	0.007	0.236	0.018
Group B	0.292	0.003	0.248	0.013

Data are presented as numbers & mean (±SD)

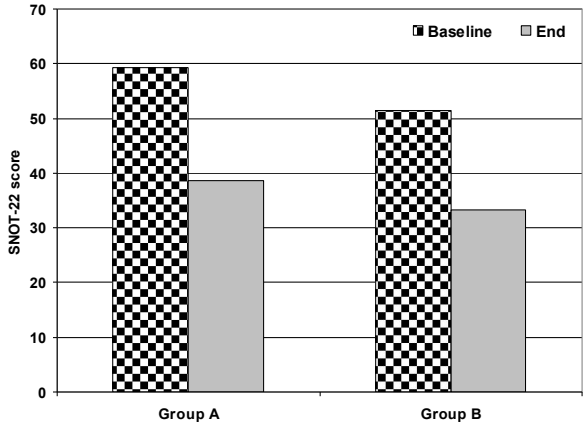

Fig. (1): Mean SNOT-22 score of studied patients at end of the study compared to baseline score

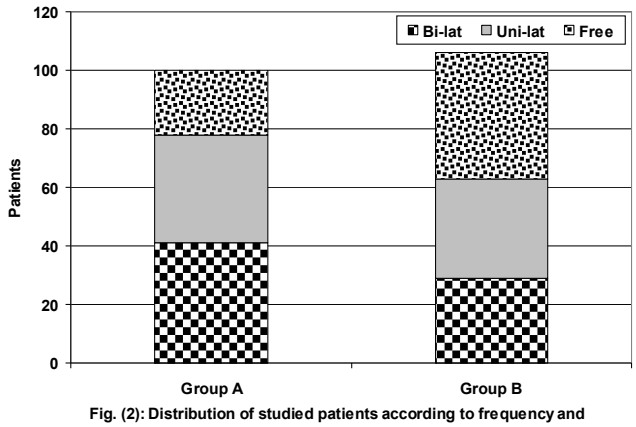

Fig. (2): Distribution of studied patients according to frequency and laterality of secretion on endoscopic examination

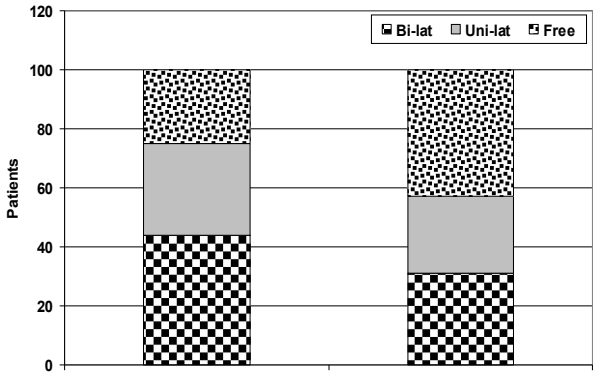

Fig. (3): Distribution of studied patients according to frequency and laterality of mucosal edema on endoscopic examination

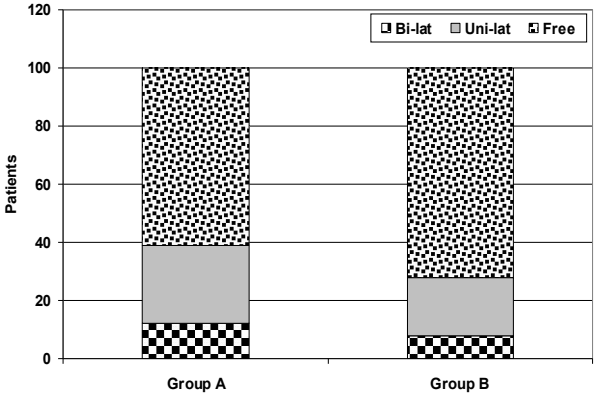

Fig. (4): Distribution of studied patients according to frequency and laterality of finding polyps on endoscopic examination

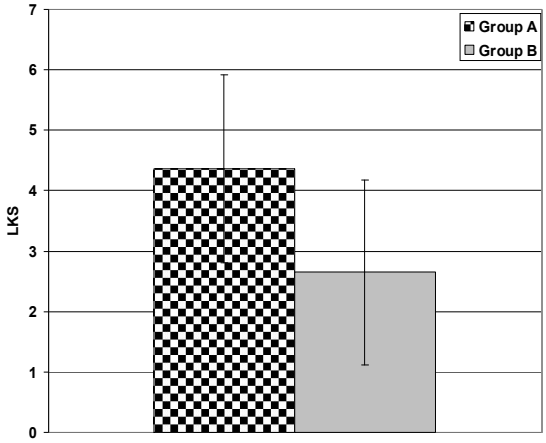

Fig. (5): Mean (±SD) total bilateral LKS of studied groups

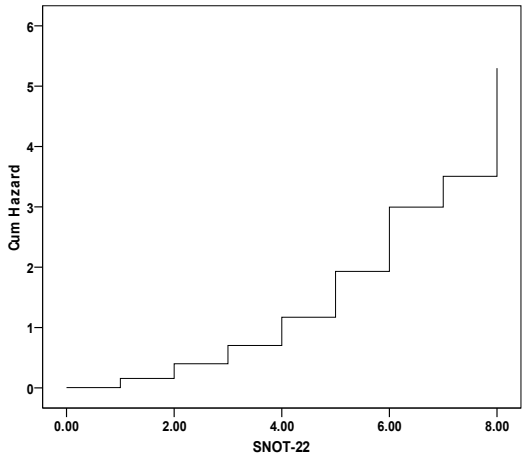

Fig. (6): Cumulative risk of high SNOT-22 as a measure of impact of CRS on QOL of studied patients according to baseline LKS scoring

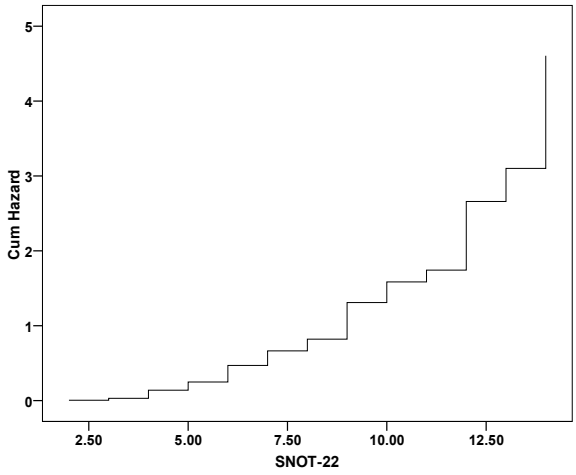

Fig. (7): Cumulative risk of high SNOT-22 as a measure of impact of CRS on QOL of studied patients according to LMS scoring

Discussion

The current study relied, for evaluation and comparison of studied CRS patients, on SNOT-22 questionnaire which is broadly used in the literature **(Piccirillo et al., 2002; Morley & Sharp, 2006)**. It includes assessments of nasal, paranasal and psychological symptoms, and those associated with sleep. It stems from the SNOT-20 and primarily aims at assessing rhinosinusitis treatment. It is considered the most adequate questionnaire to assess the quality of life of patients with CRS **(Hopkins et al., 2009)**.

All studied patients showed significant reduction of SNOT-22 questionnaire scoring after 6-weeks of treatment or after surgery compared to their at enrolment scores. In line with efficacy and adequacy of SNOT-22 questionnaire for evaluation and follow-up of CRS patients, **Marambaia et al., (2013)**

documented that SNOT-22 is a simple and effective tool for evaluation of sinonasal symptoms in cystic fibrosis patients and important for indicating the outcome of the FESS procedure. **Savastano et al., (2014)** also documented that CRS reduces the quality of life of patients, according to the SNOT-22 questionnaire.

Considering baseline SNOT-22 questionnaire score is the comparison item for both diagnosing modalities, scores of both LKS for endoscopic findings and LMS for CT findings positively and significantly correlated with total SNOT score. However, LKS scoring for endoscopic findings showed more significant correlation with baseline SNOT score. Moreover, evaluating the cumulative risk of having complicated CRS manifested as high SNOT score, LKS showed high predictability compared to LMS.

In support of the reproducibility of office nasal endoscopy in cases of CRS, **Lanza (2004) & Kuhn, (2004)** documented that the addition of nasal endoscopy to the care of patients with CRS has resulted in improved diagnostic accuracy. **Bhattacharyya & Lee (2010)** also documented that in combination with established symptom criteria, endoscopic findings improve the specificity, positive predictive value, and negative predictive value of assessment for CRS.

Leo et al., (2010) documented that a diagnosis of certainty of CRS in children relies upon either direct observation by nasal fibroendoscopy of nasal turbinates, middle meatus, and rhinopharynx, detecting mucopurulent discharge from the middle meatus, and/or edema or mucosal obstruction, or by imaging of the rhinosinusal cavities.

Kamani & Jones (2012) reviewed published literature concerning facial pain secondary to sinus disease and found CT scans should not routinely be performed for facial pain because of the prevalence of incidental changes in asymptomatic patients, but a structured history of the pain and its associated symptoms, nasendoscopy and relevant targeted investigations should lead to a correct diagnosis and guide to the appropriate treatment.

Ferguson et al (2012) found that the specificity of nasal endoscopy was 100%, with the finding of mucopurulence only present in those patients with positive CRS on CT. Also, **Shargorodsky & Bhattacharyya, (2013)** found nasal endoscopy to have high diagnostic accuracy in individuals with the combination of symptom criteria and positive endoscopic findings and in these patients a diagnosis of CRS may be made without additional imaging.

Wuister et al., (2014) performed a comprehensive search to assess the diagnostic value of nasal endoscopy in adults suspected to have CRS and reported a prevalence of CRS diagnosed with CT of .40-56% and found an added value for ruling in CRS by a positive nasal endoscopy of 25-28% and an added value for ruling out CRS by a negative nasal endoscopy of 5-30%; thus concluded that CT is not considered necessary in case of a positive nasal endoscopy and must be advised only for patients with a prolonged or complicated course of CRS or negative endoscopy. **Peters et al., (2014)** suggested that the use of diagnostic endoscopy may help decrease the need for CT and reduce costs and radiation exposure.

It could be concluded that office nasal endoscopy is effective diagnostic modality for patients with CRS and could spare the need for CT for preliminary evaluation. For these advantages, office nasal endoscopy is recommended as routine examination tool for diagnosis and follow-up of patients presenting with manifestations of CRS

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