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Computed Tomography (CT) scan of the paranasal sinuses and microRNA expression in patients with Nasal polypi

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Abstract:

Introduction: Nasal polypi is a prevalent clinical illness in the outpatient clinic in ENT. Nasal polyps are usually bilateral inflammatory lesions that arise from the ethmoid sinus and protrude into the nasal airway. MicroRNAs (miRNAs) are a class of non-coding RNAs. They are involved in controlling gene expression. MicroRNAs can control transcription and initiate translation under specific circumstances. Numerous variables influence the dynamic interaction between microRNAs and their target genes.

Aim of the study: To correlate CT findings of the paranasal sinuses and microRNA 29 expression in patients with Nasal polypi.

Subjects and Methods: The research included 100 participants, 50 of them had sinus polyps. We took a thorough ENT history, including the patient's name, sex, age, chronic illnesses, and nasal symptoms. Complaints about smell and facial ache. All subjects had 3 ml of venous blood samples taken for RNA extraction and to find the expression of microRNA 29 using RT-PCR.

Results: Patients with complete opacification of the anterior ethmoids have a lower median (IQR) in terms of a high degree of under-expression of the miR-29 biomarker. However, no significant relationships with *p*-value >0.05 were found between the markers level and other CT PNS findings.

Conclusions: In this work, we found that individuals with nasal polyps significantly under-expressed microRNA 29, and that this under-expression was associated with many aspects of the patient's clinical presentation, including the sense of nasal blockade, and full opacification of the anterior ethmoids.

Keywords: Polyps; MicroRNA; Computed tomography.

1. Introduction

Nasal polypi are protruded, pedunculated, non-sensitive outgrowth of chronic infected and inflamed mucosa of the nose and sinuses. Patients with chronic sinusitis are the most common group of persons who exhibit this pathology. Because of this, while talking about nasal polyps, the term chronic rhinosinusitis with nasal polyposis (CRSwNP) is commonly used. Nevertheless, they are also linked to several other conditions, including cystic fibrosis, some forms of systemic vasculitis as vasculitis with polyangiitis, and aspirin-exacerbated respiratory disease (AERD). As an end-stage symptom of uncontrolled allergies, managing an existing case of polyposis is just the first step in the process. Once the polyps have been managed, local therapy and systemic therapy targeting the management of the underlying allergic cause must be implemented. Patients with nasal polypi will have substantial nasal blockage, nasal and facial congestion, ageusia, and other symptoms that can present [1].

There is no known cause of nasal polypi. According to some opinions conditions that result in chronic inflammation of the nose and nasal sinuses, marked by oedema and various cellular infiltration, are the source of polyps. Although this hypothesis has a lot of researched proof behind it, the initialization cause is still unknown and may vary depending on each situation. Asthma, bronchiectasis, and cystic fibrosis are among the illnesses that are frequently linked to polyps. Nearly 10% of instances with NP are in the well-known subset of Samnter's Triad patients who also have polyposis, asthma, and aspirin hypersensitivity [2].

Since the discovery of microRNAs, also known as miRNAs, more than two decades ago, many scholars have been interested in learning more about the world of the new tiny regulatory RNA molecules. Even though the fundamentals of microRNA biosynthesis and biofunction were discovered early on, new insights into the architecture and molecular patterns of the microRNA machinery at its core, the processes by which microRNA molecules and targets are chosen from the transcriptome, and the biological processes underlying microRNA turnover have all been revealed in recent years [3].

2. Subjects and Methods

2.1.Subjects

This study involved all patients from the ENT clinics at Fayoum University Hospitals.

Inclusion criteria

All patients with sinus polypi were included.

Exclusion criteria

Individuals who met any of the following criteria were not allowed to participate in the study: very young or very old patients, pregnant, had any end-stage medical illness, severe heart or chest diseases

Study design

All participants in the study provided written informed consent after being informed of its purpose. The study was conducted as a controlled study according to the terms of the Declaration of Helsinki.

2.2.Methods

In this study, 100 participants were split into two groups:

Group A: 50 nasal polyp patients.

Group B: 50 healthy individuals.

All of the included participants were older than 18 years, and an endoscopic evaluation confirmed the existence of nasal polyps. We did not include patients who were pregnant, under the age of eighteen, or who had a history of prior surgery for any nasal disease, as well as patients with debilitating medical conditions such as renal, cardiac issues or HIV.

We completed a thorough ENT history using the following form: personal history, place of residence, history of smoking, chronic illnesses, and asthma.

Nasal symptoms include congestion, nasal blockage, colorful or watery discharge, problems connected to smell, and itching.

Afterwards, we performed an endoscopic examination to determine the degree of nasal polyp blockage as shown in **Figure 1.**

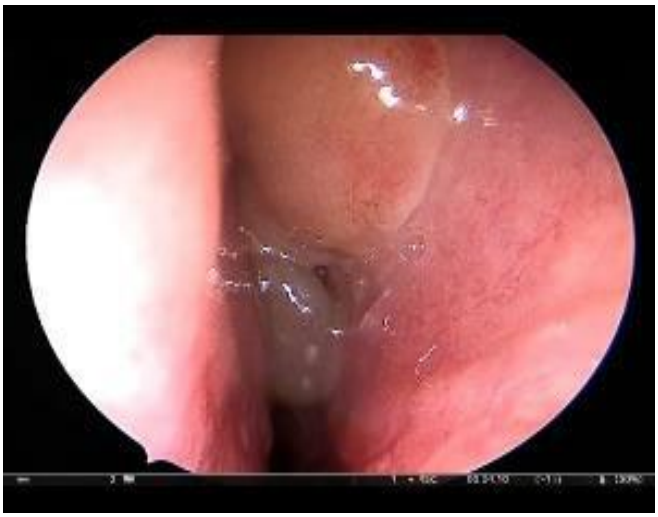

Figure 1: Endoscopic nasal examination of different patients: nasal polyps filling the nasal cavity.

To determine the precise anatomy of the PNS and to identify any mucosal abnormalities within the middle meatus and/or sinuses, a CT scan of the paranasal sinuses was performed. We staged the results of our CT scan using the Lund-Mackay technique. The three main elements of the Lund-MacKay system are the sinus location and degree of opacification: 0 denotes normal, 1 partial opacification, and 2 complete opacifications as demonstrated in **Table 1** and **Figure 2.**

Table 1: Radiological staging of CRS.

Radiological staging of CRS [4]	**Right**	**Left**
Paranasal sinuses		
Maxillary 0,1,2		
Anterior ethmoid 0,1,2		
Posterior ethmoid 0,1,2		
Sphenoid 0,1,2		
Osteomeatal complex 0*, 2*		
Total points to each side		

0 = no abnormalities, 1 = partial opacification, 2 = complete opacification 0* = not occluded, 2* = occluded.

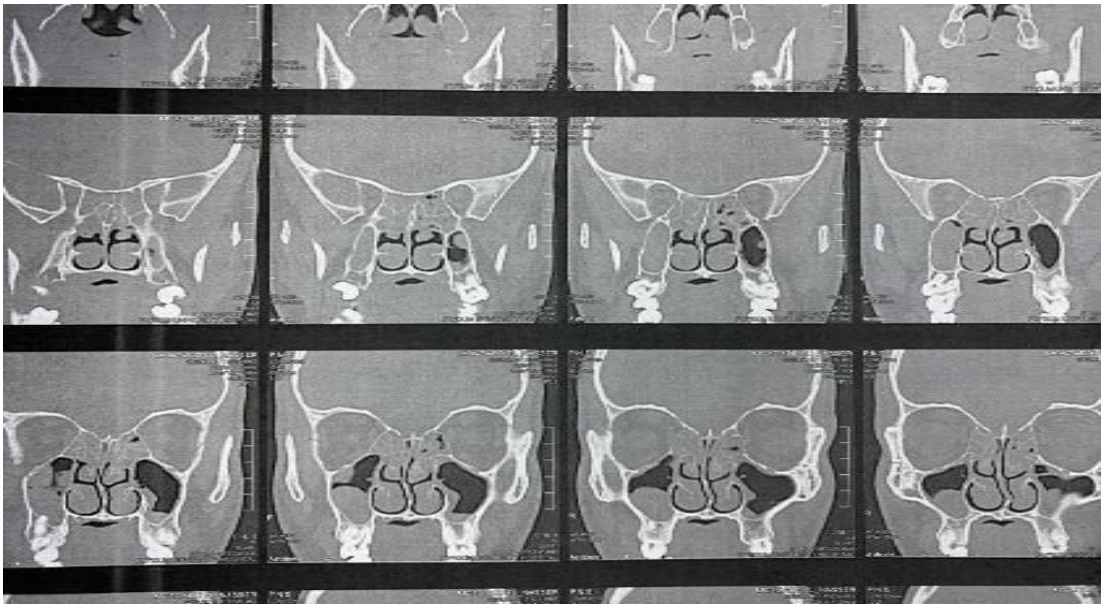

Figure 2: CT findings from different patients. A: partial opacification in the maxillary sinus and complete opacification of the anterior and posterior ethmoids.

Following this, we extracted 3 ml of venous blood from each participant to extract MicroRNA and used RT-PCR to measure the fold change in MicroRNA 29. MicroRNA extraction was carried out utilizing a (Qiagen, Germany, mini kit).

2.3.Statistical Analysis

To facilitate data entry into the Microsoft Access program, data gathering, coding, and organizing were carried out. On a Windows 7 computer, SPSS software version 16 was used to statistically analyze the data (SPSS, Inc., USA) • Basic descriptive analysis of qualitative data using percentages and numbers is done using inferential statistical tests; standard deviations are used for parametric data analysis, arithmetic means are used to determine central tendency, and so on. Using a paired t-test for quantitative parametric data, two dependent quantitative data sets are compared. - Use the Chi-square test for qualitative data when comparing two or more groups. - A bivariate correlation test to determine how well the variables are associated. Level $P < 0.05$ was determined to be the cut-off value for significance.

3. Results

The first group (Group A) consisted of fifty patients, with ages ranging from eighteen to sixty years old (mean of 35.80 ± SD 10.03 years). Of these patients, thirty were male and twenty were female. the second group (Group B) consisted of fifty individuals, comprising 32 males and 18 females, ages ranging from 21 to 62 (mean of 37.76± 11.63 years). This group served as the control (**Figure 3**). A baseline characteristic of the studied group is shown in **Figure 3.**

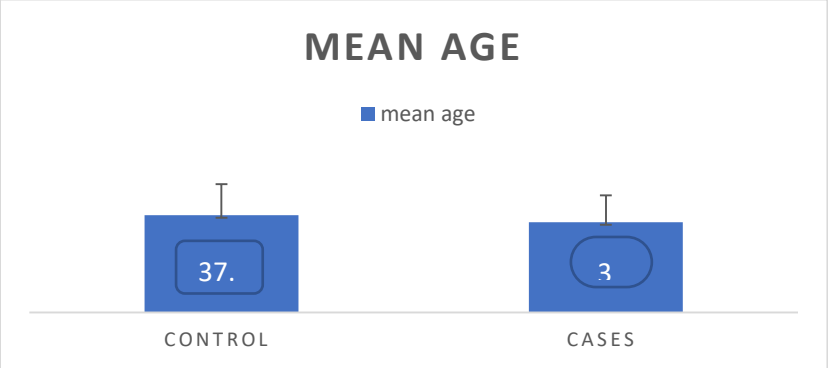

Figure 3: The mean age between the groups both cases and controls.

As for the nasal symptoms, among the patients, there were 11 patients with mild nasal discharge, 39 patients with moderate to severe nasal discharge, and 39 patients (78%) with hyposmia. 50 patients with CRSwNP were enrolled in this study; seven patients (14%) had a history of asthma, none of them were smokers, and four individuals had chronic comorbidities. The data from CT scans of the nose and paranasal sinuses (PNS) in patients are displayed in **Table 2** and **Figure 4.** 48 (84%) had their anterior ethmoids completely opacified, eight patients (16%) had the anterior ethmoids partially opacified, 32 patients (64%) had total opacification in their posterior ethmoids, 18 individuals (36%) had incomplete opacification in the posterior ethmoids, 28 patients (56%) showed complete opacification in the sphenoid sinus, 16 individuals (32%) had incomplete opacification, and about six patients (12%) didn't have any opacification in the sphenoid sinus.

Table 2: Nose CT and PNS findings among patients.

Variables		Frequency
Maxillary sinus	**1 Partial opacification**	13.8%
	2 Complete opacifications	86.2%
Anterior ethmoid sinus	**1 Partial opacification**	15.7%
	2 Complete opacifications	84.3%
Posterior ethmoid	**1 Partial opacification**	35.9%
	2 Complete opacifications	64.1%
Sphenoid sinus	**0 No abnormality**	12.2%
	1 Partial opacification	31.1%
	2 Complete opacifications	56.7%
Osteomeatal complex	**1 Partially occluded**	7.6%
	2 Occluded	92.4%

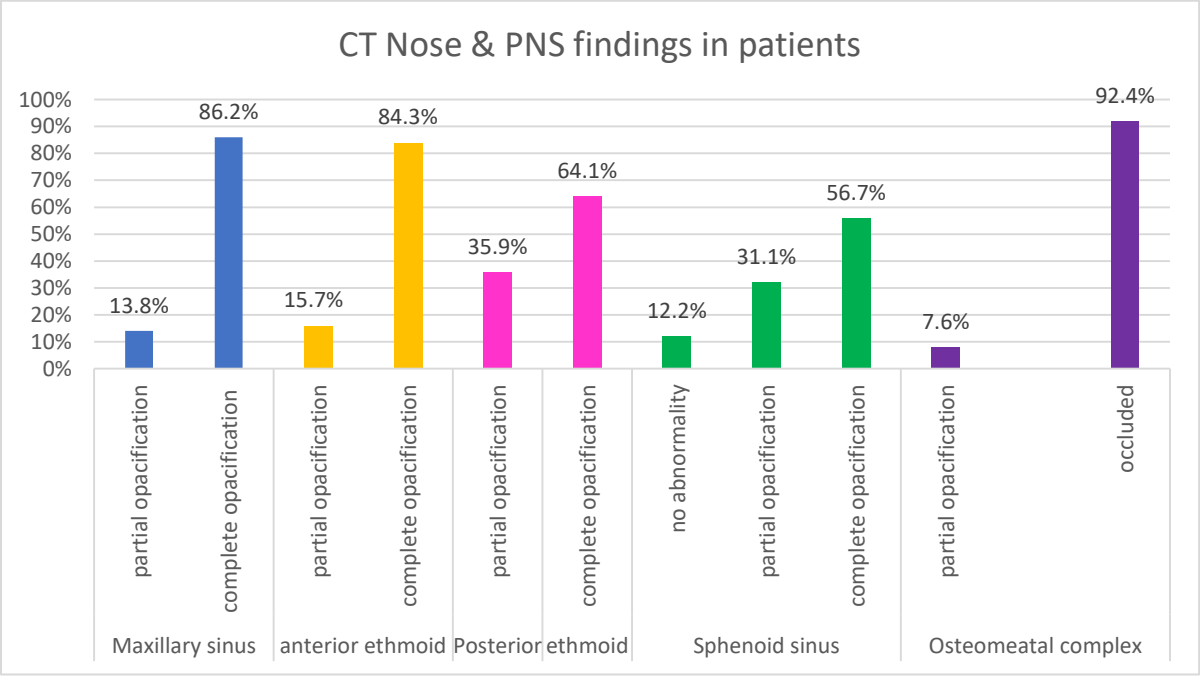

Figure 4: CT nose & PNS findings in patients' group.

In individuals with nasal polyps, the median expression of miR-29 was 0.745 (0.377-1.278), while the median expression in the control group was 1. Between the patient and control groups, there was a statistically significant difference with a low mean among the patients (under expression) ($p < 0.05$).

The median (IQR) of miR-29 was lower in patients with complete opacification of the anterior ethmoids. However, no significant relationships with p-value >0.05 were found between the markers level and other CT PNS findings (**Table 3**).

Table 3: Correlations between microRNA-29b and CT findings among the study group.

Variables	microRNA-29b	
	Median (IQR)	***P- value***
Maxillary sinus	2.67 (0.30-2.76)	0.06
	0.66 (0.36-1.0004)	
Anterior ethmoid sinus	2.67 (0.892-8.033)	0.016*
	0.63 (0.36-0.88)	
Posterior ethmoid sinus	0.817 (0.514-1.64)	0.35
	0.577 (0.366-1.005)	
Sphenoid sinus	0.805 (0.395-1.64)	0.45
	0.592 (0.374-1.006)	
Osteomeatal complex	0.536 (0.293-0.795)	0.24
	0.744 (0.398-1.32)	

* significant.

4. Discussion

Individuals with polyps in the nasal cavity vary in severity and appear with varying clinical manifestations, with an incidence of 0.5%–4.3%. Respiratory asthma typically exists alongside sinus polyps. Many individuals have recidivism following either medicinal therapy or surgical intervention. The majority of the time, triggered by Th2 cells—is the underlying mechanism behind sinus polyps. This inflammation is characterized by alterations in TSLP, IgE, IL-25, and IL-33

levels as well as eosinophil infiltration and polyps in the nose [5]. In addition, there are large concentrations of mast cells, eosinophils, macrophages, and innate lymphoid cells. Under a microscope, nasal polyps are identified by the following characteristics: degradation of extracellular matrix with remarkably identifiable structures; fibrin accumulation; goblet mucus glands proliferation; and epithelial metaplasia. [6].

Single-stranded RNAs with lengths ranging from 18- to 22 nucleotides have been identified as microRNAs. They are created by two sequential processing processes that are not translatable: first, primary microRNAs, referred to as pri-microRNAs, undergo modifications into pre-microRNAs, which are the antecedents of microRNAs, and then pre-microRNAs are altered into mature microRNAs. MicroRNAs modulate both transcriptional and post-transcriptional levels of gene transcription, and they are essential for virtually every recognized biological reaction, such as cell division and proliferation [7].

Erroneous variations in microRNA levels are frequently an initial stage in the pathogenesis of several diseases. This suggests that microRNAs may eventually function as potential biomarkers that might be converted into treatment options for a broad spectrum of conditions. Numerous microRNAs are important drivers connected to a range of illnesses, such as cancer, and inflammatory, neurological, and immunological conditions. According to Sun et al. (2018), some of these microRNAs have even been developed as potential treatments for certain advanced illnesses [8].

Although sinus polyps are associated with alterations to intracellular microRNA levels, variations in microRNA activity were also seen in the nasal lavage fluid (NLF)-EV (extracellular vesicles) of the patients [9].

Certain microRNAs can control the epithelial-to-mesenchymal transition (EMT) to influence the airway modification of CRSwNP. One such microRNA is miR-155, which is widely utilized in medical research and may be influenced by steroids (Liu et al., 2021). findings that microRNA contributes to the genetic and morphological features of sinus polyp growth and development, emphasizing the importance of microRNAs in nasal polyps for establishing out how they form and creating effective treatment plans [10].

Using the microRNA 29 biological marker, we were able to determine the level of expression of this biomarker and its correlation with CT scan findings in patients suffering from nasal polyps. We enlisted 100 people and split them into two groups: the patient group and the control group, which was healthy. Our results showed that the patients with nasal polyps and the healthy controls differed statistically significantly, and the patients' mean expression of miR-29b was low (under expression).

According to our findings, patients with substantial facial pain and blocked nasal passages had a lower median for the microRNA-29 marker. In terms of miR-29 level, patients with total opacification of the anterior ethmoids have a lower median (IQR). However, no significant relationships with p-value >0.05 were found between the markers level and other CT PNS findings.

5. Conclusion

In this work, we discovered that nasal polyp patients dramatically under-expressed microRNA 29 and that this under-expression was linked to the severity of different clinical manifestations, and CT findings among patients notably the opacification of the anterior ethmoids group of sinuses.

Ethical approval and consent to participate: The Faculty of Medicine's Institutional Ethics Committee in Fayoum gave its approval to the study

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Conflicts of Interest: All authors declare they have no conflicts of interest.

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