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Morphometric Analysis of Accessory Bony Canal Near Foramen Rotundum

S Ragul Prasath[1], and Yuvaraj Babu K[2]*

[1]*Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai -600077, India*

[2]*Assistant Professor, Department of Anatomy, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai -600077, India*

ABSTRACT

Foramen rotundum is a circular aperture present in the base of the skull in the sphenoid bone, it connects the middle cranial cavity and the pterygopalatine fossa. Sometimes there may be a variation in several skulls that leads to the formation of the bony canal near the Foramen rotundum.Anatomical awareness of such variation in the middle cranial cavity fossa are important.The main aim of this study is to observe the presence or absence of accessory bony canal around foramen rotundum.32 unsexed dry cranial cavity from the Department of Anatomy,Saveetha Dental College was observed for the presence of accessory bony canal near foramen rotundum in the middle cranial cavity.The observed data was tabulated and analysed.14 accessory bony canal was observed near the Foramen rotundum in the total of 32 Skulls. Hence the occurrence was found to be 21.87%.In this study 9 accessory bony canals were observed on the left side with a percentage of 14.06% and the rest 5 was observed on the right side with a percentage of 7.81%. There is no incidence of bilateral accessory bony canal.Our study of the morphometric analysis of accessory bony canal near foramen rotundum may create an awareness for such variations in the middle cranial cavity and the orbital regions

KEY WORDS: FORAMEN ROTUNDUM,ACCESSORY BONY CANAL, PTERYGOPALATINE FOSSA, MIDDLE CRANIAL CAVITY.

INTRODUCTION

Foramen rotundum is a circular aperture present in the base of the skull in the sphenoid bone.It is a small canal which is deeply situated in the base of the middle cranial cavity. Anatomically it connects the middle cranial cavity and the pterygopalatine fossa.Size of the Foramen rotundum is negligible and hence they play a minor role in the human body.The perfect ring-shaped formation of the Foramen rotundum is observed in all cases of the foetuses after 4 months.The foramen rotundum is mostly oval shaped in fetal period and it is round shaped in general after birth.The average diameter of the Foramen rotundum is 3.5mm in the adult (Liu et al., 2016). It is a small canal and is deeply located in the base of the middle cranial cavity of the skull which represents the way of exit of the maxillary nerve, the second branch of the trigeminal nerve. Emissary vein and minute vessels may pass through it and via pterygopalatine fossa.It represents a frontier area between the endo and exocranial spaces. It's involvement which is preferentially related with tumoral pathologies profoundly modifies the prognosis of the disease (Liu and Yi, 2020).

In some cases,a bony depression with accessory osseous passages in the right side of middle cranial fossa was

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observed in a dry adult human skull.This was situated below the optic canal and superior orbital fissure.The foramen rotundum and an accessory bony canaliculus were present in the medial fossa whereas the lateral fossa was blind.The bony depression was further divided into two parts, medial and lateral fossa, by an incomplete oblique bony septum.The foramen rotundum leads into the pterygopalatine fossa. Sometimes there may be a variation in several skulls that leads to the formation of the bony canal near the Foramen rotundum.An awareness of such anatomical variation in the fossa of middle cranial cavity are vital for the neurosurgeons and radiologists who interprets imaging of this area,doctors who operate in this area in this vicinity of cavernous sinus and anaesthetists who blocks the neural the neural signals transmitting through the bony canal. Accessory bony canal variations may be present which makes it to be present on the right/left side of the Foramen Rotundum. There may be a sharp pin point canal passing nearly adjacent to it (Mohebbi et al., 2017).

Many studies have reported the presence of Warwick's foramen near foramen rotundum.Search for accessory bony canal near the Foramen rotundum has not much studies. Hence there was a lacunae about accessory bony canals and structures passing through it.The location of this bony canal is inferior to the superior orbital fissure. Our research actually deals with the morphometric analysis of the bony canal and the anatomical variations pertaining to it.

Previously our department has published extensive research on various aspects of dentistry (Begum et al, 2017; Ganapathy, Kannan and Venugopalan, 2017; Jain, 2017a, 2017b; Ranganathan, Ganapathy and Jain, 2017; Ariga et al., 2018; Gupta, Ariga and Deogade, 2018; Anbu et al., 2019; Ashok and Ganapathy, 2019; Duraisamy et al., 2019; Varghese, Ramesh and Veeraiyan, 2019), this vast research experience has inspired us to research about the morphometric analysis of accessory bony canal near foramen rotundum.The aim of this study is to identify the presence or absence of Accessory bony canal near foramen rotundum.

MATERIAL AND METHODS

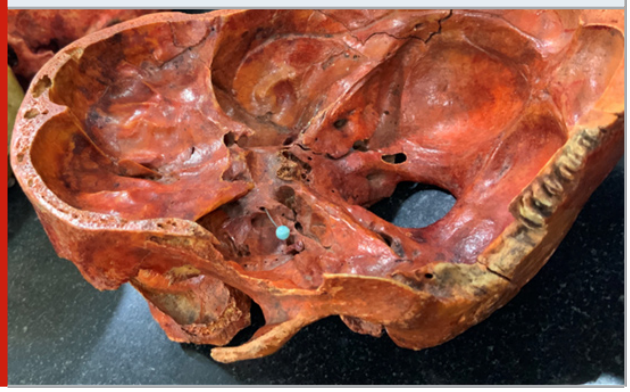
32 unsexed dry cranial cavity from the Department of Anatomy, Saveetha Dental College was observed for the presence of accessory bony canal near foramen rotundum in the middle cranial cavity. The observed data was tabulated and analysed.The incidence of the accessory bony canal near foramen rotundum was observed and recorded.

RESULTS AND DISCUSSION

14 accessory bony canal was observed near the Foramen rotundum in the total of 64 Foramen's observed in each side of the 32 skulls.Hence the occurrence was found to be 21.87%.In this study 9 accessory bony canal was observed on the left side with a percentage of 14.06% and the rest 5 was observed in the right side with a percentage of 7.81%.There is no incidence of bilateral accessory bony canal.

An abnormal bony depression in the right side of middle cranial fossa with accessory osseous passages was observed in a dry adult human skull.It was situated

Figure 1: Shows the presence of Accessory bony canal near foramen rotundum on the left side marked using bluish green pin.



The perfect ring shape of the foramen rotundum is observed during the 4th month of the fetal life. During the fetal life the foramen rotundum is oval in shape and after birth it becomes round shape.The average diameter of the foramen rotundum is 3.5mm in the adult skulls (Çalıskan et al., 2018). Davis reported the occurrence of a very rare variation of foramen rotundum in which it opens into the orbit along with a branching canal connecting middle cranial fossa with orbit.The articles tells us that this variation was detected in about 1.06% of the individuals and also it was located on the right side only in one cases it was found to be bilaterally.The variation was that a branching of a 5mm long canal from the lateral wall of the foramen rotundum that opened into the orbit. Also the article cited that the diameter of this prominent canal was between 0.5 and 0.6 but it could be as 1mm or as thin as 0.2mm ('Symmetry as measured from foramen rotundum', 1985).The accessory nervous trunk of the Maxillary nerve separately left the trigeminal ganglion on the outer side of the maxillary nerve.

The main trunk of the Maxillary nerve canal, within the greater sphenoid wing to join the infero-medial that main trunk at the entrance in the pterygopalatine fossa. It represents a frontier area between the endo and the exocranial spaces. It also has a vital involvement which was related with tumoral pathologies that profoundly modifies the prognosis of the disease and so should allow soon multiple disciplinary therapeutic discussion. It also represents the way of exit of the maxillary nerve,second branch of the trigeminal nerve (Naito, 1961). The Internal Aperture postnatally develops in width from 2.06 mm to 3.50 mm and in height from 1.8 to 2.73mm.The mean distance opposite to the median sagittal plane increases between newborn time and the adults from 10.00mm at the right side to 15.78 mm and at the left side from 10.75 to 17.62mm (Inal et al., 2015).

below the optic canal and superior orbital fissure.The foramen rotundum and an accessory bony canaliculus were present in the medial fossa whereas the lateral fossa was blind (Miguel, 1942).The bony depression was further divided into two parts ,medial and lateral fossa, by an incomplete oblique bony septum.The foramen rotundum leads into the pterygopalatine fossa.The foramen rotundum can be found and identified easily on computed tomography (C.T scan) angiography image. The diameter measured in the CT image in accordance with that in specimen.The anterior opening and posterior opening can be located by the stationary structures in the sphenoid sinus (Lodge, 1950).

The superior part of the Dorsum sellae may be a separate bone or it may be joined to the petrous portion of the temporal bone.The foramen rotundum may be double or absent (0.64%) of 157 skulls.The usual diameter of the optic canal is 5.5mm but varies from 3.5 to 6.5mm,The foramen spinosum and ovale may be continuous (Sepahdari and Mong, 2013). A very rare variation of foramen rotundum in which it opens into the orbit along with a branching canal connecting middle cranial fossa with orbit. Such type of anatomical variation was detected in about 1.06% of individuals and it was almost always located on the right side. Only in one case it could be found left-sided and in another skull it was spotted bilaterally. The prominent variation was consisted of the branching of a 5 mm long canal (length wise) from the lateral wall of the foramen rotundum that opened into the orbit.The canal was straight and directed slightly superolaterally, likely transmitted the zygomatic nerve, Maxillary nerve and part of the infraorbital nerve (Stechison and Brogan, 1994).

The Maxillary nerve provides postganglionic parasympathetic innervation to the lacrimal and salivary glands, and to the mucosal glands of the Maxilla, gums and maxillary sinuses.Maxillary nerve also provides sensory innervation to teeth of the upper jaw (maxilla) and to skin of the middle part of the face. The other characteristic feature of maxillary nerve is that it provides innervation of facial bones and then continues anteriorly to enter the orbit through the inferior orbital fissure as the infraorbital nerve.Accessory foramen have been reported in the various studies by Jelena Et al, Gupta Et al, Kodama Et al, Naufna Hafeez has reported the presence of warwicks foramen near foramen rotundum in 14% of cases. Search for Accessory bony canal around foramen rotundum has no studies (Cheng et al., 2015). Hence our observation of 14 accessory bony canals near foramen rotundum provides morphometric data about variations that may occur in this area.Limitations of this study are that only a limited number of South Indian skulls are taken into consideration and the skulls used were unsexed.

CONCLUSION

Our study of the morphometric analysis of accessory bony canal near foramen rotundum may create an awareness for such variations in the middle cranial cavity and the orbital regions for the radiologist, neuro and ophthalmic surgeons who operate in this area in the vicinity of cavernous sinus and anaesthetists, during regional block anaesthesia and the orbit that is the future scope of this study. Factors influencing the results are the Emissary vein connecting the extracranial cavity is found to pass through the accessory bony canal, also minute vessels and Meningeal artery may pass through this bony canal near the foramen rotundum.

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Conflict of Interest: The author declares that there is no conflict of interest in the present study.

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