



## Patterns and prevalence of paranasal sinuses diseases among patients referred for paranasal sinuses computed tomography in Port Harcourt Rivers State, Nigeria

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### Abstract

**Background:** Paranasal sinuses are air-filled cavities found in the facial bones. The pathological conditions of these sinuses ranges from sinusitis to neoplasm. The aim of this study was to evaluate the computed tomography (CT) findings in paranasal sinus pathologies among patients referred for paranasal sinuses CT scan in Rivers State, Nigeria.

**Materials and Methods:** The examinations were performed using GE multi-slice helical machines in axial and coronal sections with standard protocols and parameters. Retrospective study design was adopted for this study. A convenience sample size of 230 records of patients that underwent CT scan for paranasal sinus pathology between January 2012 and March, 2018 was selected from the archive of the selected study centers randomly. Data were obtained using structured proforma. The data were analysed using descriptive statistics.

**Results:** Out of 230 cases studied, sinusitis (41.74, n=96) was the most common pathology and the least was osteoma (1.74%, n=4). In 85% (n=188) of the cases, more than one sinus was involved. Maxillary sinus was involved in 89.6 % (n=206) and the least was sphenoid sinuses 26.42% (n=96). The most commonly involved areas by PNS pathologies extension in this study was soft tissues (58.60%, n=135) and the least was lacrimal gland (7.83%, n=18). Most common age group affected by the pathologies was 16-30 years age group (40%, n=92) and the least were within age group 0-15 years (3.48%, n=8). In this study, paranasal sinus pathologies were more in males (58.70%, n=135) compared to female population (41.3%, n=95).

**Conclusion:** The commonest paranasal sinuses pathology in this study was sinusitis. Maxillary sinuses were the most commonly affected sinus. Majority of the PNS pathologies were within the age group 16-30 years of age while the least were within the age group 0-15 years. Male preponderance was noted.

**Keywords:** paranasal sinuses, computed Tomography, maxillary sinuses

### Introduction

Paranasal sinuses which is an air-filled cavities in the human facial bones, plays very vital roles which include; humidifying and warming of inspired air, controlling pressure within the nasal cavity, reducing of the weight of the skull and helping in the resonance ability of the nasal cavity [1-3]. The spectrum of paranasal sinuses pathologies includes congenital disorders, inflammatory diseases and tumors [4-6]. Previous studies have shown that individuals are predisposed to the various diseases of paranasal sinuses due to different factors such as allergy, excessive exposure to cold, tobacco smoking, alcohol-intake, trauma and infections by pathogens such as virus, bacteria and fungi [5, 7-10]. Ologe and Adeniji David and Reh *et al.* [9, 11-12] also emphasized the effect of perennial dusty environment which irritates the nasal mucosa thereby increasing the incidence of sinus polyp. They also stated that this condition in addition to the earlier mentioned habits have contributed greatly to the incidence of sinus infections in developing countries including Nigeria. Young adults are significantly more affected by the increased prevalence of paranasal sinuses

pathologies [6, 9-10, 13]. This has been attributed to the fact that younger adults are more exposed to environmental factors such as dusty and polluted environments as a result of their search for white collars job, irregular checkup and treatment [13]. Paranasal sinuses pathologies were also reported to vary between the genders. Ologe and Adeniji, Verma *et al* and Kabeya *et al.* [6, 9-10] reported high incidence of PNS pathologies among male population while Timmangouda and Abbas *et al.* [13, 25] reported high incidence among female population. According to Abbas *et al.* [13] females are more exposed to smoke from cooking and house cleaning than males.

Conventional x-ray of the paranasal sinuses (PNS) is still the simplest and cheapest method of diagnosing the PNS pathologies, but because of superimposition of structures in x-rays and inadequate diagnostic information, it cannot be used as a guide for endoscopic sinus surgery [5-6, 14-16]. Magnetic resonance imaging (MRI) has superior soft-tissue contrast, but poor differentiation of bony structures. Computed tomography (CT) is the method of choice in that it has good resolution,

increased soft-tissue sensitivity and demonstration of bony involvement and destructions [5-6, 17-19]. The preference for a specific imaging modality depends largely on the availability, speed of information derivation and the cost of the procedure. Computed tomography of the PNS is very vital in that it provides the following information; presence of inflammatory diseases, thickened sinus membrane, surgery planning for tumors associated with bony structures [5, 14]. High prevalence of paranasal sinus pathologies are associated with environmental pollution which is common in Rivers State due to the numerous oil and gas industrial activities in the area [5, 9, 20]. A good knowledge of the spectrum of CT findings in paranasal sinuses pathologies is useful information to ear, nose and throat surgeons and physicians that manage these conditions. To the best of our knowledge, there has not been any study on the CT findings in PNS pathologies in Rivers State, Nigeria. This study was designed to evaluate the CT findings in paranasal sinuses pathologies among patients referred for CT PNS in Rivers State, Nigeria.

### Materials and Methods

This is a retrospective cross sectional study of all the patients referred to the computed tomography units of multi-diagnostic centers in Rivers State Nigeria for CT paranasal sinuses from January, 2012 to January, 2018 performed using helical CT GE machine. A convenience sample size of 230 met the inclusion criteria set for this study and was selected using random sampling technique. Ethical approval for this study was obtained from the institutions research and ethical committees. All patients information obtained were treated with high level of confidentiality. The demographic data such as gender, age and radiological reports were collected from archiving unit of the institution. Only patients that were referred for CT paranasal sinuses scans and whose request forms and radiological reports contains the demographic data, findings and clinical indications were included for this study, while patients who did not meet the above inclusion criteria were excluded. This study was conducted between December, 2017 and February, 2018. The obtained data were processed and analyzed in line with the study objectives using Statistical Package for Social Sciences (SPSS Inc, Chicago, Illinois) version 21.0 and descriptive statistics.

### Results

Two hundred and thirty subject data were studied in this study. Among these subjects, males were highest with 58.6% (n=135) relative to 41.4% (n=95) of females. The highest number of subjects were within the age group 16-30 years 40% (n=92) followed by age group 31-45 years 33.48% (n=77) and the least were with age group 0-15 years which is 3.48% (n=8) (Table 1).

Table 2 shows the spectrum of CT findings in paranasal sinuses pathologies based on the pathologies. Out of 230 subjects included in this study, sinusitis has the highest percentage of PNS pathology in this study which is 41.74% (n=96) followed by polyps 19.13% (n=44) and the least was

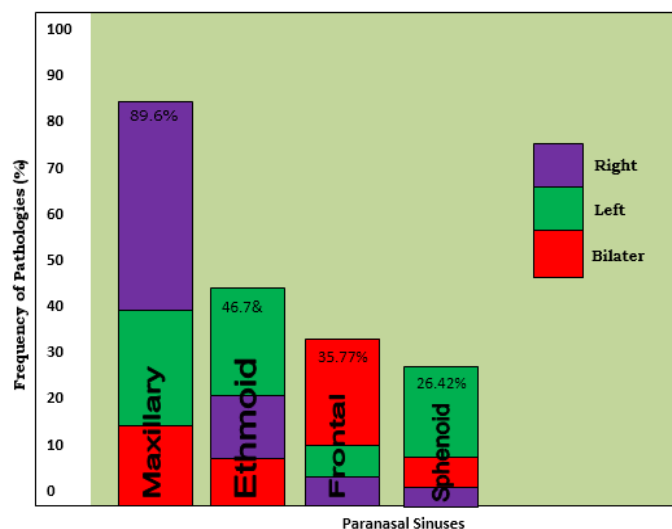
osteoma which is 1.74% (n=4). Fig 1 shows the spectrum of CT findings in paranasal sinuses pathologies based on the various paranasal sinuses involved. Out of 230 subjects included in this study, maxillary sinuses were involved in 89.6% (n=206) with right, left and bilateral sides involvement of 40.7%, 28.58% and 20.3% respectively followed by ethmoid sinuses which is 46.7% (n=170) with right, left and bilateral sides involvement of 25.08%, 11.52% and 9.9% respectively and the least is sphenoid sinuses which is 26.42% (n=96) with right, left and bilateral sides involvement of 7.14%, 12.08% and 7.2% respectively. Table 3 also shows the spectrum of CT findings in paranasal sinuses pathologies based on the areas of involvement. Soft tissue involvement by the pathologies was highest with 58.6% (n=135) followed by infra-temporal involvement 34.35% (n=79) and the least was lacrimal gland which is 7.83% (n=18). Table 4 shows age distribution of paranasal sinuses pathologies. Majority of the pathologies were within the age group 16-30 years which is 40% (n=92) followed by 31-45 years age group 33.48% (n=77) and the least were within age group 0-15 years which is 3.48% (n=8). Within age group 16-30 years, sinusitis was the most common pathology 23.91% (n=55) followed by polyps 8.70% (n=20). The age group 16-30 years had the highest percentage of polyps which is 8.70% (n=20) followed by 31-45 years age group 7.0% (n=16) and the least was within the age group > 60 years which was 0.87% (n=2). Table 5 shows sex distribution of paranasal sinuses pathologies. Males had the highest percentage which is 58.70% (n=135) when compared to females with 41.3% (n=95). Sinusitis was the most common PNS pathology among male and female with percentages of 28.26% (n=65) and 13.48% (n=31) respectively followed by polyps which is 11.74% (n=27) and 7.39% (n=17) for male and female respectively.

**Table 1:** Age and Sex Distribution of Subjects Studied.

Age Groups (Years)	Sex		
	Male	Female	Total
0-15	5	3	8 (3.48%)
16-30	60	32	92 (40%)
31-45	43	34	77 (33.48%)
46-60	17	14	31 (13.48%)
61 and above	10	12	22 (9.56%)
Total	135 (58.6%)	95 (41.4%)	230 (100%)

**Table 2:** Spectrum of paranasal sinuses pathologies

Spectrum of PNS Pathologies	Frequency	Percentage (%)
Sinusitis	96	41.74
Polyps	44	19.13
Carcinomas	32	13.91
Mucocele	21	9.13
Papilloma	16	6.96
Granulomatous disease	10	4.35
Fibrous dysplasia	7	3.04
Osteoma	4	1.74
Total	230	100



**Fig 1:** Paranasal Sinuses involvement of the Sinuses Pathologies

**Table 3:** Areas of involvement of paranasal sinuses pathologies

S/N	Areas involved	Frequency	Percentage (%)
1	Soft tissue involvement	135	58.60%
2	Intra-cranial	46	20%
3	Infra-temporal involvement	79	34.35
4	Orbits	30	13.34
5	Lacrimal gland	18	7.83
6	Non-specified	68	29.66

**Table 4:** Age Distribution of Paranasal Sinuses Pathologies Age Group (Years)

PNS Pathologies	0-1	16-30	31-45	46-60	>60
Sinusitis	3	55	23	11	4
Carcinoma	0	8	13	8	3
Polyps	2	20	16	4	2
Papilloma	1	2	11	2	0
Mucocele	1	2	7	5	6
Granulomatous disease	0	4	4	1	1
Fibrous dysplasia	1	0	0	1	5
Osteoma	0	1	2	0	1
Grand Total	3.48% (n=8)	40% (n=92)	33.48% (n=77)	13.48% (n=31)	9.57% (n=22)

**Table 5:** Sex Distribution of Paranasal Sinuses Pathologies

PNS Pathologies	Male	Female	Total	%
Sinusitis	28.26%(n=65)	13.48%(n=31)	96	41.74
Carcinoma	7.40%(n=17)	6.51%(n=15)	32	13.91
Polyps	11.74%(n=27)	7.39%(n=17)	44	19.13
Papilloma	2.61%(n=6)	4.35%(n=10)	16	6.96
Mucocele	6.52%(n=15)	2.61%(n=6)	21	9.13
Granulomatous disease	1.74%(n=4)	2.61%(n=6)	10	4.35
Fibrous dysplasia	0	3.04%(n=7)	7	3.04
Osteoma	0.44%(n=1)	1.30%(n=3)	4	1.74
Grand Total	58.70%(n=135)	41.3%(n=95)	230	100



**Fig 2:** There is soft tissue mass occupying the whole maxillary sinuses with no contrast enhancement. No destruction or erosion of adjacent bone. Nasomaxillary non-enhancing soft tissue mass. Mucocele and Nasomaxillary polyp as differentiates

**Discussion**

The commonest paranasal sinuses pathology in this study was sinusitis followed by polyps and the least was osteoma. These findings are in keeping with the studies done by Abbas *et al* and Verma *et al* [6, 13]. In both studies, sinusitis has the highest percentage of occurrence followed by polyps and carcinomas. The high incidence of sinusitis in this present study could be attributed to the low socio-economic factors and overcrowding which are common in developing countries like Nigeria at large and Rivers State in particular [13]. In this study also, maxillary sinus was the most commonly involved sinuses with right side having the highest percentage of involvement followed by the left side and the least was bilateral sides while sphenoid sinuses was seen to be the least involved sinus by the pathologies. The result of this study is in agreement with studies conducted by Maru and Gupta, Smith and Brindley, Maduforo *et al*, Abbas *et al*, Manjit and Verma *et al*. (2016) [6, 13, 21-24]. In their studies, the followings were revealed which agreed with the findings of this study. In Abbas *et al* [13] study, maxillary sinuses appears highest (72.1%) and the least was sphenoid sinuses (27.2%). Maduforo *et al* [23] study also shows maxillary sinuses with the highest percent while the least was sphenoid sinus. Manjit [24] reported maxillary sinus to be the most frequently involved sinus (86.36%) and the least was sphenoid sinus (20.9%). Maru and Gupta [21] also reported maxillary sinuses as the most common involved sinus and the least was sphenoid sinuses. In other study conducted by Smith and Brindley [22] also revealed that maxillary sinuses has the highest percent of involvement (55.5%) followed by ethmoid sinus (46.5%) and the least was sphenoid sinuses (20%). These findings in this study and other previous studies has been attributed to the anatomical position of the maxillary sinuses which are located below the nasal cavities

anatomically and their drainage is aided by gravity<sup>[13]</sup>. Therefore, their drainage into the nasal cavities is aided by gravity, especially when their openings are not obstructed by pathologies and so any alteration in the aforementioned paranasal sinuses may first be subtle and not a radiological evident except it becomes extensive with blockage of sinus opening<sup>[13]</sup>. The result of this study also showed that soft tissue area of involvement of paranasal sinuses pathologies is the most common while the least was lacrimal gland. These findings are in agreement with some aspect of the study conducted by Verma *et al.*<sup>[6]</sup> in Japan using MRI scan. In their study, soft tissue involvement is the commonest followed by both intracranial and infra-temporal involvement (22%) each, as against the findings in this study in which only infra-temporal involvement have the second highest percentage of involvement (34.35%) followed by non-specified (29.66%).

In this study, younger adults within the age group of 16-30 years were significantly associated with increased prevalence of paranasal sinuses pathologies. The high incidence of paranasal sinus pathologies among younger adults of age group 16-30 years has been attributed to more exposure to environmental factors such as dusty and polluted environment in cause of their search for white collar jobs, irregular checkup and treatment<sup>[13]</sup>. These findings are consistent with the studies conducted by Ologe and Adeniji, Abbas *et al.*, Kabeya *et al.* and Verma *et al.*<sup>[6, 9-10, 13]</sup> The findings in this study strongly agreed with Kabeya *et al.*<sup>[10]</sup> which reported that younger age were significantly associated with increase prevalence of paranasal sinus pathologies. According to their findings, Abbas *et al.*<sup>[13]</sup> reported that 19-29 years age group had the highest percent (29.2%), Ologe and Adeniji<sup>[9]</sup> reported that paranasal sinus pathologies are common among age group 11-40 years and Verma *et al.*<sup>[6]</sup> findings shows that 16-30 years age group have the highest incidence of paranasal sinus pathologies (37%) followed by 31-45 years (30%). The results of the aforementioned researchers showed that elderly patients above the ages of 50 years were not much in their studies whereas in this present study, subjects between the ages of 50 years and above account for about 19.04% of the total sample size with the least percent among age group 0-15 years. Subjects between the ages of 0-15 years having the least percent of paranasal sinus pathologies is consistent with the finding of the study done by Abbas *et al.*<sup>[13]</sup> and this could be due to the fact that in children their ostia are usually very wide and also some of their sinuses are not fully formed<sup>[13]</sup>. Sinusitis was the most common pathology among younger adults of age group 16-30 years and the least was osteoma. Meanwhile osteoma which was the least pathology in this study was found to be highest among subjects within age group 16-30 years. Also the highest number of paranasal sinuses pathologies was found more in male than female and sinusitis was the commonest paranasal sinuses pathology seen across both gender. These findings are consistent with findings of the studies conducted by Ologe and Adeniji, Manjit and Verma *et al.*<sup>[6, 9, 24]</sup> In Manjit<sup>[24]</sup> study, males were highest 67% (n=67) when compared to female populations 33% (n=33) and in Verma *et al.*<sup>[6]</sup> study, males were 51% (n=51) while females 49% (n=49). The increasing number of males being commonly prone to paranasal sinuses pathologies could be attributed to the fact that males are more

exposed to dusty and polluted environment especially due to the nature of their occupation such as carpentering and driving. Also they are also more exposed to some habitual patterns that are paranasal sinuses pathologies predisposing factors such as smoking and alcohol in-take. These findings in this study are inconsistent with some previous studies conducted by Abbas *et al.* and Timmanagouda<sup>[13, 25]</sup>. Abbas *et al.*<sup>[13]</sup> reported high incidence of paranasal sinus pathologies among females with 53.75% relative to 46.25% for males. According to Abbas *et al.*<sup>[13]</sup> females are more exposed to dust and smoke from home cleaning and cooking than males which result to allergic rhinitis which is one factor that causes sinusitis. In Timmanagouda<sup>[25]</sup> findings, females also have high incidence of paranasal sinuses pathologies with 65.4% while 34.6% were males.

### Conclusion

The most common paranasal sinuses pathology in this study was sinusitis and the least was osteoma. Maxillary sinuses were the most commonly affected sinus. Majority of the PNS pathologies in this study were within the age group 16-30 years of age while the least were within the age group 0-15 years with sinusitis as the most common PNS pathology among these age groups.

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