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# Incidence of Foramen Vesalius in Adult Human North Indian Crania

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***Abstract:*** *Foramen Vesalius is a small, variable and an inconstant foramen located in the greater wing of sphenoid, anteromedial to the foramen ovale, in the middle cranial fossa. This foramen is also known as emissary sphenoidal foramen as it transmits a small emissary vein which drains Cavernous sinus. The importance of this foramen lies in the fact that an infected thrombus from an extracranial source may reach cavernous sinus.*

*The present study was undertaken to observe the incidence of foramen Vesalius in the adult human crania in north India. For this purpose, 200 macerated skulls of unknown age and sex were observed. These skulls were obtained from the departments of Anatomy in TeerthankarMahaveer Medical College & Research Center (Moradabad), King George Medical College (Lucknow), Shri Ram MurtiSmarak Institute Of Medical Science (Bareilly) and Govt. Medical College Kannauj. The foramen Vesalius was found to be present in 68 skulls (ie 34%); out of which it was bilaterally in 28 skulls (14%) and unilaterally in 40 skulls (20%)- in 16 skulls on right side and in 24 skulls on left side. The knowledge of foramen Vesalius is important for neurosurgeons and anatomists and anthropologists.*

***Keywords:*** *Foramen Vesalius, middle cranial fossa ,skull, sphenoid.*

## I. Introduction:

Foramen Vesalius is a small, variable and an inconstant foramen located anteromedial to the foramen ovale. This foramen is also known as emissary sphenoidal foramen. It opens below and lateral to scaphoid fossa. It transmits an emissary vein, "Vein of Vesalius", through which the cavernous venous sinus and pterygoid venous plexus communicate[1].Vesalius in his famous book, "**De humanicorporisfabrica**" describes this foramen with uncommonly subjective language, "because one skull more elegant than the others, belonging to a man of middle age by far the most handsome I have ever seen, displays this foramen"[2].

The importance of this foramen is that it offers a path to the spread an infection from the extracranial source to the cavernous sinus. The small FV, if present, is generally situated posteromedially from the foramen rotundum (FR) and anteromedially from the foramen ovale (FO), foramen spinosum (FS), and carotid canal[3]. The FV is located between the FO and FR, but particularly more closely to the FO, and thus neurosurgery may misplace the needle during percutaneous intervention targeting the FO for treatment of the trigeminal neuralgia, resulting in severe complications such as intracranial bleeding[4].

Therefore, the present study aimed to evaluate the frequency of occurrence and the morphometry of the FV in North India, and these anatomical considerations may assist the surgeon to a better planning and a safer execution of percutaneous approach to the middle cranial fossa through the FO.

## II. Material &Method :-

The present study was conducted in the department of Anatomy In Govt. Medical College Kannauj, TeerthankarMahaveer Medical College & Research Center (Moradabad), King George Medical College (Lucknow), Shri Ram murtiSmarak Institute Of Medical Science (Bareilly).

This study was performed in 200 adult macerated human skulls of Indian individuals of unknown age, sex and damaged skulls were excluded from the study.

The skulls were washed their anterior, superior, posterior, inferior surface properly, cleaned with the help of soft brush and wipe with clean and dry cloth. Thereafter we were observed for Incidence of Foramen Vesalius.

Patency was confirmed by inserting a bristle through each probable foramen, evaluates the Size of foramen by vernier callipers and observed the presence, absence, double and any other variations of foramen.

**Observation :-**

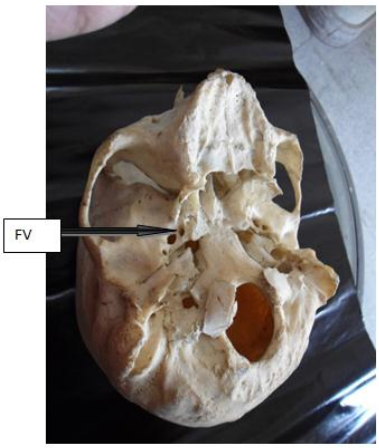



**Figure:1 shown FV on Rt side (unilateral)**

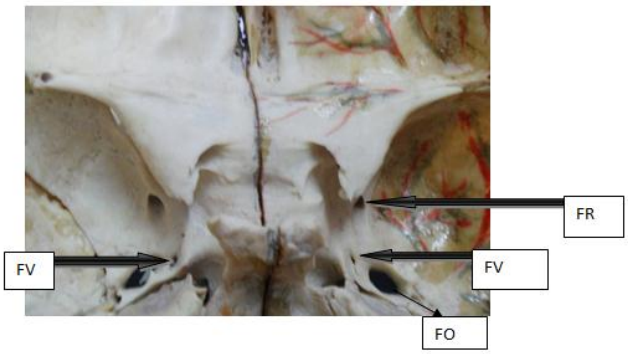



**Figure:2shownbilateral FV**

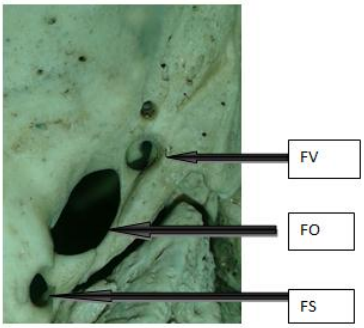



**Figure:3 shown FV with different shape**

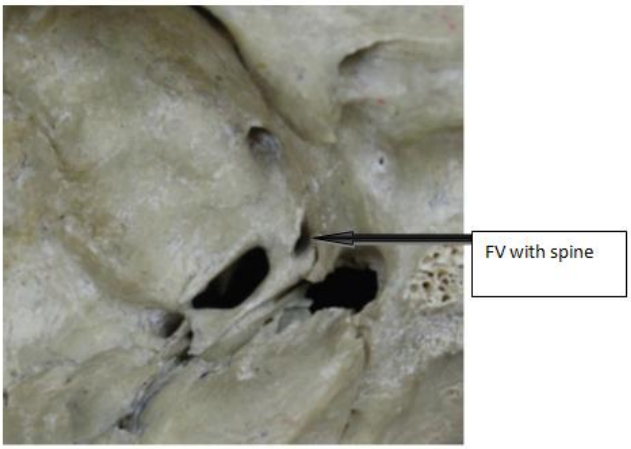



**Figure:4 shown FV with spine**

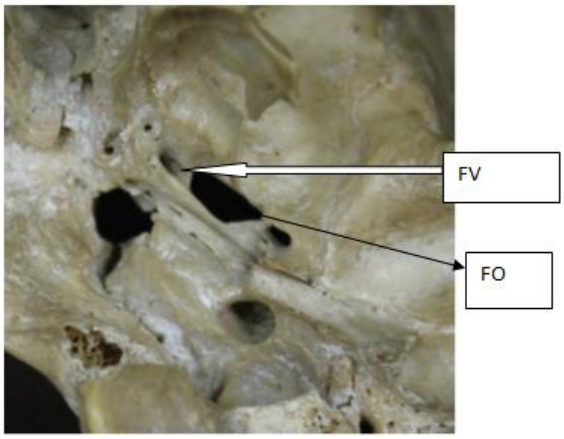



**Figure:5 shown FV converge in foramen ovale**

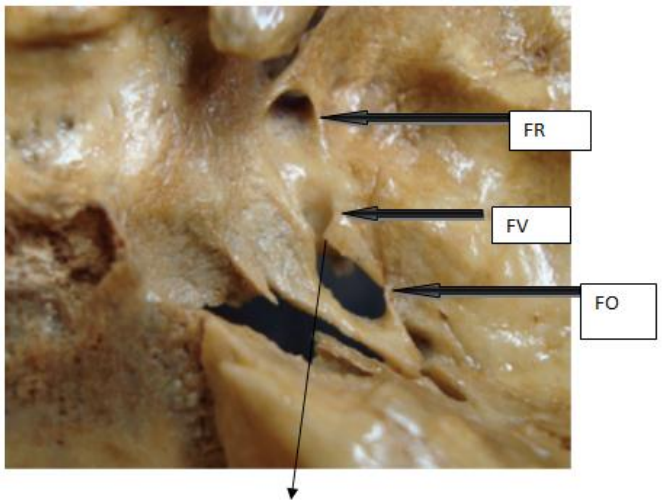



**Figure:6 shown FV converge in FO**

**Table -1 Incidence of foramen vesalius**

| No. Of skull | Incidence | Unilateral | Bilateral | Rt side | Lt side |
|---|---|---|---|---|---|
| 200(400 sides) | 34% | 20% | 14% | 15% | 19% |

**Table-2 Distance between FO – FV**

| No. Of skull | Right side<br>Mean ±SD | Left side<br>Mean±SD |
|---|---|---|
| 68 | 1.363±0.328mm | 1.480±0.378mm |

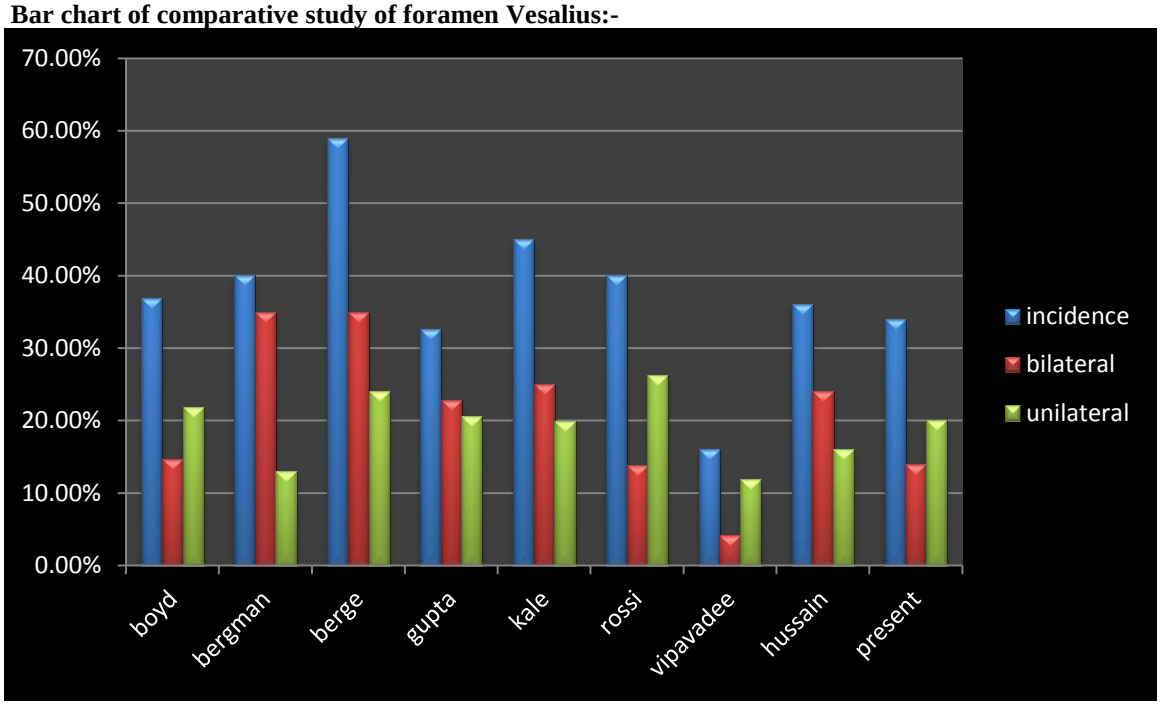
## III. Discussion:-

Importance of this foramen lies in the fact that it gives passage to vein of vesalius, an emissary vein. Emissary veins are those, which link the intracranial venous sinuses with veins outside the cranial cavity. They pass through the potential space between galeaaponeurotica and pericranium. They are of importance in that they are channels along which infected thrombus can reach the interior of cranial cavity from outside it. Since emissary vein passing through foramen vesalius connects pterygoid venous plexus with cavernous sinus, the infected thrombus may reach cavernous sinus. Surgical importance of foramen vesalius lies in the fact that during percutaneous trigeminal rhizotomy, needle insertion through the vesalius foramen the cavernous sinus puncture may occur[5]. During development, most of the central skull base bones are preformed in cartilage and then ossify by the process of endochondral ossification with a small contribution from membranous bone. At 11 weeks 5 days the entire skull base is preformed in cartilage and then ossification of skull base progresses in an orderly pattern from posterior to anterior. Postsphenoid and presphenoid centres that appear at 14 weeks form the sphenoid bone and 17 weeks respectively with a contribution from orbitosphenoid and alisphenoid centres that appear at 16 weeks and 15 weeks respectively5. The greater wings are formed from alisphenoid centres. Moreover, it has been shown that the foramen of vesalius represents the site of fusion between the membrane bone and medial cartilaginous, alatemporalis[6]

**Table of Comparative study of foramen Vesalius:-**

| Name of author | Year | Incidence | Bilateral | Unilateral |
|---|---|---|---|---|
| **Boyd et al** [7] | 1930 | 36.8% | 14.7% | 21.8% |
| **Bergmen et al**[8] | 1995 | 40% | 35% | 13% |
| **Berge et al**[9] | 2001 | 59% | 35% | 24% |
| **Gupta et al**[4] | 2005 | 32.58% | 22.85% | 20.58% |
| **Kale et al** [10] | 2009 | 45% | 25% | 19.9% |
| **Rossi et al** [11] | 2010 | 40% | 13.76% | 26.25% |
| **Vipavadee et al**[12] | 2012 | 16% | 4.2% | 11.9% |
| **Hussain et al** [13] | 2012 | 36% | 24% | 16% |
| **Present study** | 2014 | 34% | 14% | 20% |

**Bar chart of comparative study of foramen Vesalius:-**




Many studies have reported the incidenceof the foramen of Vesalius and noted that thisforamen may have variations. According toByod et al[7] (1930) found 36.8%,Lang[14] (1883) and Bergman[8] et al(1995), theforamen found in 40% of cases, Williams et al.(1995) found foramen in 8.5% cases,Kodama[3]et al.(1997) found in 21.75% cases, Berge[9] et al(2001) found foramen in 59%, Gupta etal[4] (2005) found in 32.85% of cases Wysocki etal[15] (2007) reported in 22% of cases, ,Ramalho etal[16](2007) with analysis on 64 human skullsobtained incidence of 71.87% and Kalpan et al[7](2007) who obtained 100% incidence but with only 10 skulls examined,Kale et al[10](2009) found in 45%, ,Shinohara et al[17] (2010) found the foramen to 33.75% in 400skulls,Rossi etal[11] (2010) found in 40%,Vipavadee et al [12] (2012)found in 16%, Hussain et al[13](2012) found in 36%and present study found 34% in 200 skull which is higher thenwilliams etal , kodama et al ,wysocki et al, gupta et al , shinhora et al, vipavadee et al and lower then Long et al , Bergman et al , Ramalho et al, Byod et al, Berge et al, Kale et al , Rosi et al. In this study we have seen that different different shape and types of foramen vesalius which is "8" shaped , a foramen converge in to the foramen ovale and a forame with spine .

The presence of foramen vasalius bilaterally(as shown in figure no. 2) was reported byByod et al[7] (1930) found in 14.7%,Bergman et al[8] (1995) found in 35%, Berge et al[9] (2001) in 35%,gupta et al[4]( 2005) in 22.%, Kale et al[10] (2009) in 25%, Shinohara et al[17](2010) in 12.5%,Rossi et al[11] (2010) in 13.76, Vipavadee et al[12] (2012) found in 4.2%, Hussain et al[13] (2012) in 24%, and in present study found 14% in 200 skulls which is grater then Shinohara et al , Rossi et al ,Vipavadee et al and lesser then Boyd wt al , Bergman et al , Berge et al, Gupta et al , Kale et al , and Hussain et al.

The presence of formenvasalius unilaterally(as shown in figure no. 1) was reported by Byod et al[7] (1930) in found 21.8%, Bergman et al[8](1995) in 13% of cases, according to study by Kodma et al[3] (1997) was 5.5%,Berge et al[9] (2001) found in 24%,Gupta et al[4] (2005) found in 20.58%, Kale et al[10] (2009) found in 19.9%,Rossi et al[11] (2010) found in 26.25%, Shinohora et al[17](2010) found occurrence of unilateral foramen

vasalius in 18.25% of cases,Vipavadee et al[12](2012) found in 11.9%,Hussain et al[13] (2012) found 15%,and in persent study found 20% in 200 skulls we found that our incidence of unilaterally presnt foramen is higher than Bergmanet al, Gupta et al, Kale et al, Vipavadee et al, Hussain et al and lesser then Byod et al, Berge et al, Rossi et al.

Regarding incidence of foramen vesalius Lang et al[14](1883) found the foramen in 49% of skulls on the right side and 36% on the left side, Gupta et al[4] (2005) found foramen in 20% right side and 12.85% on the left. Shinohara et al[17] (2010)found an incidence of 7.75% on the right side and 10.5% on the left. Shinohara et al[17] (2010) was the presence of a double foramen was observed in 7 of the 400 skulls examined, Rossi et al[11](2010) found foramen in 15.62% right side and 11.25% in left side, Vipavadee et al[12](2012) found in 9.31% right side and 11.25% left side, and present study found 15% in right side and 19% in left side in 400 sides of skulls(200 skulls) which is more than Shinohara et al and less then Lang et al, Gupta et al, Rossi et al in right side incidence and left side incidence in present is more than Gupta et al,Shinohara et al,Rossi et al and lesser then Lang et al.

In this study, we found FV at a distance to the FO was 1.363±0.328mm on right side and 1.480±0.378mm on left side.Rossi et al[11] (2010) found 1.853±0.303mm on right side and 2.464±0.311mm on left side,Shinohara et al[17] (2010) found 3.15±1.64mm on right side and 2.53±1.30mmon left side, Vipavadee et al[12](2012) found 2.05±1.17mm on right side and 2.464±0..311mm on left side. We didn't found any significant difference between present study and Rossi, Shinohara, Vipavadee .

In this study we have seen different different shape and types of foramen vesalius which is "8" shaped , a foramen converge in to the foramen ovale and a foramen with spine (shown in figure no.3,4,5and 6)

## IV. Conclusion:-

Owing to being a small and inconstant foramen, the FV is not routinely in attention during surgery. The knowledge of the occurrence of the FV may assist the neurosurgeon to realize that the FV is located very close to the FO, particularly at the extracranial view of the skull base. Therefore, in case it exists, the approach through the FO could be the more complicated procedure and the operation should be carefully performed to avoid the FV puncture.

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