



## PARANASAL SINUSES INFLAMMATORY DISEASES IN PATIENTS REFERRED FOR BRAIN CT IN PORT HARCOURT, RIVERS STATE, NIGERIA: INCIDENTAL FINDINGS

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### ABSTRACT

**Objective:** We aimed to evaluate the paranasal sinuses inflammatory disease among patients referred for brain CT as an incidental finding. **Materials and Methods:** A retrospective cross sectional study was conducted on 338 patients diagnosed of sinusitis on computed tomography (CT) brain over a period of four years. Data such as patterns of the pathology, sex and age were collected using data capture sheet. Radiological reports were evaluated. **Results:** out of 338 patient's records evaluated, 841 cases of sinusitis patterns of appearance on tomogram were identified. Out of 841 cases, 36.88% (n= 312) was mucosal thickening 30.26% (n = 256) was opacification and bony erosion was 15.96% (n = 130). Maxillary sinus was the most commonly affected 35.52% (n = 287) followed ethmoid 29.08% (n = 235). Age group 61 years and above was highest 35.43% (n = 298) and the least was 0 – 15 years 7.01% (n = 59). The male to female ratio was 1.4:1 with 57.4% (n = 194) male and 42.62 (n = 144) female. Out of the identified pathology patterns, 64.21% (n = 540) were found in male while 35.79% (n = 301) in female. **Conclusion:** Mucosal thickening and bony erosion were the most common and uncommon findings of patterns of sinusitis in this study respectively. Maxillary sinus was highly affected. Male preponderance was noted and young adults were commonly affected by the pathology.

**Key words:** Paranasal sinuses, inflammatory disease, CT, incidental findings.

### INTRODUCTION

Paranasal sinuses inflammatory disease is an inflammation of the paranasal sinuses. Ideally, paranasal sinuses are air-filled cavities that surround the nasal space in the facial bones. The moment the sinuses are filled with fluid and blocked by pathogens such as viruses, bacteria and fungi, the mucosal are inflamed and this can cause infection (Famaz et al., 2013; Mukesh et al., 2007). The blockage of the paranasal sinuses could be due to the swelling of the mucosal lining of the nose, nasal polyps, common cold and nasal septum deviation (Anon, 2010; Chadha and Chadha, 2007, Famaz et al., 2013). Sinus inflammatory disease also known as sinusitis is subdivided into acute, sub-acute and chronic sinusitis. Acute sinusitis is one has lasted for less than 1 month, sub-acute sinusitis for 1 -3 months and chronic conditions for longer than 12

weeks. (Famaz, et al., 2013). Sinusitis also require surgical intervention especially the chronic type and so its detection as an incidental finding should be taking seriously (Christine,2012, Mccwillan et al., 2009; Famaz et al., 2013; Kalaycik et al., 2016). An incidental finding could be defined as“ asymptomatic finding that is found unintentionally and has obvious clinical importance since it may need treatment or cause symptoms not associated to the reason for the study” in neuroimaging research (Kalaycik et al., 2016, Wolf et al., 2008) .Furthermore, radiologists normally report sinusitis as an incidental finding on brain imaging be it MRI or CT scan and this finding is usually common according to Yue et al (1997), Katzman et al (1999) and Kim et al (2002).

Radiological investigations play an important role in the diagnosis, differentiation detection and characterization of sinusitis. Apart from the aforementioned roles of radiological imaging, it also helps the physicians and ear, nose and throat (ENT) surgeons in deciding the treatment and surgical plans and also in a follow-up process (Mukesh et al., 2013 Maffe et al., 1993, Maffe et al., 1994; Hasso and Lambert, 1994). Conventional X-ray remains the crude investigative tool for paranasal sinuses inflammatory disease with low accuracy and limitation of information due to superimposition of structures. Currently computed tomography (CT) is the imaging modality of choice for the evaluation of paranasal sinuses diseases since it has the ability to demonstrate both soft tissue and bony involvement ( Zinreich et al., 1987, Mukesh et al., 2013). Sinusitis on computed tomogram is describe in terms of the mucosal thickening greater than 4mm, opacifications, air fluid level (Famaz et al., 2013, Mukesh et al., 2013). The patterns of sinuses inflammation depend largely on the causes of the inflammation.

On computed tomogram, acute bacteria sinusitis appears as air-fluid levels, complex opacifications and renounced mucosal thickening (Lev et al., 1998, Harnsberger, 1991). Chronic sinusitis appears as atrophic or thickened polypoidmucosa, sclerososis and thickening of the bony structure or wall of the paranasal sinuses (Anzai et al., 2004; Dual et al.,2005). Fungal sinusitis is a form of chronic sinusitis with appearance of complete opacification of the sinus, bony erosion and calcifications. Several studies have reported maxillary sinuses as the commonest involved sinus by sinusitis followed by ethmoid and the least was sphenoid sinus (Famaz et al., 2013), Mukesh et al., 2013 Patel et al., 1996). Studies conducted by Kalayak et al (2016) and Fainaz et al (2013), reported male preponderance while Mukesh et al (2013) reported female to be highest. Radiological imaging of the brain is used with increasing frequency and often includes paranasal sinus inflammatory disease as incidental finding (Borretzen et al., 2007, Wani et al., 2001; Rege et al., 2012). This finding can cause unnecessary anxiety to the patient and can also lead to sudden expenditure by the health system. A good knowledge of the patterns of paranasal sinus inflammatory disease in this locality would serve as useful information to physicians and ear, nose and throat (ENT) surgeons who are managing these conditions and to the patients who cannot afford to pay for CT investigation. To the best of our knowledge, this study is the first to capture data on the patterns of incidental finding in paranasal sinus inflammatory disease in patients referred for CT brain in Port Harcourt, Rivers State, Nigeria.

The objectives of this study are to:

- 1) Evaluate the patterns of paranasal sinus inflammatory disease as an incidental finding in patients referred for CT brain in Port Harcourt, Nigeria.
- 2) Determine the sex distribution of the disease.
- 3) Assess the age group commonly prone to the disease condition in this locality.

## **MATERIALS AND METHODS**

The brain CT examinations were performed using helical third generation general electric (GE) CT machines. Standard CT protocol and parameters for brain were adopted in performing the CT scan by qualified Radiographers. This was a cross sectional retrospective review of radiological reports of patients who underwent brain CT scan. The request forms and radiological reports were also used as materials for this study. The sample size for this study were convenience sample of 338 patient's records who were clinically diagnosed of paranasal sinuses inflammatory disease in patients referred for brain CT in the selected study centers and have met the inclusion criteria set for this study over a period of three years from January 2015 to December 2017. An ethical approval and permission to obtain data in these centers were obtained from the managements of the selected centers. All patients' information obtained was treated with high level of confidentiality. The inclusion criteria for this study include: Radiological records of patients who underwent brain CT and had paranasal sinuses inflammatory diseases as an incidental finding in their reports. Other information retrieved includes patient's sex and age. This study was conducted between November 2017 and January 2018. The collected data were categorized into patterns of sinusitis, the sex distribution of the pathology and the age groups in line with the study objectives. The categorized data were processed and analyzed using Statistical Package for Social Sciences (SPSS) version 20(IBM Corporation, Chicago, IL,USA) and descriptive statistics in line with the study objectives.

## **RESULTS**

In this retrospective cross sectional study, 338 patient's records met the inclusion criteria set for this study. The male to female ratio was 1.4:1 with 57.4% (n = 194) male and 42.6% (n = 144). Table 1 shows the classification of sinusitis based on the duration of the pathology. It reveals that acute sinusitis was the highest 49.17 % (n =268) followed by chronic sinusitis 27.16% (n = 148) and the least was non-specified 8.44% (n = 46). Out of 545 cases identified, the reviewed records shows that unspecified causes of sinusitis was highly documented 39.30% (n = 224) followed by bacteria sinusitis 37.54% (n = 214) and the least was fungal sinusitis 23.16% (n = 132). Table 3 revealed that major pattern of the appearance on CT tomogram was mucosal thickening 36.88% (n = 312) followed by opacifications 30.26% (n = 256) and the least was bony erosion 15.96% (n = 130). Majority of the cases involved the maxillary sinuses 35.52% (n = 287) followed by ethmoid sinuses 29.08% (n = 235) and the least was sphenoid sinus 12.63% (n =102) (table 4). Out of 422 cases of patterns of appearance of sinusitis involving the maxillary sinuses, 41.71% (n=176) was mucosal thickening followed by opacifications 31.75% (n = 134) and the least was air fluid levels 1.39% (n = 48) (table 5). The sex distribution of the patterns of the pathology identified revealed that, 64.21% (n = 540) cases were found in male while the remaining 35.79% (n = 301) were in female (table 6). Table 6 also shows that out of 540 patterns of sinusitis in male, mucosal thickening was highest 37.8% (n = 204) and the least was bony erosion 14.4% (n = 78).

The patterns of the pathology was distributed against age group in table 7, and it revealed that majority of the cases were within age group 61 and above years 35.43% (n = 298) followed by age group 31-45 years 20.93% (n = 176) and the least within age group 0 – 15 years 7.01% (n = 59).

**Table 1: Classification of the sinusitis based on the duration of the pathology.**

<b>Duration of inflammation</b>	<b>Frequency (n)</b>	<b>Percentage %</b>
Acute	268	49.17
Sub acute	83	15.23
Chronic	148	27.16
Non- specified	46	8.44
<b>Total</b>	<b>545</b>	<b>100</b>

**Table 2: Classification of Sinusitis based on their causes.**

<b>Causes of Sinusitis</b>	<b>Frequency (n)</b>	<b>Percentage %</b>
Bacteria Sinusitis	214	37.54
Fungal Sinusitis	132	23.16
Unspecified type	224	39.301
<b>Total</b>	<b>570</b>	<b>100</b>

**Table 3: Classification of pathology based on the patterns of appearance on CT Tomogram**

<b>Patterns of Sinusitis Appearance</b>	<b>Frequency (n)</b>	<b>Percentage %</b>
Opacifications	256	30.26
Air – Fluid levels	143	16.90
Mucosal thickening	313	36.88
Bony erosions.	130	15.96
<b>Total</b>	<b>841</b>	<b>100</b>

**4: Classification of the pathology based on the involved sinuses.**

<b>Sinuses Involved</b>	<b>Frequency (n)</b>	<b>Percentage %</b>
Maxillary	287	35.52
Ethmoid	235	29.08
Frontal	184	22.77
Sphenoid	102	12.63
<b>Total</b>	<b>808</b>	<b>100</b>

**Table 5: Patterns of inflammatory disease appearance on computed tomogram distribution based sinuses involved**

<b>Involve Sinus</b>	<b>MT</b>	<b>O</b>	<b>AFL</b>	<b>BE</b>	<b>TOTAL</b>
Maxillary	176(20.9%)	134(15.3%)	48(5.7%)	64(7.6%)	<b>422(50.2%)</b>
Ethmoid	74(8.8%)	61(7.3%)	52(6.2%)	10(1.2%)	<b>197(23.4%)</b>
Frontal	46(5.5%)	38(4.5%)	19(2.3%)	42(5.0%)	<b>145(17.2%)</b>
Sphenoid	16(1.9%)	23(2.7%)	24(2.9%)	13(1.5%)	<b>77(9.2%)</b>
<b>Total</b>	<b>312(37.1%)</b>	<b>256(30.4%)</b>	<b>143(17.0%)</b>	<b>129(15.3%)</b>	<b>841(100%)</b>

(MT = Mucosal thickening, O = Opacification, AFL = Air-fluid level, BE = Bony Erosion).

**Table 6: Sex Distribution of the Patterns of the pathology among 841 cases identified.**

<b>Sex</b>	<b>MT</b>	<b>O</b>	<b>AFL</b>	<b>BE</b>	<b>TOTAL</b>
Male	204(24.3%)	172(20.5%)	86(10.2%)	78(9.27%)	<b>540(64.2%)</b>
Female	108(12.8%)	84(1.0%)	57(6.13%)	52(6.13%)	<b>301(35.8%)</b>
<b>Total</b>	<b>312(37.1%)</b>	<b>256(30.4%)</b>	<b>143(17.0%)</b>	<b>130(15.5%)</b>	<b>841(100%)</b>

(MT = Mucosal thickening, O = Opacification, AFL = Air-fluid level, BE = Bony Erosion).

**Table 7: Age group distribution of the patterns of the pathology on tomogram**

Patterns of the pathology

<b>Age (Years)</b>	<b>Group</b>	<b>MT</b>	<b>O</b>	<b>AFL</b>	<b>BE</b>	<b>TOTAL</b>
0 – 15		25(2.97%)	20(2.40%)	10(1.20%)	4(0.48%)	<b>59(7.02%)</b>
16 – 30		56(6.66%)	33(3.92%)	46(5.50%)	31(3.69%)	<b>166(19.74%)</b>
31 – 45		74(8.80%)	51(6.06%)	32(3.80%)	19(2.30%)	<b>176(20.93%)</b>
46 – 50		53(6.30%)	46(5.50%)	15(1.78%)	28(3.33%)	<b>142(16.88%)</b>
51 and above		104(12.40%)	106(12.60%)	40(4.76%)	48(5.70%)	<b>298(35.43%)</b>
<b>Total</b>		<b>312(37.10%)</b>	<b>256(30.40%)</b>	<b>143(17.0%)</b>	<b>130(15.50%)</b>	<b>841(100%)</b>

(MT = Mucosal thickening, O = Opacification, AFL = Air -fluid level, BE = Bony Erosion).

## DISCUSSION

Paranasal sinuses inflammatory diseases as incidental finding in computed tomography (CT) scan of the brain is common in this study. This finding would serve as useful information to clinicians and ear, nose and throat (ENT) surgeons. Sinusitis from our evaluation account for about 60% of the incidental findings seen in CT brain examinations. In this study, acute sinusitis was the highest form of the disease noted in the radiological reports followed by chronic sinusitis. This finding could be associated with the overcrowding and low socio-economic status of the people which is common among developing countries including Nigeria. The prevalent pattern of sinusitis in this study was mucosal thickening followed by opacification and the least was bony erosion. This is similar to the findings in the studies conducted by Famaz et al (2013), Kristo et al (2003); Gupta et al, (2014).

However, there was disagreement between our finding and that of Cho and Jung (2009) conducted in South Korea. In Cho and Jung (2009) study, opacifications was the most prevalent followed by mucosal thickening. Maxillary sinuses were the most prevalent involved sinus followed by ethmoid sinuses and the least was sphenoid sinuses. This finding could be attributed to the anatomical location of the maxillary sinuses which is located lower than the other sinuses and aided by gravity. This is in agreement with previous studies conducted by Famaz et al (2013), Patel et al (1996), Wani et al (2001); Cooke and Hadley (1991), Gordts et al (1996). In their studies, mucosal thickening was the most prevalent patterns followed by the opacification. In this study, males were highly affected when compared to their female counterpart. This could be attributed to the fact that males are commonly exposed to the predisposing factors of sinusitis such as dusty and polluted environments due to the nature of their jobs. This is consistent with the studies conducted by Gupta (2014) and Katman et al (1991), Kim (2002). An exceptions are Famaz et al (2013); and Kalayak et al (2016) who reported more females than males in their studies. Men had a suggestively higher prevalence of

mucosal thickening and opacification in this study. This is in agreement with previous studies conducted by Tarp et al (2000), Cooke and Hadley (1991) and Havas et al (1998). We also found that majority of the cases of sinusitis were within age group 61years and above. Although over 60% of the cases were within age groups below 61years and above. This shows that young adults were commonly affected by the disease condition. This finding 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 by people of these age groups (Abbas et al; 2014). We also found that age group 0 – 15 years had the least cases of sinusitis and this could be attributed to the fact that in children their Ostia are usually very wide and also some of their sinuses are not fully formed (Abbas et al; 2014).These findings are consistent with the results of related studies conducted by Verma et al (2016), Gupta et al (2014), Famaz et al (2013).The most common pattern of appearance of the pathology among the various age group was mucosal thickening. The high prevalence of sinusitis as an incidental finding and the patterns of their manifestation in this study indicate some unlikely subtle environmental allergens in this part of Nigeria. Radiologist should always document this incidental finding when obtaining a brain CT in both clinical and research settings as this would help the clinicians and ear, nose and throat (ENT) surgeons in managing the patients.

## **CONCLUSION**

Our study shows that acute sinusitis was common, mucosal thickening and bony erosion were the most common and uncommon finding. Maxillary sinus was most commonly affected followed by ethmoid sinuses and the least was sphenoid sinus. Male preponderance was noted and young adults were highly affected.

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