

Research Article

Sphenoidal emissary foramen and its clinical consideration

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ABSTRACT

Background: Sphenoidal emissary foramen is a small, variable and an inconstant foramen in middle cranial fossa which is located antero-medial to the foramen ovale. Emissary vein passing through it connects the pterygoid venous plexus with the cavernous sinus which has clinical significance because through an extra-cranial infection may reach to cavernous sinus. Aim of present study was to investigate the incidence and shape of sphenoidal emissary foramen, the number of present on one side and the presence of bony septum in it.

Methods: Two hundred and fifty (right 250; left-250) dry Indian adult skulls of unknown age and sex were used for this study. Middle cranial fossa of each skull was macroscopically observed for the presence, absence of sphenoidal emissary foramen. Patency was confirmed by inserting a bristle through each probable foramen and only patent foramen were calculated.

Results: We observed that sphenoidal emissary foramen was present in 72 (28.8%) skulls. Unilaterally it was present in 17.6% and bilaterally in 11.2% skulls.

Conclusions: Incidence of this foramen is variable and therefore recognition of this anatomical structure is important. Knowledge of their variations will be helpful for neurosurgeons and radiologist.

Keywords: Sphenoidal emissary foramen, Middle cranial fossa, Sphenoid bone, Emissary vein, Foramen ovale, Cavernous sinus

INTRODUCTION

Emissary foramens are present in the skull which allows the passage of emissary veins to carry blood between internal and external structures of skull. Sphenoidal emissary foramen (SEF) is a small, variable and an inconstant foramen in the middle cranial fossa. It is located antero-medial to the foramen ovale and consistently symmetrical.^{1,2} It is also known as sphenoidal canaliculus, foramen venosum and popularly foramen Vesalius.³ It transmits a small emissary vein, accessory meningeal artery and lateral sphenoidal nerve.⁴⁻⁶

Emissary vein passing through SEF connects the pterygoid venous plexus with the cavernous sinus. It has clinical significance because through which an extra-cranial infection may reach to cavernous sinus.^{1,7} Reported incidence of SEF varies from 16.1% to 79.7%.⁸ During percutaneous treatment of trigeminal neuralgia needle insertion is through foramen ovale and it may rupture the vesalis vein which may create complications.⁷ The aim of present study was to investigate the incidence and shape of SEF, the number of SEF present on one side and the presence of bony septum in it.

METHODS

Study was conducted on 250 (right 250; left-250) dry Indian adult skulls of unknown age and sex, which were obtained from our department and students from first MBBS, BPTH. Broken skulls were excluded from present study. Middle cranial fossa of each skull was macroscopically observed for the presence, absence of foramen. Patency was confirmed by inserting a bristle through each probable foramen and only patent foramen were calculated. We noted the incidence of unilateral or bilateral SEF and examined SEF's for having a septum.

RESULTS

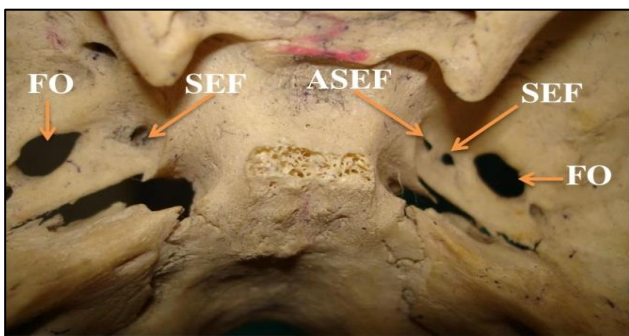
We observed that the SEF was present in 72 (28.8%) skulls. Details of distribution of Spinoidal Emissary Foramen were given in Table 1. In one skull SEF was present bilaterally along with accessory SEF on right side i. e. double SEF on right side (Figure 1). It was absent in 178 (71.2%) skulls. We did not observed confluence between the SEF and foramen ovale in our study. Also, we did not observed septum in SEF. We noted two shapes of SEF- oval and round (Figure 2 and 3).

Table 1: Distribution of spinoidal emissary foramen.

Sphenoidal emissary foramen	Total (n= 500)		Right (n= 250)		Left (n=250)	
	Number	%	Number	%	Number	%
Unilaterally (Figure 2)	44	17.6	25	10	19	7.6
Bilaterally (Figure 3)	28	11.2	16	6.4	12	4.8

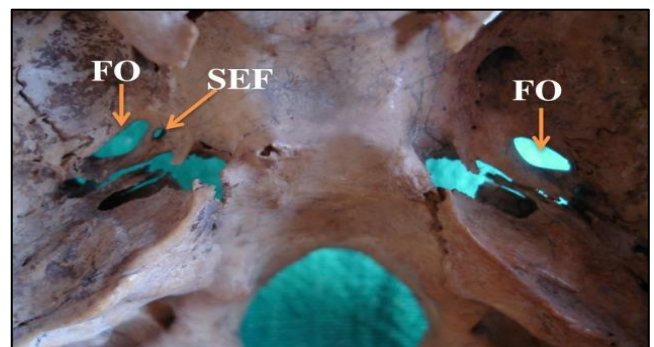
Table 2: Reported incidence of sphenoidal emissary foramen by various authors.

Authors name	Number of specimens	Incidence reported		
		Bilaterally	Unilaterally	Total
Boyd ¹²	1500 skulls	14.7%	21.8%	36.5 %
Lanzieri et al ¹³	50 skull base CT	-	-	64%
Gingsberg et al ⁸	123 skull base CT	-	-	80%
Kodama et al ²	400 skulls (male-321; female: 79) 20 juvenile skulls	Male	75.4%	24.6%
		Female	72.2%	27.8%
Gupta et al ⁷	35 skulls	22.9%	20%	42.9%
Reymond et al ¹⁴	100 macerated skulls	-	-	17%
Kale et al ³	347 skulls	25.1%	19.9%	45%
Rosi et al ¹⁵	80 skulls	13.75%	26.25%	40%
Murlimanju et al ¹⁶	78 skulls	16.7%	20.5%	37.2%
Present study	250 skulls	11.2%	17.6%	28.8%



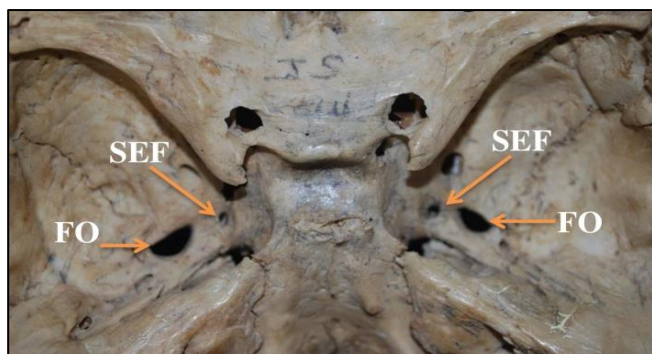
FV- foramen ovale, SEA- sphenoidal emissary foramen.

Figure 1: Accessory sphenoidal emissary foramen (ASEF) on right side.



FV- foramen ovale.

Figure 2: Unilateral presence of sphenoidal emissary foramen (SEF) which is oval in shape.



FV- foramen ovale.

Figure 3: Bilateral presence of sphenoidal emissary foramen (SEF) which is round in shape.

DISCUSSION

Foramina in the skull are very important as they allow passage of important neurovascular structures through them. Many researchers studied variations of these foramina and found that their variations are related to diseases like neurofibromatosis, osteopetrosis, and osteoporosis which can be either acquired or inherited.⁹⁻¹¹ SEF does not occur in any primate other than man. However, it is confined to man and is essentially an expression of the differentiation of cranial venous outlets, which is characteristic of Homo.⁹

Many researchers reported incidence and variations of SEF as shown in Table 2. We observed an incidence of SEF in 28.8% of skulls with the presence of at least one foramen which is on lower side when compared with other researchers except Kodama et al and Reymond et al.^{2,14} However, in the present study, we observed that in one skull SEF was present bilaterally along with accessory SEF on right side (double SEF on right side) i.e. Three SEF in one skull (Figure 1). Zdila et al reported bilateral duplication of SEF in one out of 83 skulls by direct observation and Ginsberg et al in two out of 123 skulls with high resolution CT.^{17,8} Knowledge of such anatomical variations of SEF may be helpful while interpreting CT and MRI, also for neurosurgeons to prevent iatrogenic unwanted surgical trauma. Trans-ovale approach rhizotomy is used in the treatment of trigeminal neuralgia and during this treatment foramen ovale is penetrated and while doing this SEF may be penetrated and intracranial bleeding may occur. Sindou et al reported it in 3.5% of the cases.¹⁸

Anatomical variations of SEF can be understood by the embryological basis. Most of the part of central skull base develops from endochondral type of bone formation and little part by membranous ossification. Sphenoid bone is formed by pre and post sphenoid centers with little contribution from Ali and orbitosphenoid centers.¹⁹ The greater wings of sphenoid bone develop from alisphenoid centers. The foramen vesalis is the point of fusion between the membranous part and ala temporalis (medial

cartilaginous part).^{19,20} According to Wood- Jones foramen ovale may be subdivided into two portions due to in growing spicules of bone.⁹ The anterior part is known as SEF. Hence it is an expression of cranial venous outlets and it occurs only in humans.

Clinical importance: Skull foramina identification is important for understanding the regional neurovascular anatomy because neurovascular structures passes through these foramina. SEF provide passage for emissary vein of Vesalius which is the connection between cavernous sinus and pterygoid plexus so septic thrombus of extracranial origin can reach to cavernous sinus and developed a thrombophlebitis of cavernous sinus, play a role in the equalization of intracranial venous pressure because emissary veins are valve less and may act as safety valves in certain conditions.^{1,4,12} A small nerve nervoulus sphenoidalis lateralis may pass through SEF into cavernous sinus and in 20% of cases it transmit accessory meningeal artery therefore identification of this foramen is important to prevent iatrogenic injury during various surgical procedures.^{5,6}

CONCLUSION

Incidence of SEF is variable and therefore recognition of this anatomical structure is important. Precise knowledge of their variations will be helpful not only in distinguishing abnormal structures during nuclear magnetic resonance (NMR), MRI and CT.¹⁵ Also, the knowledge of an accessory SEF will be helpful for radiologist, to clinicians in the diagnosis and during various microsurgical and micro vascular approach at the base of skull.

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