

Role of Sphenoidal Air Sinus Dimensions in Establishing the Personal Identity

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ABSTRACT

In the past some attempts have been made to study comparative anatomy of the Para nasal air sinuses. Among them some have made efforts to measure the dimensions of these Para nasal air sinuses. Mostly all of study was done on the dry bones in early phase and then with X-rays. As these dimensions are very important to the ENT surgeons and to the neurosurgeon to understand the normal anatomy of these PNS. So, in present study efforts have made to measure the dimensions of sphenoidal air sinus with the help of CT scan and MRI, Which are the latest modalities, which can give more accurate measurements. Here 50 CT scans of PNS of normal adults (37 males & 13 females) at J.J. Hospital radiology department, Byculla, Mumbai were studied. And MRI of Brain including PNS of 100 normal adults (50 males, 50 females) at Breach Candy Hospital, Mumbai was studied.

Key words: Para nasal air sinus (PNS), Antero posterior (A-P), Transverse (Trans.), Vertical (Vert.), CT scans, MRI.

INTRODUCTION

Most of the anthropologist, anatomist and forensic experts are always interested in knowing different parameters of body. According to most of the scientist have done study on anthropometric measurements of different parts of body. These parameters are very important in view of forensic experts and anatomists. Because now days very frequently events of doing murder

first occurring and then attempts are made to destroy evidences and identity of that person i.e. by trying to burn or throwing in water afterword etc, or due to decomposition. Such cases when come to police department, then they use to take help from Forensic experts to know information like age, sex, gender etc from whatever the body parts are remaining to establish the identity of person. Similar situation also arises when the remaining parts of body in masses of unclaimed bodies (muddemal) in their juridical area, which may be very badly eaten by animals sometimes, to the government medical colleges (medicolegal case) to know the information. Apart from this the natural disasters are also happening like an earthquake, flooding, building collapse, in which identification of person is a very difficult task. So in this study stress has given to know the dimensions of sphenoidal air sinus which will be helpful not as primary but as an additional data

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to confirm the borderline cases. In past years study has done on dry bones and roentgens (x-ray), but as now a days as advanced technique like CT scan and MRI are available, so efforts have been made to reach toward more accuracy in case of sphenoidal air sinus dimensions.

AIMS AND OBJECTIVES

1. To find out average maximum dimensions (A-P, Transverse, Vertical) of sphenoidal air sinus for adult male, for adult female & Combined for both sexes by CT Scan.

2. To find out average maximum dimensions (A-P, Transverse, Vertical) of sphenoidal air sinus for adult male, for adult female & Combined for both sexes by MRI.

MATERIALS AND METHODS

CT Scan Study

In this CT Scans of PNS of 50 adult patients (37 males, 13 females) having normal Para nasal air

sinuses were included and studied. All others having abnormal pathology and congenital defect were excluded from study. All these patients were referred to the radiology department of J.J. Hospital, Byculla, Mumbai. (Grant Medical College, Mumbai). All CT Scans were done on SIEMENS, SOMATOM plus-4 machine in both Axial and Coronal planes. Sections having largest dimensions were selected for measurements.

MRI Study

This study includes MRI Brains of 100 adults (50males, 50females) having normal Para nasal air sinuses, which were referred for neurological complaints at Breach Candy Hospital, Mumbai. All patients underwent MRI on PHILIPS GYROSCANS ACS-NT, 1.5 TESLA machine. After performing MRI, the images having largest dimension were selected for measurements.

RESULTS

Total 50 subjects were studied for CT scan, among the 37 subjects were adult male and 13 subjects were adult female.

Table I: Total no of Subject studied

| Study | Male | Female | Total no. of subjects |
|---------------|------|--------|-----------------------|
| CT SCAN STUDY | 37 | 13 | 50 |

The table-1 showed the average maximum dimensions of Sphenoidal air sinus for Male subjects. In which, the average maximum dimensions of the right side of Sphenoidal air sinus are 28.9 mm anteroposteriorly, 16 mm transversely and 25.12 mm vertically. Where as

for Left side they are 29.9mm anteroposteriorly, 16.5mm transversely and 25.7mm vertically. The last column indicate the average of both Right and Left side sphenoidal air sinus dimensions and they are as 29.4mm anteroposteriorly, 16.3mm transversely and 25.4mm Vertically.

Table II: For Male: Average diameter in mm

| Sphenoidal air sinus | | | | | | | | |
|----------------------|--------|-------|----------|--------|-------|-------------|-------------|-------------|
| Rt. Side | | | Lt. side | | | Average | | |
| A-P | Trans. | Vert. | A-P | Trans. | Vert. | A-P | Trans. | Vert. |
| 28.9 | 16.0 | 25.12 | 29.9 | 16.5 | 25.7 | 29.4 | 16.3 | 25.4 |

Table no.-III**For Female:** Average diameter in mm.

| Sphenoidal air sinus | | | | | | | | |
|----------------------|--------|-------|----------|--------|-------|-------------|-------------|-------------|
| Rt. Side | | | Lt. side | | | Average | | |
| A-P | Trans. | Vert. | A-P | Trans. | Vert. | A-P | Trans. | Vert. |
| 27.0 | 14.6 | 22.5 | 27.5 | 15.2 | 23 | 27.3 | 14.9 | 22.7 |

The above table shows average maximum dimensions for Female subject. In which for the Right side the average maximum dimensions are 27.0 mm anteroposteriorly, 14.6mm transversely and 25.12mm vertically. Where as for Left side it

is 27.5mm anteroposteriorly, 15.2mm transversely and 23mm vertically. The last column indicate the average of both Right and Left side sphenoidal air sinus dimensions and they are as 27.3mm

Table no.-IV**Common for both Sexes:** Average diameter in mm.

| Subject | Sphenoidal air sinus | | |
|-----------------|----------------------|-------------|-------------|
| | A-P | Trans. | Vert. |
| Male: | 29.4 | 16.3 | 25.4 |
| Female | 27.3 | 14.9 | 22.7 |
| Common for both | 28.3 | 15.6 | 24.0 |

The above table shows average maximum dimensions for adult (common for both male and female sex). The dimensions are as 28.3mm antero posterior, 15.6mm transversely and 24.0mm vertically.

Table no.-V**FOR MRI STUDY:** Total no of Subject studied

| Study | Male | Female | Total no. |
|-----------|------|--------|-----------|
| MRI STUDY | 50 | 50 | 100 |

The above table shows total no. of 100 subjects was studied for MRI study. In this 50 subjects were adult male and 50 subjects were adult female.

Table VI

For Male: Average diameter in mm
 anteroposteriorly, 14.9mm transversely and
 22.7mm Vertically.

| Sphenoidal air sinus | | | | | | | | |
|----------------------|--------|-------|----------|--------|-------|---------|--------|-------|
| Rt. Side | | | Lt. side | | | Average | | |
| A-P | Trans. | Vert. | A-P | Trans. | Vert. | A-P | Trans. | Vert. |
| 27.19 | 14.63 | 23.77 | 27.77 | 15.14 | 24.19 | 27.48 | 14.88 | 23.98 |

The above table shows average maximum dimensions for Male subjects. In which for the Right side the average maximum dimensions are 27.19mm anteroposteriorly, 14.63mm transversely and 23.77mm vertically. Where as for Left side it is 27.77mm anteroposteriorly, 15.14mm transversely and 24.19mm vertically. The last column indicate the average of both Right and Left side sphenoidal air sinus dimensions and they are as 27.48mm anteroposteriorly, 14.88mm transversely and 23.98mm Vertically.

Table no.-VII

For Female: Average diameter in mm

| Sphenoidal air sinus | | | | | | | | |
|----------------------|--------|-------|----------|--------|-------|---------|--------|-------|
| Rt. Side | | | Lt. side | | | Average | | |
| A-P | Trans. | Vert. | A-P | Trans. | Vert. | A-P | Trans. | Vert. |
| 26.57 | 15.00 | 23.03 | 27.26 | 15.38 | 23.57 | 26.92 | 15.19 | 23.25 |

The above table shows average maximum dimensions for Female subjects, where firstly we have average maximum dimensions for right side which are as 26.57mm anteroposteriorly, 15mm transversely and 23.03mm vertically. For left side they are 27.26mm anteroposteriorly, 15.38mm transversely, and 23.57mm vertically. Lastly we have Average of both right and left side and they are as 26.92mm anteroposteriorly, 15.19mm transversely and 23.25mm vertically.

Table VIII

Common for both Sexes: Average diameter in mm

| Subject | Sphenoidal air sinus | | |
|-----------------|----------------------|--------|-------|
| | A-P | Trans. | Vert. |
| Male: | 27.48 | 14.88 | 23.98 |
| Female | 26.92 | 15.19 | 23.25 |
| Common for both | 27.20 | 15.03 | 23.61 |

The above table shows average maximum dimensions for adult (common for both male and female sex). The dimensions are as 27.20mm antero posterior, 15.03mm transversely and 23.61mm vertically.

DISCUSSION

Considerable variations in the sinus size occur from person to person. In the past many anatomists like Van Alyea⁸, Schaeffer J.P.⁷ has made attempts to find out the maximum dimensions of the normal Para-nasal air sinus. The present study also includes the measurements of maximum dimensions (Antero posterior, transverse, Vertical) of normal adult Sphenoidal air sinus from CT and MRI. As these are the latest advanced modalities made available which were not in the past. So with these modalities we can go towards more accuracy. In the present study, CT scans of 50 adults (37 males & 13 females) having normal Para nasal air sinuses have been selected for measurements of maximum dimensions of Sphenoidal air sinus. Also the MRI of Brain of 100 adults (50males, 50females) having normal Para nasal air sinuses have been selected for measurements of maximum dimensions of Sphenoidal air sinus. Also this study provides separate dimensions for Male and female sex. The results of present study were compared with the previous study as follows.

The sphenoidal sinuses lie side by side within the body of sphenoid bone separated by a bony septum. They vary in size and shape and rarely symmetrical. When exceptionally large, they may extend into the pterygoid plates or greater wings and may also spread into dorsum sellae and clinoid process. H. William⁴ in his book 'Head and Neck' mentions that the sphenoid sinus is the most variable in the form of any bilateral cavity or organ in human body and it is more variable in Antero posterior dimensions. Further he mentions the average dimensions for the adult sphenoidal sinus giving range as 4 to 44mm Antero posteriorly, 2.5 to 34mm transversely, and 5 to 33 mm vertically. Also he gives the reference of average dimensions of sphenoidal sinus by Dixon as 19 to 22mm

Antero posteriorly, 15 to 17mm transversely, and 18 to 20mm vertically. While Daniel O.Graney¹ mentions the average dimensions for adult sinus as 23mm Antero posteriorly, 17mm transversely and 20mm vertically. Gerald D.Dodd² gives the combined measurements for both sinuses in the adult as 22mm Anteroposterior, 20mm transverse and 22mm vertically. Gray's³ textbook of anatomy mentions average dimensions for adult sphenoidal as 21mm Antero posteriorly, 18mm transversely and 20mm vertically. Schaeffer JP⁷ in 'Morris Human Anatomy' book (11th edition) mentions the average dimensions as 12mm Antero posteriorly, 18mm transversely and 20mm vertically. While Lee B. Lusted and Theodore E.Ketas⁵ gives the separate dimensions for right and left sphenoidal sinus at 14 years of age as for right sphenoidal sinus 12mm Antero posteriorly, 9mm transversely and 14mm vertically. For the left sphenoidal sinus 7mm Antero posteriorly, 14mm transversely and 15mm vertically.

The present study data from computerized tomographic scans provides the average maximum dimensions for adult sphenoidal sinus as 28.3mm Antero posteriorly, 15.6mm transversely, 24.0mm vertically. While the data from Magnetic resonance imaging provides the average dimensions for adult sphenoidal sinus as 27.2mm Antero posteriorly, 15.0mm transversely, 23.6mm vertically. If we compared these readings with past studies, they are within the range of past studies. The Antero posterior and vertical dimensions from the present data are recorded little more as compared to the past. This may be as due to more accuracy of these new and latest modalities like CT scans and MRI. Those were not available in the previous days.

Also if dimensions compared among CT and MRI, then dimensions from MRI are less by few mm and this may be as clarity of mucosa is more on MRI and clarity of bone is more on CT scan.

The present study data will be definitely useful as an additional data to anatomist and forensic experts in different cases. No doubt lots of studies are present with different findings and indices to identify age, sex from skull, pelvis and long bones of unknown body. If unfortunately only skull is remaining material in case of

incomplete burn, drawing or building collapse and face is not recognizable, in such cases if dimensions of sphenoidal air sinus are made available then this data will be useful as secondary data to establish the identity of that person (either below 18 or above 18 years and male or female) after confirming with first primary findings and different indices of skull to identify age and sex of unknown case.

Also this study will be useful to make the list of anthropometric data complete.

Also this data will be useful to learn normal anatomical morphology of one of the paranasal air sinuses i.e. sphenoidal air sinus

CONCLUSIONS

CT scan study

1. Data from present study provides the average dimensions for adult male Sphenoidal air sinus as; A-P-29.4 mm, Trans-16.3 mm, Vert.-25.4 mm.

2. Data from present study provides the average dimensions for adult Female Sphenoidal air sinus as; A-P- 27.3 mm, Trans- 14.9 mm, Vert.-22.7mm.

3. Data from present study provides the average dimensions Common for both sex Sphenoidal air sinus as; A-P- 28.3 mm, Trans-15.6 mm, Vert.- 24 mm.

MRI study

1. Data from present study provides the average dimensions for adult male sphenoidal air sinus as; A-P-27.4 mm, Trans- 14.8 mm, Vert. - 23.98 mm.

2. Data from present study provides the average dimensions for adult Female Sphenoidal

air sinus as; A-P- 26.92 mm, Trans-15.1mm, Vert.- 23.25mm.

3. Data from present study provides the average dimensions Common for both sex Sphenoidal air sinus as; A-P- 27.2 mm, Trans-15.03 mm, Vert.- 23.6 mm

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