

Developmental and Morphological Variations of Frontal Sinus in Pediatric Age Group in Gurugram Region of Haryana – A Study

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Received: September 2019

Accepted: September 2019

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ABSTRACT

Background: The aim is to know gender wise development and morphological variation of the frontal sinus in the pediatric age group of Gurugram district of Haryana. The development and pneumatization of the frontal sinus is the predictor of skeletal growth pattern. The craniofacial structures grow proportionately with the normal development of the body structures. **Methods:** In this prospective study, a total of 36 subjects were studied. The study was conducted in the Department of Radiodiagnosis of SGT Medical College, Budhera (Gurugram) Haryana from January 2019 to March 2019. This included 12 females and 24 males falling in the age group of 8-18 years. The frontal sinuses were evaluated on various morphological features. Plain X-Ray of paranasal sinus was evaluated by Caldwell's view. The sinuses were evaluated for width, height, number of scallops, septations and supraorbital cells. **Results:** Average width and height of left frontal sinuses were 23.8 mm with the range of 5.5 – 43 mm and 28.4 mm with the range of 13-45 mm respectively. Average width and height of right frontal sinuses were 20.4 mm with the range of 9.8 – 39 mm and 20 mm with the range of 13-38 mm respectively. The average number of scalloping on right and left were 1.9 and 2.19 respectively. The septations were noticed in 13 (36.11%) on left and in 16 (44.44%) on right side. Supraorbital cells were found in 16 (44.44%) on left side and 17 (47.22%) on right side. **Conclusion:** There is a lot of variation in the appearance and development of the frontal sinus in pediatric age group. The dimensions had been found smaller on right side as compared to left side. Scalloping and supraorbital cells had been found more on right side than on the left side. Septations were more on left side as compared to right side.

Keywords: Pneumatization, Frontal sinus, craniofacial structures, X-Ray.

INTRODUCTION

Frontal sinuses are one of the paranasal sinuses present below the brow ridges. These sinuses are absent at birth. These are well developed from eight year and fully developed after puberty. These sinuses are air spaces lined by mucosa.^[1] These open in the middle meatus through fronto-nasal duct. Frontal sinuses are the indicators of skeletal maturity [Figure 1].

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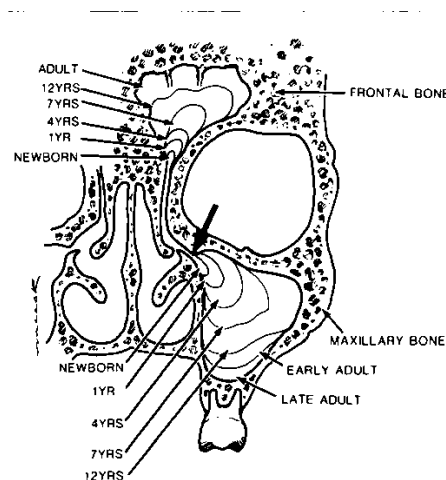


Figure 1: Diagrammatic presentation of sinuses with the corresponding age as per the developments from newborn to adult. (Borrowed image)

MATERIALS AND METHODS

In this prospective study, a total of thirty-six subjects were studied. The study was conducted in the Department of Radio diagnosis of SGT Medical College, Budhera (Gurugram) Haryana from January 2019 to March 2019. These patients had come with the complaints of headache (62%), nasal discharge (35%) and other miscellaneous complaints [Figure 2, 3]



Figure 2: 8-years old boy Paranasal sinus radiograph. There is no development of frontal sinus. Nasal septum is “s” shaped and maxillary sinuses are developing.

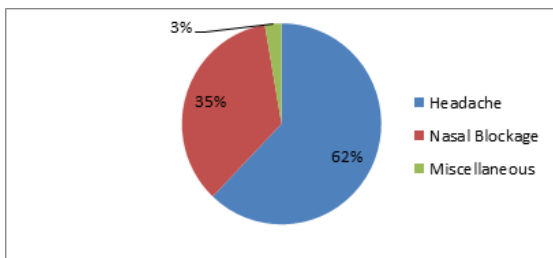


Figure 3: Chief complaints shown in the form of pie chart

This included 12 females and 24 males falling in the age group of 8-18 years [Figure 4].

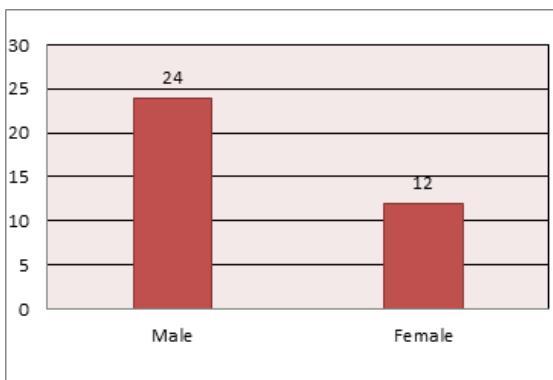


Figure 4: Gender distribution of the cases

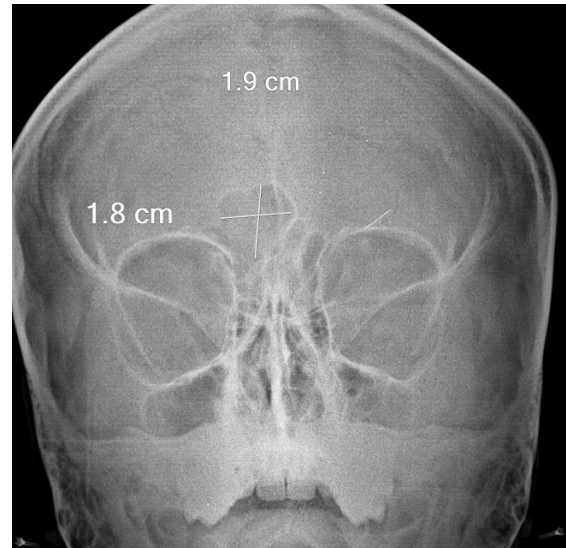


Figure 5: 14-years old girl with only right side frontal sinus measuring 19x18 mm

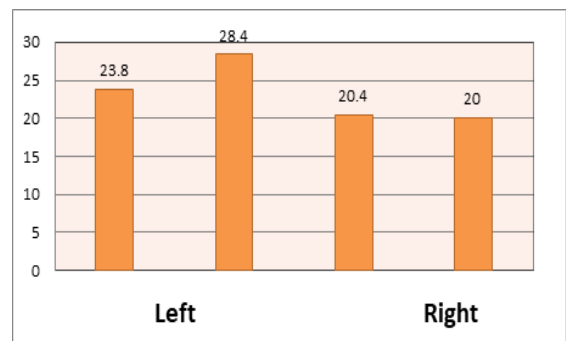


Figure 6: Bar chart shows the average width and height of right and left frontal sinuses.

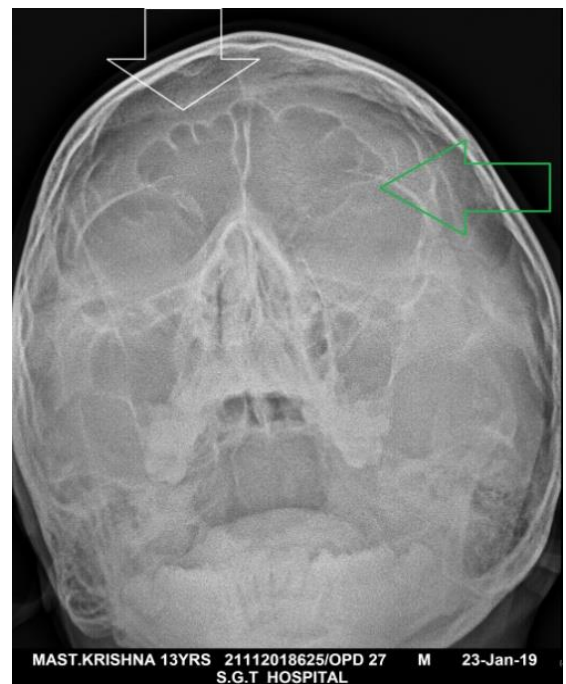


Figure 7: Plain radiograph Paranasal sinuses shows multiple scalloping of right side frontal sinus (white arrow) and septations on left side (green horizontal arrow)

The frontal sinuses were evaluated on various morphological features. Plain X-Ray of paranasal sinus was evaluated by Caldwell's view. The sinuses were evaluated for width, height, number of scallops, septation and supraorbital cells. Average width and height of left frontal sinuses were 23.8 mm with the range of 5.5 – 43 mm and 28.4 mm with the range of 13-45 mm respectively. Average width and height of right frontal sinuses were 20.4 mm with the range of 9.8 – 39 mm and 20 mm with the range of 13-38 mm respectively [Figure 5, 6]. The average number of scalloping on right and left were 1.9 and 2.19 respectively. The maximum scalloping was three on left side and five on left side [Figure 7, 8]. The septation were noticed in 13 (36.11%) on left and in 16 (44.44%) on right side. Maximum two septation were noticed on left side and one on right side. But the more sinuses on right side were having septations [Figure 9, 10].

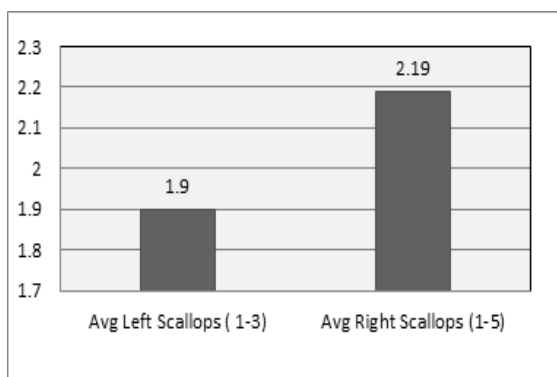


Figure 8: Bar chart shows average scalloping on right and left side. Right side shows more scalloping.

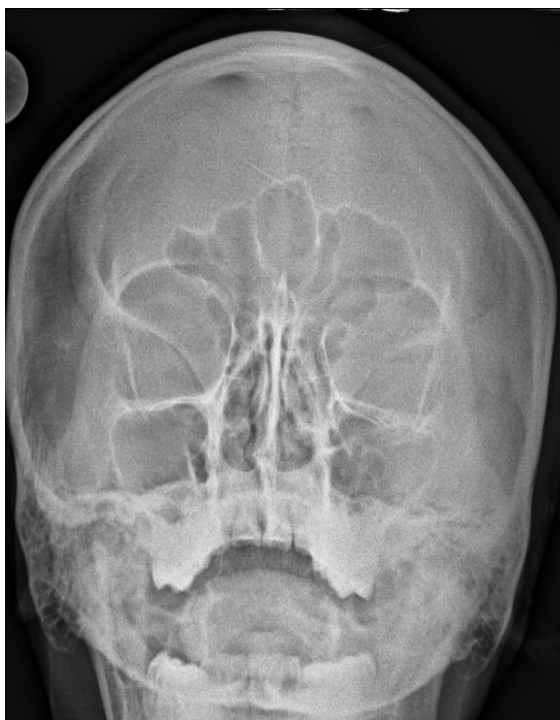


Figure 9: 14-years old female PNS radiograph showing multiple septations.

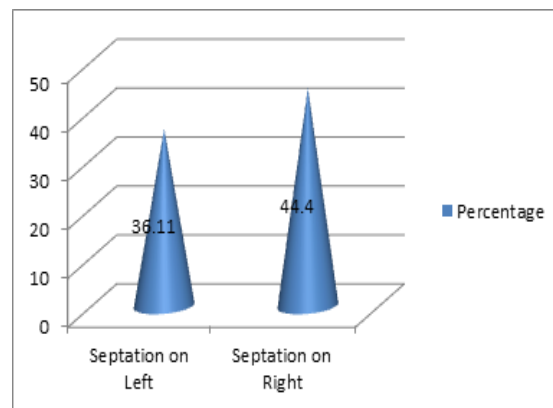


Figure 10: Chart showing comparison of the septations in percentage on right and left side. There were more septations seen on right side.

Supraorbital cells were found in 16 (44.44%) on left side and 17 (47.22%) on right side [Figure 11, 12].

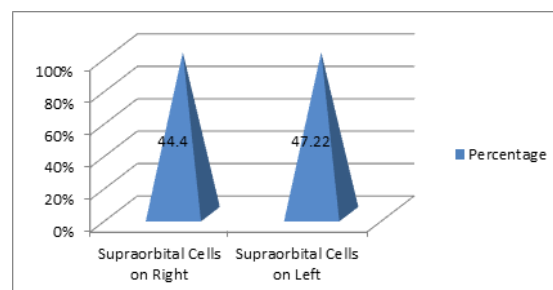


Figure 11: Depiction of supraorbital cells in pyramidal form of right and left frontal sinuses.

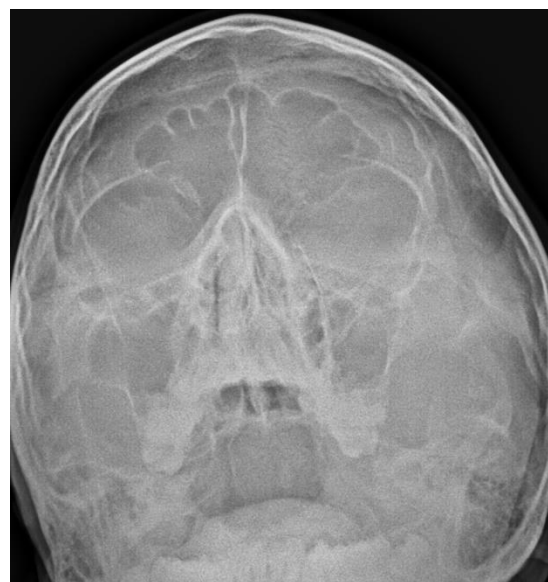


Figure 12: PNS radiograph showing bilateral supraorbital cells

RESULTS & DISCUSSION

Frontal sinuses are not present at birth and start appearing in second year of life. These become radiologically visible by seven years and are clinically important by 10 years. Frontal sinuses are always

asymmetrical and separated by a septum.^[2,3] These are funnel shaped and measure approximately 30 mm in height, 25 mm in width and 19 mm in depth. They have got volume around 10 cubic millimeters. The vertical septum divides it into two portions. The sinuses extend to the orbital portion of the frontal bone on one side and to the mid portion of the eyebrow. 25% population had the variation of the frontal sinus and this is absent in 4%. Anterior portion is formed by forehead, labella and brow whereas posterior abuts against the anterior cranial fossa. There is great morphological variation in these sinuses ranging from aplasia to hypoplasia. These variations can either be unilateral or bilateral in some proportions. The variations can also be associated with metopic suture.^[4,5] These can extend to the neighboring bones depending upon the size. Pneumatization takes place in early childhood from 1 to 12 years. The growth of the sinus is complete till around 20 years. The frontal sinuses development had been used as identification proof by forensic anthropologists and radiologists in 1925. With the advancement of various radiological diagnostic tools, the delineation of the frontal sinuses has become more relevant by standardization and quantification. There is great variation of the drainage of the frontal sinus as in 85% of the cases nasofrontal duct is absent. The sinus drains into the middle meatus or ethmoid infundibulum through big ostium. The frontal recess is superior and medial to the agger nasice cells. There can be development of mucocele as a result of injury or any blockade to the drainage of the sinus. The sinus is connected to the sub-arachnoid space by foramina of Breschet.^[6] There are so many variations related to this process which had been evaluated in the study. This becomes more important to ascertain the features of lateral nasal wall anatomy in endoscopic surgeries. There are many sinonasal diseases where the underlying anatomy of the frontal sinus is of paramount importance. It had been proved that there is not much relationship of the sinus diseases with the underlying morphology of any of the sinuses including frontal sinus.^[7,8]

CONCLUSION

There is a lot of variation in the appearance and development of the frontal sinus in pediatric age group. There is some clinical importance for knowing the demographic morphological features of the sinuses. The dimensions had been found smaller on right side as compared to left side. Scalloping and supraorbital cells had been found more on right side than on the left side. Septations were more on left side as compared to right side.

Acknowledgement

We are thankful to all the radiographers, Mr Prahlad Singh, Mr Kasif, Mr Vaibhav, Mr Villice, Mr Anil,

Mr Prince, Mr Pawan, Mr Ansari and Miss Suzan for helping in collection of data and carrying out the radiography input.

REFERENCES

1. Szilvassy J. Development of the frontal sinuses. *Anthropol* 1981;39(2):138-49.
2. Porbonikova S. An X-Ray investigation of the development of the frontal sinus in children. *Follo Med* 1974;16(4):213-20.
3. Phrabhakaran N, Naidu M, Subramanian K. Anatomical variability of the frontal sinus and their application in forensic identification. *Clin Anat* 1999;12:16-9.
4. Ponde JM, Metzger P, Amaral G, Machado M, Prandini M. Anatomical variations of the frontal sinus. *Minim Invasive Neurosurg* 2003;46(1):29-32.
5. Nikolova S, Toneva D, Georgiev I, Lazarov N. Digital radiomorphometric analysis of the frontal sinus and assessment of the relation between persistent metopic suture and frontal sinus development. *Am J Phys Anthropol*. 2018 Mar;165(3):492-506.
6. Eliezer M, Crampon F, Adnot J, Duparc F, Trost O. Original three-dimensional reconstruction of a case of metopism associated with a unilateral complete absence of the frontal sinus: Clinical interest and review of the literature. *Morphologie*. 2017 Jun;101(333):97-100.
7. Nakayama M, Niino M, Hirahara K, Kawasaki T, Kadota K, Asakura T. A case of ruptured aneurysm associated with persistent primitive trigeminal artery and metopism. *No Shinkei Geka*. 1994 Jul;22(7):651-5.
8. Harris AMP, Wood RE, Nortje CJ, Thomas CJ. The frontal sinus: Forensic fingerprint. *Apilot study*. *J Forensic Odontostomatol* 1987;5(1):9-15.

How to cite this article: Sharma S, Gupta P, Singh T, Sharma S, Sharma BB, Kapur N. Developmental and Morphological Variations of Frontal Sinus in Pediatric Age Group in Gurugram Region of Haryana – A Study. *Ann. Int. Med. Den. Res.* 2019; 5(6):EN01-EN04.

Source of Support: Nil, **Conflict of Interest:** None declared