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# Indian Journal of Anatomy

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## Assessment of Brain Ventricular System by CT in Indian Population and its Clinical Significance

Thejeswari HG<sup>1</sup>, Ashwini Kumar<sup>2</sup>, Amit Nautiyal<sup>3</sup>, Honnegowda TM<sup>4</sup>

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**Author's Affiliation:** <sup>1</sup>Assistant Professor, Department of Anatomy, Adichunchanagiri Institute of Medical, Sciences, Adichunchanagiri University, B G Nagara, Nagamangala Taluk, Karnataka 571448, India, <sup>2</sup>Associate Professor, Dept of Forensic Medicine, Kasturba Medical College, Manipal university, Manipal, Karnataka 576104, India, <sup>3</sup>Nuclear Medicine Physicist, Institute of Nuclear Medicine and Molecular Imaging, AMRI Hospitals, Dhakuria, Kolkata 700029, India, <sup>4</sup>Associate Professor, Dept. of Anatomy, Kannur Medical College, Kerala 670611, India.

**Corresponding Author: Honnegowda TM**, Associate Professor, Dept. of Anatomy, Kannur Medical College, Kerala 670611, India.

**E-mail:** honnegowda33@gmail.com

### Abstract

**Background:** Current radiological diagnosis of various cerebral dystrophy requires subjective judgment for comparing with the normal brain ventricular system dimensions, thereby knowledge of morphometric and size of normal ventricular system of brain is of paramount importance to understand these changes.

**Methods:** For the present perspective study, computerized tomography (CT) of 500 patients (Males-339 and Females-161) were studied for the measurements of lateral ventricle, third ventricle and fourth ventricle and it was statistically analyzed.

**Results:** The antero posterior extent of the body of the lateral ventricles on the right side was  $75.23 \pm 6.8$  mm and on the left side was  $71.02 \pm 7.78$  mm; the length of the frontal horns on the right side was  $28.2 \pm 2.72$  mm and on the left side was  $27.7 \pm 2.9$  mm respectively. The width and height of the fourth ventricle were  $11.87 \pm 1.08$  and  $8.9 \pm 1.5$  mm whereas width of the third ventricle was  $5.58 \pm 2.10$  mm.

**Conclusion:** The present study has defined the morphometric measurements of the Brain ventricular system (BVS) such as lateral ventricles, third ventricle, and fourth ventricle of the brain of normal individuals which has clinical correlations in diagnosis and for appropriate treatment.

**Keywords :** Brain ventricular System; Morphometry; PET / CT scan.

### Introduction

A unique feature of the vertebrate brain is the brain ventricular system (BVS), a series of connected cavities lying deep within the brain, filled with cerebrospinal fluid (CSF).<sup>1</sup> Lateral ventricles are the largest paired ventricles present within the cerebrum; the third ventricle is in the diencephalon and fourth ventricle is located posterior to the Pons and open part of the medulla oblongata.<sup>1,2</sup> In the recent times for the researchers the objective and morphometric studies of human brain ventricles is under limelight, due to its relation with several disorders such as schizophrenia, hydrocephalus, tumors, trauma and as well age related changes.<sup>3</sup> Estimates of ventricular size are important in diagnosis, in deciding about the need to intervene surgically. The range of changes in ventricular size encountered in clinical practice has led most people to feel that decisions can be taken without an exact measure of ventricular size. But in number of circumstances precise measurements will be of paramount important.<sup>4</sup> It should be noted that there is a continuous debate in the literature of neuroradiology, neurology, neuroanatomy and psychiatry, over the best method of assessing the brain ventricular system and the information known regarding the accurate measurements of the brain ventricles is limited in the literature.<sup>5</sup> By CT scanning BVS it can be studied and well visualized

overall configuration which can be reconstructed from a series of contiguous slices.<sup>6</sup> The present work is undertaken for morphometric analysis of the lateral, third and fourth ventricles of the brain in normal Indian subjects using CT scan.

## Clinical Material and Methods

### Population Studied

500 participants were prospectively recruited between the age group of 20 to 70 years, attending the department for Brain PET/CT procedure at Institute of Nuclear Medicine & Molecular Imaging, AMRI Hospital, Kolkata. All participants gave written, informed consent for clinical evaluation. Patients with no confirmed history of cerebral infarction, local mass lesions, probable communicating hydrocephalus, alcoholism, drug abuse, trauma or previous intra-cranial surgery and other hereditary diseases and were not on medication at the time of this study. This study was reviewed and approved by the institutional human research committee.

### Procedure of CT Scanning Technique

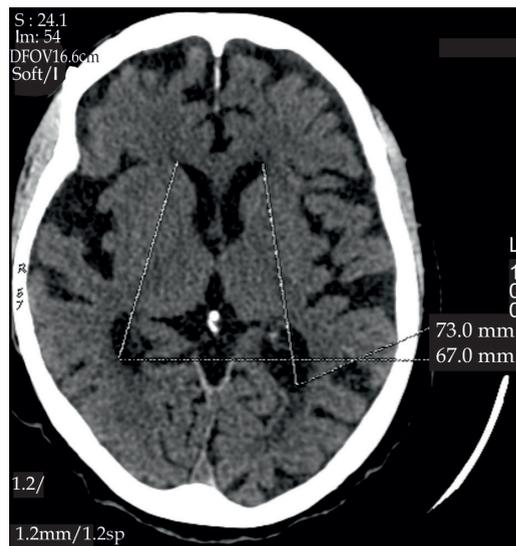
The CT scanner used in this study was the General electric GE discovery 690 PET/CT (64 slices). All CT Scans was performed in axial mode with iterative reconstruction algorithm. The patient was placed on the PET/CT table and the head was centralized and supported for correct positioning and to avoid blurring of images. A lateral scout image was taken to confirm correct positioning of patient. Orbito-meatal line was drawn and a line at an angle of 15-20 degrees to and 1 cm above it was drawn, representing the lowest tomographic section, which passed through the base of skull.<sup>7</sup>

### Method of assessment of the Brain ventricle systems

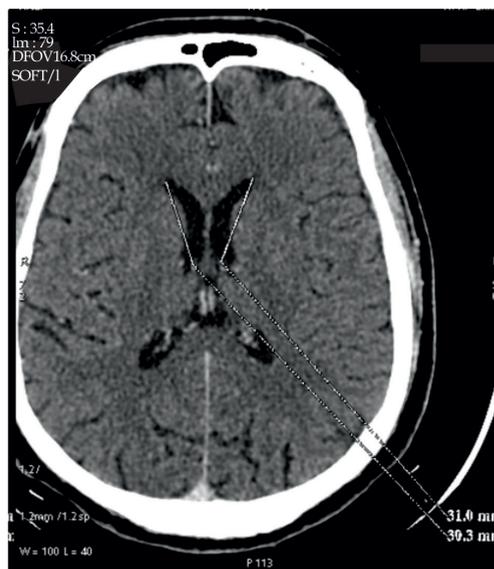
The Procedure for the measurements of BVS followed as:

1. Lateral Ventricle Measurement: a) Length of left lateral ventricular body inclusive of frontal horn (taken from tip of frontal horn to the atrium) can be seen in Figure 1.
2. Level of Interventricular Foramen.
  - a. Length of frontal horns of right lateral ventricle in Foramen (measured from its tip to the interventricular foramen).
  - b. Length of frontal horns of left lateral ventricle in cm (measured from its tip

to the interventricular foramen) can be seen in Figure 2.



**Fig. 1** CT axial image of the brain showing the length of right and left ventricles. The gray lines indicate the height and the width.

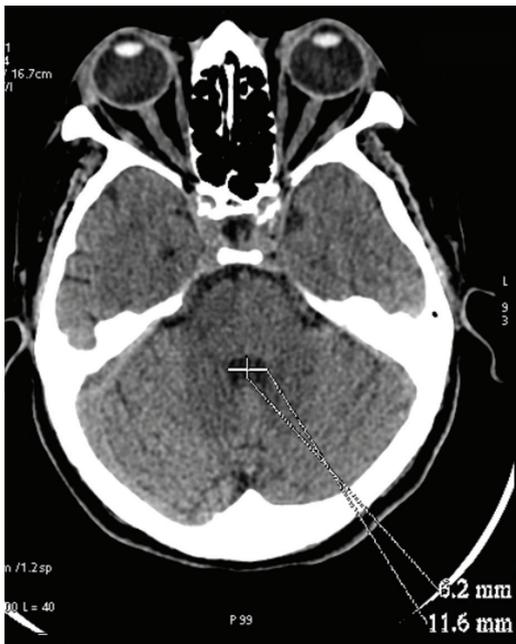


**Fig. 2** CT axial image of the brain showing the length of body of the lateral ventricles. The gray lines indicate the length of the body of both lateral ventricles.

3. Level of Third Ventricle
  - a. Greatest width of third ventricle in mm can be seen in Figure 3.
4. Level of Fourth Ventricle
  - a. Greatest height of fourth ventricle in mm (Figure 4).
  - b. Greatest width of fourth ventricle in mm (Figure 4).



**Fig. 3** CT axial image of the brain showing the length of the left lateral ventricle and body of right ventricle. The three lines show the length of body of right ventricle, length of the whole left ventricle and width of the third ventricle respectively.



**Fig. 4.** CT axial image of the brain showing the width and height measurement of the 4th ventricle. The gray lines indicate the height and the width.

**2.4. Statistical analysis**The data were analyzed using the SPSS version 20 (SPSS Inc., Chicago, IL, USA). The distribution of the data was checked for normality using Kolmogorov-Smirnov test. Since the data was normally distributed parametric tests were used. Continuous variables were assessed using Student t tests for significance of difference of the measurements between males and females.

Two-sided P-values were considered statistically significant at  $P < 0.05$ . Results are expressed as means  $\pm$  standard deviation (SD) unless otherwise indicated. The correlation between age with width of third and fourth ventricle was determined by Pearson’s correlation coefficient.

**Results**

Among 500 subjects there were more males (339) and than females (161) in this study with a male: female ratio of 1.7:1.0. Most patients were between 24 and 39 years and their mean age was 37.26 years. It was observed that the anteroposterior extent of the body of the right and left ventricles was almost equal in female’s  $69.10 \pm 6.4$  mm whereas, it was larger in the right side  $75.00 \pm 6.76$  mm than the left side  $74.66 \pm 8.4$  mm in the males. The length of the frontal horns on the right side was  $29.53 + 3.88$  mm and  $27.16 + 4.21$  mm in the males and females and on the left side was  $30.54 \pm 3.4$  mm and  $26.9 \pm 3.2$  mm in the males and females (Table 2). The mean height and width of the fourth ventricle were  $9.90 \pm 2.1$  and  $13.0 \pm 1.1$  mm in the males and  $9.6 \pm 1.2$  mm and  $11.9 \pm 1.5$  mm in the females respectively [Table-2]. On correlation between width of third and fourth ventricle with age showed positive correlation which was statistically significant as shown in (Table-3). The measurement of the ventricles was obtained from the CT monitor using the cursor were shown in Figures 1-4.

**Table 1:** Descriptive Statistics of Study Population.

	Percentage	Age (Mean $\pm$ SD)
Males	339 (67.8%)	35.10 $\pm$ 2.64
Females	161 (32.2%)	29.09 $\pm$ 2.45

**Table 2:** List of ventricular measurements (mean  $\pm$  SD) in males and females.

Parameters	Mean $\pm$ SD	(Max-Min)	P-value
	Males (n=339)	Females (n=161)	
Length of body of the right ventricle	75.00 $\pm$ 6.76	69.66 $\pm$ 8.4	0.010*
Length of body of the left ventricle	74.66 $\pm$ 8.4	69.10 $\pm$ 9.4	0.032**
Length of right frontal horn of Lateral ventricle	29.54 $\pm$ 3.4	27.4 $\pm$ 3.2	0.044**
Length of left frontal horn of lateral ventricle	29.83 $\pm$ 4.7	26.9 $\pm$ 3.2	0.015*
Width of the third ventricle	5.8 $\pm$ 1.5	5.2 $\pm$ 1.9	0.005*
Height of the fourth ventricle	9.90 $\pm$ 2.1	9.6 $\pm$ 2.2	0.556
Width of the fourth ventricle	13.0 $\pm$ 1.2	11.9 $\pm$ 1.5	0.024*

\* P value significant at the level of 0.005; \*\* P value significant at less than 0.05.

**Table 3:** Correlation study between age and width of the 4th and 3rd ventricles.

	Pearson Correlation Coefficient	P value
Width of 4th ventricle and age	0.227	0.045
Width of the third ventricle and age	0.389	0.029

## Discussion

The ventricular size of the brain is likely to be an increased in several neurological disorders such as hydrocephalus, cerebral atrophy, Alzheimer's disease, Parkinson's disease, in which precise measurements will be of important value.<sup>8</sup> Volumetric and Morphometric study of cerebral ventricles provides useful indices of cerebral asymmetry and atrophy<sup>9</sup>. A study by Williams P, L et al<sup>10</sup>. shown that the left lateral ventricle was larger than the right one and both were of same size in females. But our study results are contrary to the previous study wherein in males right one is slightly larger than left and both left and right ventricles were large in males compared to females. This is because males skull were heavier and bigger, the capacity of the skull is more compared to female skull and also because the brain size is more in males compared to females.<sup>10</sup>

Our study results revealed that the length of the right frontal horns was 29.54±3.4 mm in males and 27.4±3.2 mm in females and that of left frontal horns was equal to the right one in the males but slightly shorter in the females 26.9±3.2 mm. Studies by D'Souza and Natekar revealed that the height of fourth ventricle was 13.0±1.2 and 11.9±1.5 mm for the male and female respectively.<sup>11</sup>

Earlier study by Gawler et al.<sup>12</sup> revealed that the greatest distance between the roof and the floor of fourth ventricle was less than 10.8 mm; however in our study this distance was significantly lesser (9.90±2.1 mm) in males and females (9.6±2.2 mm) with the mean 9.50 ± 0.17 mm and it has been found that the width of the fourth ventricle was found to be greater than the height in both genders and was more in males (13.0±1.9) than in females (12.0±2.0) with the mean 12.4±1.08 mm. Gawlar J et al.<sup>12</sup>, Soininen et al.<sup>13</sup>, D'Souza et al.<sup>11</sup>, Meshram, P et al.<sup>14</sup>, Brinkman et al.<sup>15</sup> measured the width of third ventricle, found that the maximum mean width of the third ventricle was 5.9 mm, 9.2 mm, 4.2 mm. In our study, found this measure was significantly

higher in males (5.8 mm) as compared to females (5.2 mm) with mean (5.5 mm). On performing student 't' test to all the parameters between right and left in male and female have showed significant results (P<0.05) except height of fourth ventricle (p=0.556) [Table 2].

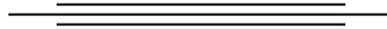
## Conclusion

The study provided useful morphometric data to better understand the lateral, third and fourth ventricles while diagnosing clinical problems associated with the various types of ventricular enlargement and other pathologic disorders.

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# Abnormal Lumbarisation & Sacralisation: A Case Study on Dry Bones

Gokul Krishna Reddy Nune

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**Author's Affiliation:** Assistant Professor, Dept. of Anatomy, NRI Academy of Medical Sciences, Mangalagiri, Andhra Pradesh 522503, India.

**Corresponding Author:** Gokul Krishna Reddy Nune, Assistant Professor, Dept. of Anatomy, NRI Academy of Medical Sciences, Mangalagiri, Andhra Pradesh 522503, India.

**E-mail:** [gkr.nune@gmail.com](mailto:gkr.nune@gmail.com)

## Abstract

The malformations of the sacrum which influence the free functioning of the spine go by the name of lumbarisation and sacralisation.<sup>1</sup> In human being sacrum is a solid bony mass formed from 5 fused vertebrae in the posterior part of bony pelvis on which the upright spine sits.<sup>2</sup> In foetus the segments of the sacrum were not fused, free to move like a tail and participate as an extension of the spine.<sup>1,2</sup> Lumbarisation is a condition in which S1 vertebra is not fused & is free to move and participates along with lumbar vertebrae in spinal activity.<sup>1,2,3</sup> Sacralisation of lumbar vertebrae is where (L5) segment is fused to the sacrum below.<sup>9,10</sup>

In the present study examined 50 sacra which are available in the dept. of Anatomy, Nri medical college, mangalagiri for the lumbarisation and sacralisation.

**Key words:** Sacrum; Fifth lumbar vertebra; Sacralisation; Sacral foramina; Lumbarisation.

## Introduction

The vertebral column protects the spinal cord and spinal nerves, supports transmits weight of the body to the lower limbs and thus plays an important role in posture and locomotion.<sup>1,2,3</sup> Sacrum is a wedge shaped bone formed by the fusion of 5 sacral vertebrae which divided into base superiorly formed by the 1st sacral vertebra articulates with 5th lumbar vertebra, the caudal apex articulates with the coccyx.<sup>4,5</sup> The anterior projecting border of 1st sacral vertebra called as sacral promontory. It has 4

pairs of pelvic sacral foramina communicates with the sacral canal. On dorsal surface, median sacral crest with 3 or 4 spinous tubercles representing fused sacral spines.<sup>5</sup> Below the 4th tubercle an "U" shaped gap in the posterior wall of the sacral canal called sacral hiatus.<sup>5</sup> There are four dorsal sacral foramina.

Transitional vertebrae in the lumbosacral region result as a congenital anomaly in the segmentation of the spine. Sacralisation means addition of sacral elements by the incorporation of lumbar vertebra mostly L5, can be unilateral/ bilateral producing partial/complete sacralisation.

The clinical significance of sacralisation of lumbar vertebra can cause L5 nerve compression resulting in pain along the sciatic nerve distribution.<sup>9,10</sup> Spondylolisthesis is also a complication documented with sacralisation.

Reduction of sacral constituents is less common than the sacralisation but lumbarisation of first sacral vertebra does occur in some cases either partially or completely separate.<sup>6,7</sup>

## Materials and Methods

Total of 50 sacrum of both sex (male 30 & female 20) which are available in the dept. of Anatomy, kalinga institute of medical sciences Bhubhaneswar were studied for the lumbarisation and sacralisation, all the sacra were photographed.

**Observations**

Features	Complete	Incomplete	Incidence(%)
Lumbarisation	6	3	18
Sacralisation	1	2	6

**Results**

The sacra were examined to assess the number of its vertebral components and the number of sacral foramina was counted.

1. *Non-sacralisation*: sacrum which are showing 4 pairs of sacral foramina and 5 vertebral segments.
2. *Frank sacralisation*: sacrum which are showing 5 pairs of foramina and 6 vertebral segments.
3. *Occult sacralisation*: sacrum which are showing 6 vertebral segments and found to be set higher in the pelvis than usual, frank sacralisation was not seen.



Fig. 3: Sacrum Showing Incomplete Lumbarisation of Sacral(S1) Vertebra.



Fig. 1: Sacrum Showing Sacralisation of Lumbar Vertebra Complete on Right & Incomplete on Left.



Fig. 4: Sacrum Showing Incomplete Lumbarisation of Sacral(S1) Vertebra.



Fig. 2: Sacrum Showing Complete Sacralisation of Lumbar Vertebra.



Fig. 5: First Sacral Vertebra.

## Discussion

To understand sacralisation & lumbarisation the embryological origin of the lumbar vertebrae to be known, the development of which commences at 3rd week of intrauterine life from somites that form along the cranial-caudal axis, on either side of the notochord, from pre-somatic mesoderm.<sup>10</sup> They differentiate into dermo-myotome & sclerotome. Each sclerotome divided into loosely packed cells cranially and densely packed cells caudally.<sup>10</sup> Some of the densely packed cells move cranially opposite the centre of myotome where they form the intervertebral disc. The remaining densely packed cells in the caudal region of the cranial sclerotome fuse with the loosely arranged cells in the cranial end of immediately caudal sclerotome to form mesenchymal centrum.<sup>8,9</sup> The mesenchymal cells surrounding the neural tube forms the neural arch.

The primary cause of sacralisation of the L5 vertebrae is likely to be a product of both genetic predisposition & developmental influences.<sup>5,6,7</sup>

Complete sacralisation consists of a complete body union of the abnormal transverse process and the sacrum. Incomplete sacralisation shows a defined joint line. Both forms can be unilateral/ bilateral.

## Clinical Importance

1. Usually presents with symptoms including spinal or radicular pain, disc degeneration, L4/L5 disc prolapse, lumbar scoliosis and lumbar extradural defects.<sup>1,2,6</sup>
2. In transitional lumbosacral segmentation the intervertebral disc in this region is significantly narrowed & disc herniation is higher, occurs even at young ages.<sup>3,6,8</sup>
3. The transitional vertebrae can increase degree of slippage in spondylolisthesis, this anomaly has known implications in the field of disc surgery.<sup>4,5</sup>
4. It has been noticed that the discs immediately above & below the transitional vertebra were significantly more degenerative.<sup>9,10</sup>

5. LSTV is one of the causative factors of low back pain.
6. Complications of sacralisation of 5th lumbar vertebra causes pain due to pressure on nerves or nerve trunks, ligamentous strain around the sacralisation, compression of soft tissues between bony joints.<sup>10,11</sup>

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## A Cadaveric Study on Variations in Origin of Profunda Femoris Artery in Haryana Population

Meetu Agarwal<sup>1</sup>, BK Mishra<sup>2</sup>, Devesh Kumar Sharma<sup>3</sup>

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**Author's Affiliation:** <sup>1</sup>Assistant Professor, <sup>2</sup>Professor & Head, <sup>3</sup>Tutor, Department of Anatomy, Al Falah School of Medical Science & Research centre, Dhauj, Faridabad 121004, Haryana, India.

**Corresponding Author:** Devesh Sharma, Tutor, Department of Anatomy, Al Falah School of Medical Science & Research centre, Dhauj, Faridabad 121004, Haryana, India.

**E-mail:** sharmadevesh306@gmail.com

### Abstract

**Introduction:** The femoral artery is the continuation of external iliac artery and it enters the femoral triangle behind the inguinal ligament at mid-inguinal point (mid-Point between the anterior superior iliac spine and pubic symphysis). The profunda femoris artery usually arises from the lateral aspect of the femoral artery. The anatomical knowledge of the profunda femoris artery is very important to prevent inadvertent damage to it during clinical procedures.

**Aim and Objectives:** Aim of the present study was to discuss the variations in origin of the profunda femoris artery and their clinical significance.

**Materials and Methods:** The study was conducted on 40 lower limbs in 20 embalmed human cadavers of unknown age, from the Department of Anatomy of Al-Falah School of Medical Science and Research Center, Dhauj, Faridabad.

**Results:** The most common site of origin of PFA is lateral aspect of FA. In the present study done on 40 lower limbs we found lateral, posterolateral, posterior and medial origins of profunda femoris artery. The most common range of the distance of origin of PFA from midinguinal point was 21 - 30 mm.

**Conclusion:** This study will be very helpful to the surgeons, radiologist and plastic surgeons to understand possible variations in Profunda femoris artery while performing procedures on FA.

**Key Words:** Femoral Artery; Profunda Femoris Artery (PFA); Inguinal Point.

### Introduction

The femoral artery is the continuation of external iliac artery and it enters the femoral triangle behind the inguinal ligament at mid-inguinal point (mid-Point between the anterior superior iliac spine and pubic symphysis). The profunda femoris artery usually arises from the lateral aspect of the femoral artery (3.5 cm below the mid-inguinal point). Near its origin the medial and lateral circumflex femoral arteries arise from the profunda femoris artery.<sup>1</sup> The femoral artery is commonly used for arterial catheterization (second choice for cannulation) as it is easily accessible.

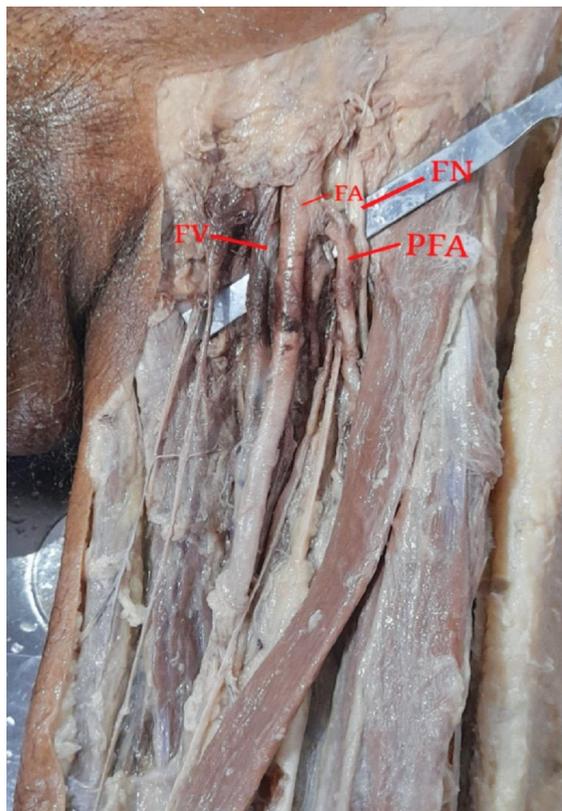
It is used for investigating the arterial system anywhere in the body and for various clinical procedures, like coronary angioplasty. For femoral embolectomy, in case of lower limb arterial thromboembolism, the femoral artery in the femoral triangle is directly opened at the origin of the profunda femoris artery. In all these cases the anatomical knowledge of the profunda femoris artery is very important to prevent inadvertent damage to it during clinical procedures.<sup>2</sup> The course of femoral vessels and origin of profunda femoris artery have long received attention from both anatomists and surgeons.

**Materials and Methods**

The study was conducted on 40 lower limbs in 20 embalmed human cadavers of unknown age from the Department of Anatomy of Al-Falah School Of Medical Science And Research Center, Dhauj, Faridabad. The Femoral triangle of the lower limbs were dissected in embalmed cadavers and exposed according to Cunningham’s Manual of Practical Anatomy by the help of dissecting instruments (scalpel, scalpel blade, blunt scissors, pointed scissors, blunt forceps, and pointed forceps).

**Results**

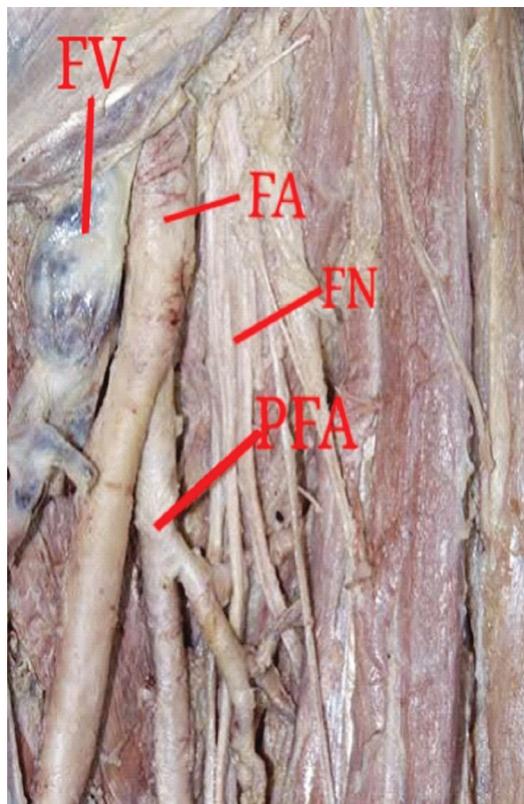
The most common site of origin of PFA is lateral aspect of FA. In present study done on 40 limbs we found that in 32/40 limbs PFA originated from lateral aspect of FA (Figure-1). In 5/40 limbs PFA originated from posterior aspect of FA (Figure-2) and in 2/40 limbs PFA originated from posterolateral aspect of FA (Figure-3). In 1/40 limbs PFA originated from medial aspect of FA (Figure-4). [Table no. 1]



**Fig.1:** PFA originating from lateral aspect of FA.

In present study the distance from mid-inguinal point to the origin of PFA was between 10 - 20 mm in 2 limbs of the right side and 4 limbs of the left side. The range of 21 - 30 mm was found in 9 limbs

of the right side and 7 limbs of the left side. This distance of 31-40 mm was found in 4 limbs of the right side and 3 limbs of the left side and 41-50 mm was found in 3 limbs of the right side and 3 limbs of the left side. This distance is 51 - 60 mm was found in 1 limbs of the right side and 2 limbs of the left side and the distance is 61-70 mm was found in 1 limbs of the right side and 1 limbs of the left side. [Table no. 2]



**Fig. 2:** PFA originating from posterior aspect of FA.

**Table 1 :** Position of origin of PFA.

Position	Right	Left
Posterior	3	2
Posterolateral	0	2
Lateral	16	16
Medial	1	0

**Table 2 :** Distance From Midinguinal point to origin of PFA.

Range (mm)	Right	Left
10-20	2	4
21-30	9	7
31-40	4	3
41-50	3	3
51-60	1	2
61-70	1	1



Fig. 3: PFA originating from posterolateral aspect of FA.

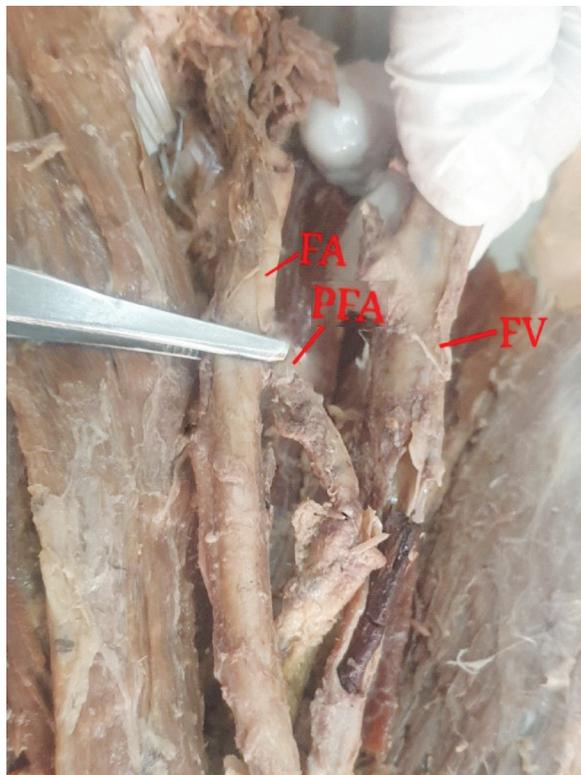


Fig. 4: PFA originating from medial aspect of FA.

## Discussion

Profunda femoris artery is a branch of the internal iliac artery in the lower animals. As a result of evolution, the origin shifted distally from the internal iliac artery to the femoral artery. 'Ontogeny repeats phylogeny'. Arrest at different stages of development may lead to anatomical variations related to the division of the femoral artery. VAAS F<sup>3</sup> and Siddharth P<sup>4</sup> reported that the profunda femoris artery acts as a collateral vessel in the occlusion of the femoral artery and for this important function, it has to have a large caliber, which can be explained based on the aforementioned comparative anatomy. To avoid the iatrogenic femoral arteriovenous fistula formed during puncture of femoral artery the anatomical knowledge of the level of origin is important. The different anatomical relationships and lack of knowledge of variations of these vessels make the haemostasis difficult to manage.<sup>5</sup>

The anatomical knowledge of variations of femoral artery and its branches is important as these arteries are frequently accessed in the present modern era by surgeons and radiologists for number of procedures like coronary angiography, balloon valvuloplasty, percutaneous valves, hip joint replacement etc.<sup>6</sup>

The various variations in the origin of profunda femoris and its branches are described in the literature. Anatomical variations regarding the level of the division of the femoral artery have been reported and explained by studies done by different authors. Dixit et al.<sup>7</sup> observed distance 31-40 mm on right side and between 41-50 mm on the left side. Prakash et al.<sup>6</sup> noted this distance to be 4.2 cm. Siddharth P et al observed as 4.4 cm<sup>4</sup>. Vedat Sabancıogulları et al.<sup>8</sup> recorded the distance of the origin point of PF to the midpoint of the inguinal ligament was found to be 5.6 cm in the right and 2.2 cm in the left. This distance is very important in order to locate the PF while performing cannulation of femoral artery.

In present study the distance from mid-inguinal point to the origin of PFA was between 10 - 20 mm in 2 limbs of the right side and 4 limbs of the left side. The range of 21 - 30 mm was found in 9 limbs of the right side and 7 limbs of the left side. This distance of 31-40 mm was found in 4 limbs of the right side and 3 limbs of the left side and 41-50 mm was found in 3 limbs of the right side and 3 limbs of the left side. This distance is 51 - 60 mm was found in 1 limbs of the right side and 2 limbs of the left side and the distance is 61-70 mm was found in 1 limbs of the right side and 1 limbs of the left side.)

The most common site of origin of PFA is lateral aspect of FA. In present study done on 40 limbs we found that in 32/40 limbs PFA originated from lateral aspect of FA. In 5/40 limbs PFA originated from posterior aspect of FA and in 2/40 limbs PFA originated from posterolateral aspect of FA. In 1/40 limbs PFA originated from medial aspect of FA. (Table no. 1) But few authors consider posterolateral and lateral side origin is the most common pattern.

The medial origin of PF carries a risk of damage to this large and unexpected arterial channel while collecting blood in infants from FV and during exposure of saphanous veins for ligation its junction with the FV.<sup>9</sup>

### Conclusion

According to the present study the most common site of origin of PFA was from lateral side of FA. A rare variation was also found where the PFA was arising from medial side of FA. To avoid the iatrogenic femoral arteriovenous fistula formed during puncture of femoral artery, the anatomical knowledge of the level of origin is important. The different anatomical relationships and lack of knowledge of variations of these vessels make the haemostasis difficult to manage during procedures.

The anatomical knowledge of variations of femoral artery and profunda femoris artery is important as these arteries are frequently accessed in the present modern era by surgeons and radiologists for number of procedures like coronary angiography, balloon valvuloplasty, percutaneous valves, hip joint replacement etc.

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## Thyroidea ima Artery a Rare Variation - Case Report

Sunita Bharati<sup>1</sup>, N.Sujatha<sup>2</sup>, Manisha Nakhate<sup>3</sup>

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**Author's Affiliation:** <sup>1</sup>Associate Professor, <sup>3</sup>Professor and Head, Dr. D.Y. Patil Medical College, Navi Mumbai, Maharashtra 400706, India. <sup>2</sup>Assistant Professor, NRI Medical College, Vizag, Andhra Pradesh 531162, India.

**Corresponding Author:** Sunita Bharati, Associate Professor, Department of Anatomy, Dr. D.Y. Patil Medical College and Hospital, Nerul, Navi Mumbai 400706, Maharashtra, India

**E-mail:** drsunitagiri@gmail.com

### Abstract

**Introduction:** The thyroidea ima artery is an inconstant vessel with a highly variable rate of occurrence and origin. Its course in the superior mediastinum and lower neck is hazardous in median surgical approaches to these areas. Thyroidea ima is a rare anomalous artery supplying the thyroid gland apart from the superior and inferior thyroid arteries.

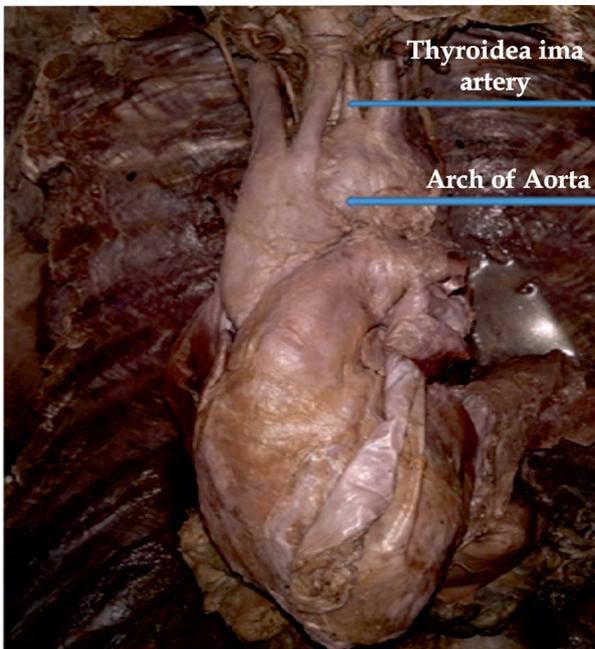


Fig. 1: Thyroidea ima artery arising from arch of aorta.

**Case Report:** During routine dissection of embalmed male cadaver approximately 65 yearsold in the department of the Anatomy at Shri Sathya Sai Medical College & Research Institute, Ammapettai, Chennai, this variation was found in thorax region. Thyroidea ima artery arising from arch of aorta.

**Clinical importance:** It is of surgical importance in thyroid, parathyroid, tracheal and mediastinal surgeries.

**Conclusion:** Thyroidea ima artery, although a rare arterial variation, a thorough regional anatomic knowledge and meticulous dissection will not only help us in identifying such a vascular variation, also help us in preventing an accidental injury.

**Key words:** Thyroidea ima; Thyroidectomy; Anomalous blood vessels.

### Introduction

The Thyroidea ima artery is an inconstant vessel with a highly variable rate of occurrence and origin. Its course in the superior mediastinum and lower neck is hazardous in median surgical approaches to these areas. Thyroidea ima is a rare anomalous artery supplying the thyroid gland apart from the superior and inferior thyroid arteries. The thyroidea ima artery (TIA) is an anatomical anomaly that commonly functions as an accessory blood supply for the isthmus and inferior aspect of the thyroid. They most commonly arise from the innominate, aortic arch, right common carotid or

subclavian artery. The presence of this artery is of surgical significance in thyroid, parathyroid and tracheal surgeries.<sup>1,2</sup>

### Case Report

During a routine dissection of a male cadaver, we observed a rare variation in branches of arch of aorta in thorax region. We observed three branches of arch of aorta along with one extra branch. The extra branch is thyroidea artery which was going upwards towards the thyroid gland to supply isthmus and inferior aspect of thyroid.

### Discussion

The Thyroidea artery can originate from large arteries, such as the aortic arch, common carotid arteries, and subclavian arteries, brachiocephalic artery or from smaller vessels, such as the pericardiophrenic artery and thyrocervical trunk<sup>3</sup>. It is considered as a compensatory artery when the other thyroidea vessels showed deficiencies<sup>4</sup>. With varied mediastinal origins, lengths, and termination points, the embryological origin of the TIA has been hypothesized to be related to the descent of the thyroid and variable arterial differentiation during the fetal period<sup>5,6</sup>. Bilateral thyroidea arteries have been reported by Gruber. Gruber has also reported the origin of thyroidea artery from between the brachiocephalic and left carotid, from between the right subclavian and right carotid, from between the left carotid and subclavian, from the internal thoracic artery, right subclavian artery, in one from the right inferior thyroid, and in one from the transverse scapular artery.<sup>4</sup> Depending on arterial course and length, the TIA can also supply the trachea, parathyroid glands, and thymus as a single branch or as multiple branched anastomoses.<sup>7,8</sup> The thyroid gland is typically supplied by the superior and inferior thyroid arteries which arise from the external carotid artery and thyrocervical trunk, respectively.

Identification and dissection of these vessels are critical in head and neck surgeries, such as hemi-/total thyroidectomies and parathyroidectomies, as these arteries are important landmarks for structures such as the recurrent laryngeal nerve.<sup>9</sup> Ligation of these arteries are standard procedures to decrease blood loss during surgery and to improve patient outcomes.<sup>10</sup> The presence of a TIA can complicate such surgeries as physicians may fail to recognize it due to its unpredictable location, morphology, and relative rarity, as well as

variations in nomenclature.<sup>11</sup> The TIA is considered a small arterial vessel, with an average diameter of 3 to 5 millimetres. Its origin is often a high-pressure large artery in which severe haemorrhage and blood loss can occur if prompt haemostasis. Due to its general relation to the trachea, the TIA can be damaged in emergency airway interventions such as cricoideotomies and tracheostomies.<sup>12</sup> In such situations, the emergent nature and potential complications in treatment delay may preclude radiological identification of the TIA.<sup>13</sup> In addition to frank haemorrhage, there may also be dissection of the artery in surgical settings, which can result in retraction into the superior mediastinum and creation of blood clots within the thoracic cavity that are difficult to access.<sup>14,15</sup>

### Conclusion

The thyroidea artery is a rare vascular variant that is present in 3-10% of the general population. The origin, course, and termination of the TIA is variable, which contributes to the difficulty in its identification. Emergency and surgical considerations of the TIA are critical in haemostasis and preventing haemorrhage into the mediastinal cavity. Limited research has been performed to investigate the relative prevalence and clinical implications of the TIA.

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# Anamolus & Complete Fusion of Atlas with Occipital Bone:-A Case Report Seen in Dry Skull

Gokul Krishna Reddy Nune

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**Author's Affiliation:** Assistant Professor, Dept. of Anatomy, Nri Medical College, Mangalgiri, Guntur 522503, Andhra Pradesh, India.

**Corresponding Author:** Gokul Krishna Reddy Nune, Assistant Professor, Dept. of Anatomy, Nri Medical College, Mangalgiri, Guntur 522503, Andhra Pradesh, India.

**E-mail:** [gkr.nune@gmail.com](mailto:gkr.nune@gmail.com)

## Abstract

Occipitalisation of atlas is an osseous anomaly in the region of the foramen magnum.<sup>1</sup> This is important as skeletal abnormalities at this junction may result in sudden death.<sup>1,2</sup>

**Material & Methods:** During routine undergraduate osteology teaching, a dry skull with Occipitalisation of atlas was encountered in the department of Anatomy, nri medical college, mangalgiri, India.

**Results:** In this skull, both anterior and posterior arch along with transverse process of both sides of atlas were completely fused with occipital bone.

Reduction in diameter of foramen magnum due to this condition can cause neurological complications due to compression of spinal cord or medulla oblongata, vertebral vessels, 1st cervical nerve, this knowledge of occipitalisation of the atlas is important to orthopaedicians, neurosurgeons, physicians and radiologists dealing with abnormalities of the cervical spine.

**Key Words:** Occipitalisation; Atlas; Assimilation; Occipital bone; Atlantooccipital fusion.

## Introduction

Occipitalisation of the atlas is fusion of the atlas bone with the base of occiput.<sup>1,3,5,7</sup> Occipitalisation can be incomplete/complete, can be acquired after a healed fracture (acquired) or congenital. In the congenital type the symptoms are more. The signs and symptoms may vary from headache

to neurological syndrome, symptoms include cord compression due to surrounding soft tissue abnormality.<sup>6,7,8</sup>

Vertebral arterial compression or even its total occlusion in the bony canal can lead to dizziness, seizures, mental deterioration and syncope.<sup>7,8</sup>

It is mostly asymptomatic & is found incidentally when other diseases are ruled out.<sup>5,6</sup> Thus because of its multiple variations knowledge of such anomaly is essential.

## Case Report

During osteology classes for undergraduate students we found a Skull showing completely fused atlas vertebra with the occipital bone at the base of the skull, along with its transverse processes on both sides.

The entire anterior arch fused with the basilar part of the occipital bone leaving a small gap in between. The posterior arch was with the posterior margin of the foramen magnum.

The hypoglossal canals were seen. The two superior facets of atlas fused with the occipital condyles.

The right and the left transverse process of the atlas each containing complete transverse foramen are also fused. There is a groove posterior to inferior articular facet on the posterior arch on both sides.

The inferior articular facet on the right side (17X17mm) appeared to be larger than left(14X16mm) and facets were smooth and flat.

The anterior aspect of the foramenmagnum was minimally reduced by the right(more on the right side) and left lateral mass of the atlas. More on the right side.

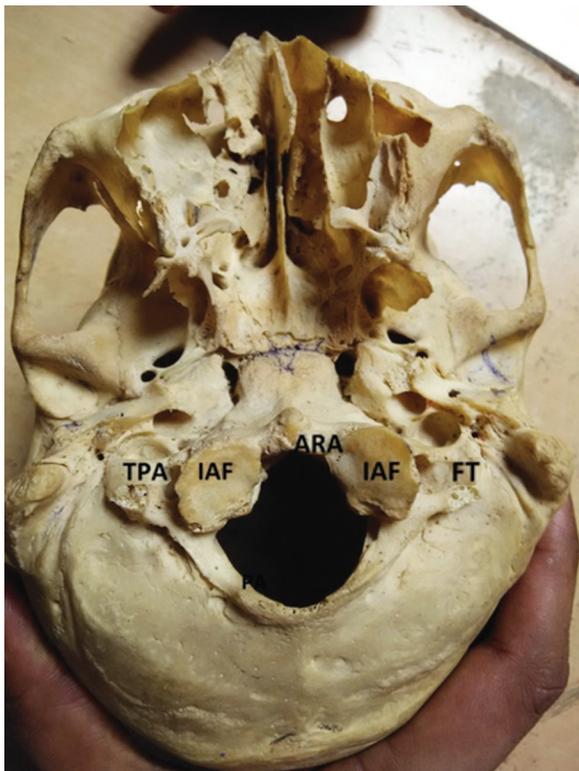


Fig. 1: Base of Skull Showing. The Occipitalisation of Atlas Vertebra.

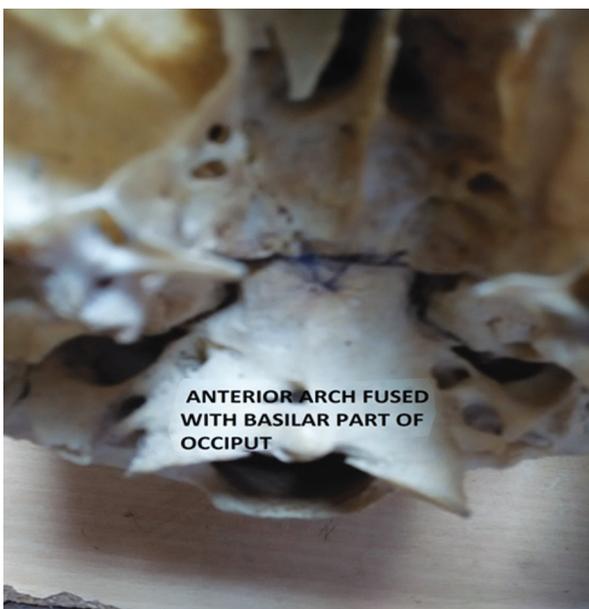


Fig. 2: Base of Skull Showing. The Anterior Arch of Atlas Fusion with Basilar Part of Occipital Bone.

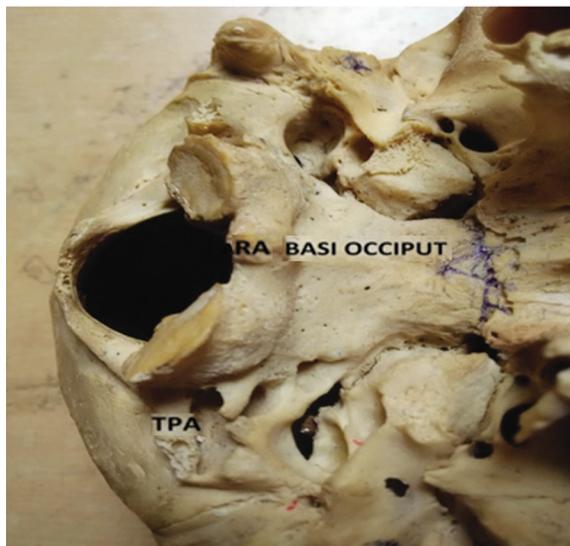


Fig. 3: Base of Skull Showing Complete Fusion of Transverse Process of Atlas with the Occipital Bone Left Side.

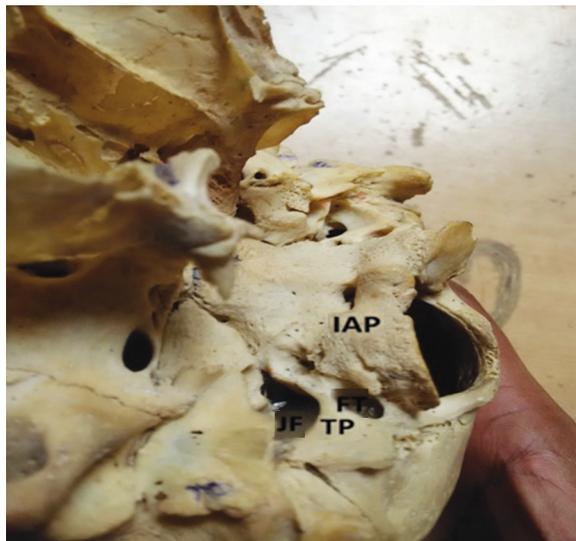


Fig. 4: Base of Skull Showing Complete Fusion of Transverse Process of Atlas with the Occipital Bone Right Side.

- TPA:- Transverse process of Atlas
- IAF:- Inferior articular facet
- ARA:- Anterior arch of Atlas
- FT:- Foramen transversarium
- PA:- Posterior arch
- JF:- Jugular foramen

**Discussion**

In the development of basilar part of occiput & atlas, the rostral half of the first cervical sclerotome combines with the caudal half of the last occipital sclerotome to form the base of the skull.<sup>2,3,4</sup>

While the caudal half of the first cervical sclerotome combines with the rostral half of second

cervical sclerotome to form 1st cervical vertebra and odontoid process.<sup>4,5</sup>

The disruption in the development results in atlanto-occipital fusion.

Affected individuals may have the following physical features: low hairline, torticollis, restricted neck movements, and an abnormally short neck.

Absolute immobility of an atlanto occipital joint results in compensatory hypermobility of atlas on the axis due to exerting stress on occipito-odontoid ligament with over stretching.<sup>5,6,8</sup>

The sagittal diameter of the foramen magnum is an important parameter in spinal cord compression.

The atlanto-occipital fusion may reduce the lumen of the foramen magnum and lead to neurological complications due to compression of the spinal cord & also vertebral artery influencing the blood flow to the brain resulting in syncope, seizures, dizziness, vertigo and neurological symptoms.<sup>6,7,8</sup>

It may also result in compression of 1st cervical nerve affecting the sub occipital triangle muscles which are postural muscles, thus, giving rise to an abnormal posture of head and an unsteady gait.<sup>7,8</sup>

There will be anterior compression of medulla oblongata leading to dysfunction of the lateral corticospinal tract, resulting in the form of hyperreflexia, spasticity, Hoffman's sign, and Babinski's sign.

The impingement of posterior column due to presence of dural bands<sup>6,7</sup>, can cause Paraesthesia, numbness, impairment of 2 point discrimination and vibration and conscious proprioception impairment.

Cranial nerve findings associated with occipitalisation of the atlas include lower cranial nerve palsies leading to dysphagia, dysarthria and nystagmus.<sup>5,6,7</sup> Occipito-cervical synostosis is associated with other skeletal malformations such as Spina bifida of atlas, basilar invagination,

cervical stenosis, Klippel-Feil syndrome fusion of the second and third cervical vertebrae) and Arnold Chiari malformation (pathophysiology of both is essentially the same).<sup>8</sup>

Transverse process is very important landmark for head and neck surgeons, when it is inclined and fused to occipital bone, there may be difficulty in reaching various structures and may lead to asymmetry in structure and shape of apertures for the vessels and nerves around the foramen magnum.<sup>8</sup> Therefore, the knowledge of such anomaly is essential.

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