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Research Article

Nasal Endoscopy Using Angled Endoscopes

Rejuvenating The Shunned Art of Diagnostic Nasal Endoscopy Using Angled Endoscopes- A Descriptive Study

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Abstract: Nasal endoscopy is a minimally invasive, routine outpatient diagnostic procedure. With 0 degree scope being used as the first and often only endoscope in diagnostic nasal endoscopy, this study will explicate use of angled scopes to identify anatomical variants and common disease pointers. A Cross-sectional descriptive study involving 756 subjects, between age group of 12-80 years with chronic nasal complaints. All subjects underwent diagnostic nasal endoscopy with 0-, 30- & 70-degree endoscopes. Common anatomical variants along with disease markers were identified. Anatomical variants embedded in lateral wall of nose such as accessory maxillary ostium (AMO) & medialized uncinated (MU), were seen better on 30 & 70 degree scopes (AMO -12% & 12.8% respectively & MU -7.6 and 8.1% of study population respectively), when compared to 0 degree scopes (AMO-5.6% & MU-7 %). Disease pointers projected a general trend of being better visualized on angled scopes of 30 & 70 degree endoscopes. It included discharging meati (27.9 % & 26.3% subjects on 30 & 70 degree vs 25 % subjects on 0 degree), polyposis (20.2 & 19.6% on 30 & 70 degree vs 13% on 0), eschar (6.1% & 5.7% on 30 & 70 degree vs 4.5% on 0), CSF rhinorrhoea (1.3% & 2.1% on 30 & 70degree vs 0.5% on 0). With inclusion of angled scopes in routine nasal endoscopies, one gains capability to diagnose early disease processes, mucosal changes and learn intra nasal anatomy better. The angulation of lenses provides a better field of vision with appropriate magnification and illumination.

Keywords: Endoscope, Diagnostic Nasal Endoscopy, Angled Endoscopes, Anatomical Variants and Disease Markers

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1. INTRODUCTION

With the advent of endoscopy, visualization of structures which were usually not appreciated with naked eyes are well under our vision now. Nasal endoscopy facilitates thorough examination of nasal anatomy along with identification of pathology, all of which is near impossible to visualize using standard techniques with headlight or head mirror. Nasal endoscopy is a minimally invasive routine outpatient procedure which is presently the initial method of evaluating nasal complaints. Nasal endoscopy is a direct vision examination of the nasal and sinus passages using an amplified high-quality view. It is a standard thing in the office of an otolaryngologist and provides an objective diagnostic instrument in the assessment of nasal mucosa, sinonasal anatomy, and nasal pathology. Nasal endoscopy can be performed using a flexible fiberoptic endoscope or a rigid endoscope. Both flexible and rigid endoscopy are typically tolerated well once conducted by experienced personnel. With the endoscope, the surgeon gains capacity for precise anatomy identification along with angled, illuminated, and magnified viewing of the internal nose preoperatively, intraoperatively and postoperatively [1-3]. Nasal endoscopy and image analysis are the two most commonly used measurements in the evaluation of chronic rhinosinusitis (CRS). Endoscopy has numerous applications in the treatment of individuals with sinonasal symptoms, and it is essential in both preoperative and postoperative care coordination. Nasal endoscopy serves a wide spectrum of services such as nasal biopsy sampling, microbiological culture collection, video recordings, other than diagnostic component. Nasal endoscopy allows for better illumination, larger magnification, and unfettered access to pathologic places. As a result, examiners receive a more precise and comprehensive diagnostic evaluation. There is an ample armamentarium of nasal endoscopes available with the current generation of otorhinolaryngologists, including the rigid endoscopes with 0,30,45,70,90 & 120 degree lenses[4-6]. With 0-degree scope being used as the first and often the only endoscope in diagnostic nasal endoscopy, this study will explicate the use of angled scopes such as 30 & 70 degrees, to visualize the entire nasal cavity. Often, more preference is given to CT scan for diagnosing sinonasal diseases and nasal endoscopy is neglected or considered of low diagnostic value. After comprehensively going through research on nasal endoscopies, the literature advocating implication of angled nasal endoscopes for diagnostic purposes was surprisingly scarce. The research is aimed at studying the role of angled nasal endoscopes (0, 30 & 70 degrees) in detecting pathologies, hidden areas and anatomical variations of the nose and paranasal sinuses. This study elaborates the diagnostic inputs which can be obtained via the usage of different angled scopes during a routine diagnostic nasal endoscopy.

2. MATERIALS AND METHODS

2.1 Study Type and Ethics

The study was a descriptive cross-sectional study conducted in the Department of Otorhinolaryngology, Mahatma Gandhi Medical College & RI, SBV Deemed to be University, Pondicherry. The approval from institutional ethics committee was obtained. (MGMCRI/RES/01/2019/IHEC/082). Over a period of 21 Months i.e. from February 2020 to October 2021, 756 patients attending ENT Outpatient department with nasal complaints were evaluated. The study was done according to the declaration of Helsinki.

2.2 Inclusion and Exclusion Criteria

All patients ageing between 12 years- 80 years with complaints consistent with nasal or sinus disorders, like chronic nasal obstruction (> 3 months), chronic nasal discharge (> 3 months), bleeding from nose, nasal mass, facial pain/pressure, anosmia/ hyposmia, posterior nasal drip, headaches (related to sinus infection or deviated nasal septum), and allergies, were included in the study. Subjects less than 12 years of age or more than 80 years of age, those with history of previous sinonasal surgery, patients with active epistaxis, cystic fibrosis, pregnant females, patients suffering from immune-compromised disorders or having autoimmune diseases and patients who declined to participate, were excluded from the study. Patient information sheets in local language were provided and written and informed consent was taken.

2.3 Sampling and Statistics

Sample size of 756 subjects was calculated keeping level of significance (α) as 0.05, estimated proportion (p) as 0.23 and estimated error (d) as 0.03; where p (estimated proportion) was calculated based on a previous study by Shelkar et al [4] All the data was added in a master chart and was processed using SPSS software (version 22).

2.4 Basic Protocol

A brief history of the chief complaint, associated symptoms, previous treatment, previous and current nasal-sinus medications, allergic disorders, and associated medical conditions was taken. After a detailed history, all patients underwent a complete ENT examination with special emphasis on anterior rhinoscopy using a head mirror and bulls eye lamp or headlight. Written and informed consent was taken before the diagnostic nasal endoscopy. For each patient a 0, 30, 70 degree rigid Hopkins nasal endoscopes were used. (Figure 1)

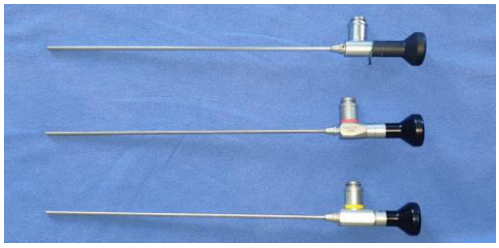

Fig 1 showing three endoscopes

2.5 *Endoscopic Technique*

All diagnostic nasal endoscopy was performed under cover of local anesthesia. Nasal cavity was packed with cotton/roller gauze soaked in 0.09% of xylometazoline/oxymetazoline with 4% lignocaine solution. With the 0-degree rigid scope, being usually the first scope to be introduced into the nasal cavity, the scope was passed along the floor of the nasal cavity up to the nasopharynx and all the structures seen were noted (first pass). This 0-degree scope was then passed at an angle of 30 degrees from floor to visualize the structures along the lateral wall of nose such as middle meatus and middle turbinate (second pass). Finally, scope was angled more medially and superiorly to middle turbinate to visualize the superior most structures (third pass). Then a 30 degree and 70-degree scope was introduced along the three passes mentioned above and all the structures and anomalies visualized were duly noted.

2.6 *Noted Variables*

The demographic variables evaluated in the study included age and sex. Study variables of Anatomical Variants and the Disease pointers involving nose & paranasal sinuses were evaluated as categorical variables. All continuous variables were evaluated using mean and standard deviation. Categorical variables were evaluated and expressed in percentages.

3. RESULTS

In this study, subjects ageing from 12 years to 80 years of age were included. The mean age throughout the study came out to be 41.26 with a standard deviation of ±16.36. The youngest subjects were of the age 13 and the oldest ones being 80 years old. The subjects from the 4th decade of life were predominant in the study. (Figure 2a,2b)

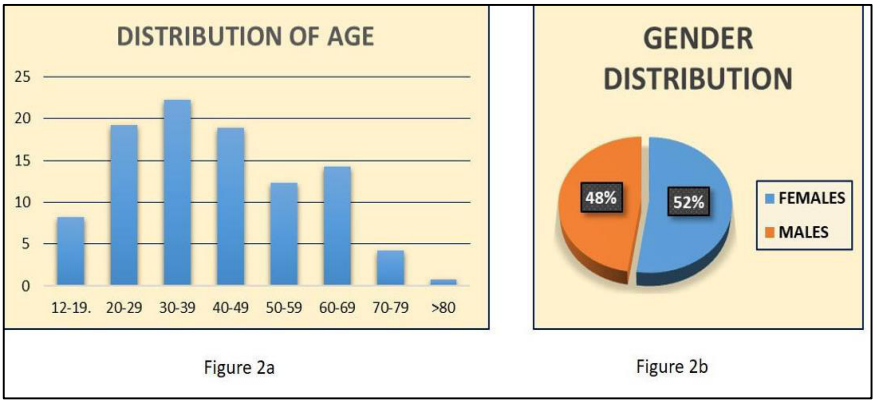

Figure 2- 2a- Bar graph representing distribution of age groups, 2b- Pie Chart describing gender distribution

While anatomical variants such as deviated nasal septum, spur, concha bullosa and ethmoidal bulla projected near identical frequencies, notable distinction were observed in other anatomical anomalies. Medialised uncinated was slightly visualized better with angulated scopes of 30 and 70 degrees (7.6 and 8.1% respectively of study population) when compared to a straight looking 0 degree scope (7 % of study population). Similarly, accessory ostium was observed better with endoscopes having angulated lenses of 30 and 70 degree endoscopes (12% & 12.8% respectively), as compared to zero degree lens endoscope (5.6%). Inferior turbinate hypertrophy which was accurately identified using 0^0 & 30^0 endoscopes in 333(44%) and 328(43.3%) individuals. However, while using a 70^0 lens, due to the down-facing angulation, hypertrophy of inferior concha was just seen in 12 subjects (1.6% of study population). (Figure 3a,3b,3c)

Figure 3- 3a- Accessory ostium of maxillary sinus, 3b- Medialised uncinated process, 3c- Sphenoid sinus ostium

Table 1- Table summarizing Cumulative analysis of Frequency and percentage of anatomical variants seen across 0, 30 & 70 degree endoscopes

Anatomical variants	Zero Degree n (%)	Thirty Degree n (%)	Seventy Degree n (%)
Deviated nasal septum	384 (50.8)	382 (50.5)	380 (50.3)
Spur	242 (32)	239 (31.6)	240 (31.7)
Inferior turbinate hypertrophy	333 (44)	328 (43.3)	12 (1.6)
Medialised Uncinate	53 (7)	58 (7.6)	61 (8.1)
Concha Bullosa	232 (30.7)	229 (30.2)	228 (30.1)
Paradoxical middle turbinate / Double Middle turbinate	44 (5.8)	41(5.4)	44 (5.8)
Accessory Ostium	42 (5.6)	91 (12)	97 (12.8)

Table 1: When compared with 30 & 70 degree endoscopes, a 0 degree endoscope identified only 25% subjects with mucopurulent discharge from the middle meatus. The angled endoscopes were able to identify discharging middle meatuses better, accounting for 27.9% and 26.3% subjects on 30 & 70 degree endoscope respectively. When nasal polyposis were observed using 0, 30 & 70 degree scopes, there was an obvious increment in numbers of polypoidal tissue identified using angled scopes. While the straighter lens of 0^0 was able to identify only 13% of subjects to have polypoidal changes, angled scopes of 30^0 & 70^0 identified 20.2 & 19.6 percent subjects respectively. In the study population, eschar of the nasal mucosa was visualized more frequently on a 30 & 70 degree scope (6.1% & 5.72 %) when compared to a 0 degree scope (4.5%). Amongst the subjects, crusting was better isolated using 30 & 70 degree scopes (3.7 & 3.3%) when compared to a 0 degree (2.6%). CSF rhinorrheas were better spotted in 2.12% of study subjects, on whom 70 degree scopes were employed. Whereas, 0 & 30 degree scopes only visualized CSF leak in 0.53 & 1.3% respectively. Identification of nasal masses across three above mentioned scopes showed only slight difference in frequency. Similar pattern was seen in frequency of visualization of foreign body nose amongst 0, 30& 70 degree scopes. (Figure 4a,4b,4c)
(Table 2)

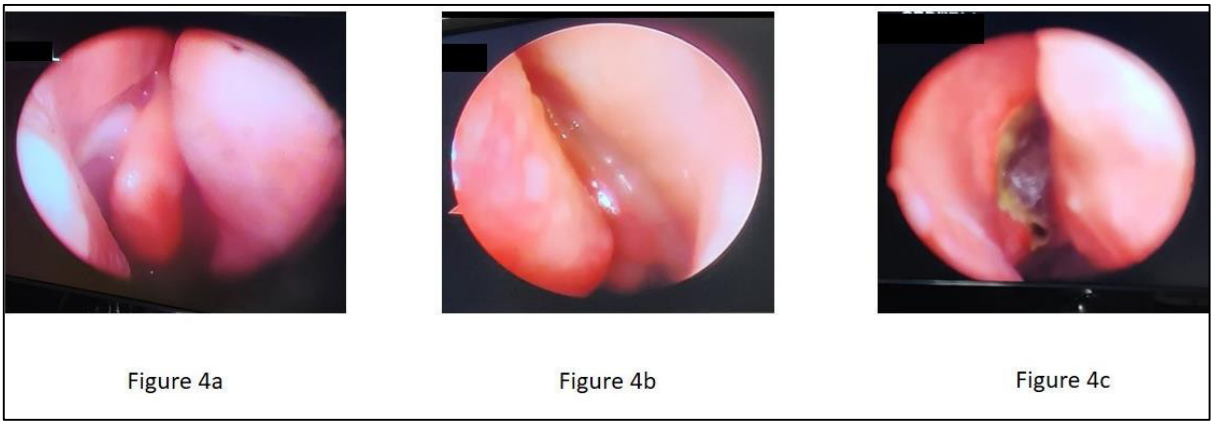

Fig 4- 4a- Mucopurulent discharge in middle meatus-4b- Early polypoidal changes-4c- Nasal eschar

Table 2 - Table summarizing Cumulative analysis of Frequency and percentage of disease pointers seen across 0, 30 & 70 degree endoscopes

Disease pointers	Zero Degree n (%)	Thirty Degree n (%)	Seventy Degree n (%)
Mucopurulent discharge from Middle Meatus	189 (25)	211 (27.9)	199 (26.3)
Polyps	98 (13)	153 (20.2)	148 (19.6)
Nasal Masses	69 (9.1)	76 (10.1)	74 (9.8)
Foreign body in nose	16 (2.1)	19 (2.52)	14 (1.9)
Crusting	20 (2.6)	28 (3.7)	25 (3.3)
Eschar	34 (4.5)	46 (6.1)	43 (5.7)
CSF Rhinorrhea	4 (0.5)	10 (1.3)	16 (2.1)

Sphenoid sinus ostium, a region hidden to routine diagnostic nasal endoscopy. In our study, we were able to pinpoint sphenoid ostium opening in 142 of our subjects via careful manipulation of 30 & 70 degree nasal endoscopies. Out of the 756 subjects studied, sphenoid ostium was visualized in 142 subjects via 70 degree scope in patients, whereas 30 degree scope was able to observe it in only 112 subjects.

4. DISCUSSION

Since the advent endoscopes, diagnostic nasal endoscopy has become a commonly performed outpatient procedure in the field of otorhinolaryngology. Diagnostic endoscopy aids in visualization of anatomical variations which might predispose to nasal and paranasal sinus diseases. Also, diagnostic nasal endoscopy provides an accurate and magnified view of the

disease processes in & around the nasal cavity. Adequate use of angled nasal endoscopes maybe helpful in early diagnosis and pre-operative planning of common nasal and paranasal sinus pathologies. In our study, we have evaluated anatomical anomalies and disease markers via subjecting 756 subjects to nasal endoscopies using three different angled nasal endoscopes i.e. 0, 30 & 70 degree. The demographic distribution in our study projected the mean age of presentation to be 41.26 ±16.36, with highest percentage of subjects from the 4th decade of life. Similar age distribution was observed in Shelkar et al [4], where majority of patients were in the age group of 31 to 40 years. In our study, the study population consisted of 52 % females and 48% males. This male to female ratio was similar to the gender distribution seen in a study by Stankiewickz et al [7] on nasal endoscopy and CRS, where females comprised 51.2% and 48.7 % were males. Anatomical anomalies might predispose an individual to develop numerous nasal and sinus pathologies. In some cases, the mere presence of these anomalies causes nasal symptoms and discomfort. In our study, deviated nasal septum was found to be the most common anatomical variation. The frequency of identification of DNS across the three angled endoscopes used i.e. 0, 30 & 70 degree, were 50.8%, 50.5% & 50.3 % respectively. The minor disparity, observed in the DNS frequency distribution, can be associated with occasional presence of very high deviations of nasal septum which can be missed on angulated scopes such as 70 degrees. The second most frequent variation found on 0 & 30 degree endoscope was inferior turbinate hypertrophy. However, on a 70 degree scope, due to the down facing angulation, apparent visualization of hypertrophied inferior concha and its actual width were not accurately visualized. This aberration was prominent in our results where 0 & 30^0 scopes showed 44 % & 43.3 % individuals to have ITH, whereas on 70^0 scope it was seen only in 1.6 % subjects. Third commonest anatomical anomaly found uniformly across all three variety of endoscopes was nasal spur which was closely followed by concha bullosa. Nasal spur accounted for 32 %, 31.6 % & 31.7 % study subjects when examined using 0,30 & 70 degree scopes respectively. Pneumatized concha also projected close ranged values of around 30 % in all three endoscopic examinations. Ethmoidal bulla was next anatomical variation found almost equally amongst all three types of endoscopes. Its percentage of presence in study subjects ranged from 19.4 % to 18.5 % when viewed from 0 degree to 70 degree scope. Similar pattern was found in visualization of paradoxical/ double middle turbinate, where it was present in 5.4% to 5.8% subjects across all three variety of scopes. Structures embedded inside the lateral wall such as accessory ostium and medialized uncinated showed distinctive values on angled endoscopes as compared to a 0 degree scope. The better visualization of these apparently hidden structures of lateral wall of nose on 30^0 & 70^0 endoscopes can be attributed to wide angles of illumination provided by these angled nasal scopes. Accessory ostium was better visualized using angulations of 30 and 70 degree scopes (12 % & 12.8 % subjects respectively), when compared to 5.6 % subjects seen on 0 degree scope. Similarly, medialized uncinated was observed in 7.6 % and 8.1 % study population when angled scopes of 30 & 70 degree were employed, which in comparison to a 0 degree examination was 7%. In a study done by Tyagi et al [8], where a comparison between DNE and CT scan of nose and PNS were done, usage of 0, 30, 70 & 90 degree endoscopes were done. The results of endoscopic examination in 100 subjects were found to be similar to our outcome. DNS was the most common anatomical variant (61%), followed by ITH (48%), Concha bullosa (41%), paradoxical MT (23%) and medialized uncinated (18%). In this study, CT scan missed 4 cases of DNS which were picked up by angled endoscopes, reinforcing the fact that DNE can act supplementary to the gold standard CT scan. In another study done by Lohiya et al [9], comparison of DNE as a diagnostic modality was done with CT scan for diagnosing CRS using 0 & 30 degree endoscopes. The anatomical variants visualized for a study population of 100, slightly varied from our study values. Higher values of diagnosed DNS, Paradoxical MT & Accessory maxillary ostium (79%,28% & 21% respectively) were noted. This can be attributed to the inclusion of only CRS patients in the study [9], which again emphasizes on relation between anatomical variants and related causation of nasal diseases. Shelkar et al[4] used a 0 & 30 degree endoscope to identify common nasal and paranasal sinus diseases. Anatomical variants in the study showed spur to be present in 35.7 % subjects, concha in 25%, bulla in 14.2% and accessory ostium in only 3.5% subjects. As compared to our study, accessory ostia were found in lesser population than expected. This can be related to usage of an extra 70 degree endoscope in our study which helped us to identify more accessory ostia. In a study done by Maru et al [10], comparing anterior rhinoscopy, DNE and CT scan for sinonasal diseases, evaluated 80 patients with zero degree scope & CT scan. Anatomical variants in the study included DNS 63%, ITH 47%, concha bullosa 38% and medialized uncinate 10%. Disease pointers is a combined term, used to express manifestations of sinonasal diseases as seen on nasal endoscopy. In our study, we looked for seven such parameters in 756 individuals using 0,30 & 70 degree scopes. The most common disease marker seen in our study was mucopurulent discharge from middle meatus, which was observed slightly better on angled scopes of 30 & 70 degree (in 27.98 & 26.3% of subjects) as compared to a 0 degree examination (25%). Due to the angulated lens, we were able to get a well illuminated and magnified view of middle meatal area. Polypoidal tissue was the second most common disease marker which was identified in more numbers when we used a 30 or 70 degree endoscope. While gross nasal polyposis was visualized well on a zero degree endoscope (13% of study population), early polypoidal changes can often be missed. With availability of angulated scopes, which can visualize structures of the lateral wall with better focus and magnification, early polypoidal changes in the middle meatus and anterior ethmoidal areas are better observed. In our study, 30 & 70 degree endoscopes were able to recognize early polypoidal changes in 20.2 & 19.6 % of study subjects. This proved to be evident increment in isolating early polypoidal changes, which can in turn aid us to provide early medical intervention. Nasal masses were the third most frequent disease manifestation, and its distribution across all the three types of endoscopes showed minimal improvement when angled endoscope were employed. Angled endoscopes of 30 & 70 degrees showed 10.1 % & 9.8% subjects to have nasal masses, whereas 0 degree showed masses in only 9.1%. Masses arising from the maxillary sinus or ethmoidal air cells or frontal recesses were better visualized using the angled scopes. Foreign body in nose are commonly seen in children and young adults, as seen in our study as well, with most of subjects in the age group of 12-19 years. Frequency of visualizing nasal masses were more or less equal when compared amongst the three nasal endoscopes i.e. 2.1 %, 2.52% & 1.9 % on 0, 30 & 70 degrees respectively. This can be attributed to the lodgement of foreign body nose mostly along the floor of the nasal cavity. Crusting and eschar were the other nasal disease markers which were examined in our study

using three different scopes. The distribution of both these markers also showed the trend of being more frequently visualized by angled endoscopes. Cases of eschar increased vehemently due to the prevalence of mucormycosis during the COVID-19 pandemic overlapping the study period[11-12]. It accounted for 4.5% of study population when investigated using a 0 degree scope. With 30 & 70 degree scopes providing an extensive visual field due to its angulated lenses, eschar occupying towards lateral wall and under surfaces of turbinates were better visualized. This was shown by our statistics, which showed 6.1 & 5.7% of population having eschar when compared to lower numbers of eschars identified on 0 degree endoscopy. CSF rhinorrhoea, an uncommon disease presentation in otorhinolaryngology, was found to be the least frequent disease marker. When a 0 degree scope was used, only 0.53 percentage of subject were identified to have CSF leak. The numbers increased when a 30 degree (1.3%) and 70 degree (2.12%) scopes were used. This can be attributed to the better visualization of superior part of nasal cavity and the roof with angulation of scopes. Shelkar et al [4] in their study, made 100 of subjects undergo nasal endoscopic examination with 0 & 30 degree scopes. Nasal polyposis was seen in 27%, Mucopus in 22 %, nasal masses in 12%, rhinolith or impacted foreign body in 4 % and CSF rhinorrhoea in 1% study population. The distribution was found to be similar to our study, with an exception of higher frequency of nasal polyposis. In a study done on diagnosis of CRS, Tyagi et al [8] used a series of nasal endoscopes such as 0,30,70 & 90 degrees. In their study, mucopus in the middle meatuses was seen in 69 % of the study population, while nasal polyps were observed in 22.8 % of subjects. This exaggerated number of cases of CRS and polyposis in their study can be implied to usage of multiple angled nasal endoscopes for diagnosis. Such results encourage the routine use of angled nasal endoscopes in successfully identifying sinonasal pathologies. In a study by Kishore et al [13], patients with sinonasal complaints were subjected to nasal endoscopy with 0 & 30 degree scopes. In their study they have stressed upon the identification of early polypoidal tissue around middle meatus in 3.5% of study population. Nasal masses (14%), choanal polyp (5%) and discharging middle meatuses (10.7%) were the other disease markers. In our study, where 0 degree identified gross nasal polyposis, angled endoscope helped in identifying additional 6-7 % subjects with early polypoidal changes. In studies done by [9, 14] and Nathan et al [15], nasal endoscopy was compared with CT scan of nose & PNS in patients with chronic rhinosinusitis. They used 0 and 30 degree endoscopes for observing polypoidal changes, mucopus from middle meatus and edematous mucosa. Lohiya et al [9] in their study observed discharge in middle meatus in 47 % subjects and polypoidal tissue in 27 % subjects. Deosthale et al [14] had similar projections where polyposis alone accounted for 24 % subjects, mucopurulent discharge for 32% subjects and polyps with diseased mucosa in 14% subjects. Nathan et al [15] showed 55 % population to have polyposis and 46 % subjects having mucopurulent discharge. All these three studies have reinstated the fact that diagnostic nasal endoscopy with various angled scopes is an effective tool for early identification of CRS. These studies have emphasized on cost friendliness of DNE and its role in predicting disease process during medical management. In these studies, DNE with angled endoscopes has been proven to be a good alternative for CT scan in diagnosing CRS, especially in centres where resources are limited. Additionally, using our 30 & 70 degree endoscopes, identification of sphenoidal opening in 142 of our subjects was possible, using surgical landmarks described in previous studies[16,17]. While searching for sphenoidal opening, 30 degree endoscope was positively able to identify the ostium in 112 out of 756 subjects. Whereas the 70 degree endoscope, owing to its angulation identified the ostium in 142 subjects. Examination of these sphenoid ostia are vital when sphenoidal sinusitis is being suspected and are often missed out of a routine DNE with 0 degree scope. In our study, we evaluated the anatomical variants of nose and paranasal sinuses along with the common sinonasal disease markers. All our subjects underwent a diagnostic nasal endoscopy with 0, 30 and 70 degree endoscopes. With our results, we would like to stress upon the implications of angled nasal endoscopes in identifying nasal pathologies while delineating various anatomical anomalies. With no previous studies comparing the observations of nasal endoscopy across different angled scopes, we would like to elaborate the advantages of angulation in the DNE procedure. With the help of wider field of vision provided by these angled endoscopes, we were able to identify laterally lodged anatomical variants such as accessory ostium. Angled endoscopies boosted our diagnostic capabilities in identifying signs of early disease such as early polypoidal changes, mucopus in middle meatus, which could have been easily missed in a 0 degree endoscopy. Accurate visualization of eschar, CSF rhinorrhoea and nasal crusting were also possible via employment of angulated scopes. Apart from being an easily available, cheap, quick OPD based procedure; an accurately performed diagnostic nasal endoscopy with angled scopes might delay the need of radiological scans and can give supplementary diagnostic inputs when a CT scan is warranted.

5. AUTHOR CONTRIBUTION STATEMENT

Shashwat Datt Mehta – data collection, Karthikeyan – concept and design , manuscript, Vijayasundaram - manuscript

6. CONFLICT OF INTEREST

Conflict of interest declared none.

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