



OCCURRENCE AND IMPORTANCE OF PARIETAL FORAMEN IN SOUTH INDIAN SKULLS

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ABSTRACT

The parietal foramina are situated on either side of the sagittal suture on the posterior part of the parietal bone. The parietal foramina are symmetrical and they are roughly oval in shape. They are openings which are seen on the skull vault. The parietal emissary vein passes through the parietal foramen and occasionally a small part of the occipital artery is also observed along with the parietal emissary vein. The aim of this study is to determine the occurrence and importance of parietal foramen in South Indian skulls. An observational study was carried out on 34 dry adult human skulls which were obtained from the Department of Anatomy, Saveetha Dental college and Hospitals, Chennai, India, to study the occurrence and importance of parietal foramen. The data were statistically analyzed through SPSS software. Descriptive statistics were done. The total presence of the parietal foramen was seen in 31 skulls (91.2%) The bilateral presence of the parietal foramen was 14 (41.2%), the unilateral (right) presence was found to be 9 (26.5%), the unilateral (left) presence was found to be 8 (23.5%). There were 3 skulls (8.8%) which showed no presence of the parietal foramen. The knowledge of parietal foramen is important during surgeries to prevent the blood loss and in clinical examination the possibility of an enlarged parietal foramen and the foramen acting as an easy route of infection to spread to dural venous sinuses should be kept in mind.

Keywords: Parietal foramen; emissary foramen; parietal emissary vein; sagittal suture

INTRODUCTION

The parietal bone develops from a single intramembranous centre near the parietal eminence and ossification occurs at the 8th week of intrauterine life. The four borders of the parietal bone join with each other and with the temporal bone, frontal bone, occipital bone, contralateral parietal bone and the sphenoid bone. The two parietal bones form the roof and sides of the cranium (Hoheisel, 1930) (Todd *et al.*, 1990). The parietal foramina are situated on either side of the sagittal suture on the posterior part of the parietal bone. These foramina are symmetrical and they are roughly oval in shape and are openings seen in the skull vault.

The parietal foramen is an opening for the parietal emissary vein, which drains into the superior sagittal sinus. It is located between the sagittal suture on both sides (bilateral) in most cases at the posterior part of the parietal bone. A small branch of the occipital artery is occasionally seen along with the parietal emissary vein. A bony point that is present on the sagittal suture medially between the two parietal foramina is termed as obelion (Dixon and Jamieson, 1937) (Currarino, 1976). The fourth layer of the scalp is considered as the dangerous area because of the presence of the parietal emissary vein. The parietal foramina in

humans has become an interesting topic for researchers (Boyd, 1929).

Radiologists should be able to differentiate and distinguish this foramen from the lytic lesions of the skull. The parietal foramen is always not constantly present and is subjected to anatomical variations which results in unilateral presence, presence of the parietal foramen on the sagittal suture and in few cases its absence has also been noted (Wysocki *et al.*, 2006). The size of the parietal foramen also varies considerably. The parietal foramen is said to be smaller than the burr hole which is used by the neurosurgeon. The size of the parietal foramen has been reported as between 1.8-2.0mm (Wysocki *et al.*, 2006), although Boyd stated that the average size was less than 0.5mm and greater than 1.5 mm was rare (Boyd, 1929).

Previously our team has a rich experience in working on various research projects across multiple disciplines. (Muthukrishnan and Warnakulasuriya, 2018), (Govindaraju, Neelakantan and Gutmann, 2017), (Chen *et al.*, 2019), (Priyanka *et al.*, 2017), (Sitharthan *et al.*, 2019), (Priyadharsini *et al.*, 2018), (Azeem and Sureshbabu, 2018), (Wu *et al.*, 2019), (Abitha and Santhanam, 2019), (Manohar and Abilasha, 2019), (Venu, Dhana Raju and Subramani,

2019), (Wang *et al.*, 2019), (Girija, Jayaseelan and Arumugam, 2018), (Sheriff, Ahmed Hilal Sheriff and Santhanam, 2018), (Dhinesh *et al.*, 2017) Now the growing trend in this area motivated us to pursue this project. With this inspiration we planned to pursue research to determine the occurrence and importance of parietal foramen in South Indian skulls.

MATERIALS AND METHODS

An observational study was carried out on 34 unsexed dry human skulls which were obtained from the Department of Anatomy, Saveetha Dental College, Chennai, India. The study was done to determine the variations in the occurrence of parietal foramen with respect to incidence and laterality. The parietal foramen was observed and the occurrence (presence or absence), laterality (bilateral, right unilateral or left unilateral) was observed. The obtained data was tabulated and was analyzed using Statistical Package for Social Sciences for Windows, version 20.0 (SPSS Inc., Chicago, IL, USA). The data were assessed by being subjected to descriptive analysis with the help of frequencies, percentages. The data was represented by the means of bar graphs.

RESULTS AND DISCUSSION

Among 34 dry human skulls, parietal foramen was present in 91.2% (31 skulls) and it was absent in 8.8% (3 skulls). Parietal foramen was present in most of the dry human skulls. Among 34 dry human skulls, bilateral presence of the parietal foramina was seen in 41.2% (14 skulls), the unilateral - right presence was found to be 26.5% (9 skulls), the unilateral left presence was found to be 23.5% (8 skulls). Parietal foramina had bilateral presence in most of the dry human skulls we observed. The occurrence of parietal emissary foramen were also done by various other authors the data from these previous study was compared with the data of the present study in (Table 1) ((Boyd, 1929); (Yoshioka, Rhoton and Abe, 2006); (Murlimanju *et al.*, 2015)). Yoshioka *et al.*, reported bilateral emissary foramen to be present in 40% of skulls examined almost similar to our present study (41.2%). Our study has reported the highest presence of unilateral foramen (50%) when compared to other three studies. Both Boyd and Yoshioka *et al.* reported the presence of parietal emissary foramina as near to 60% only but our present study reported an occurrence of nearly 91.2% which is similar to works done by Murlimanju *et al.* who reported the presence to be 87.9% of skulls examined.

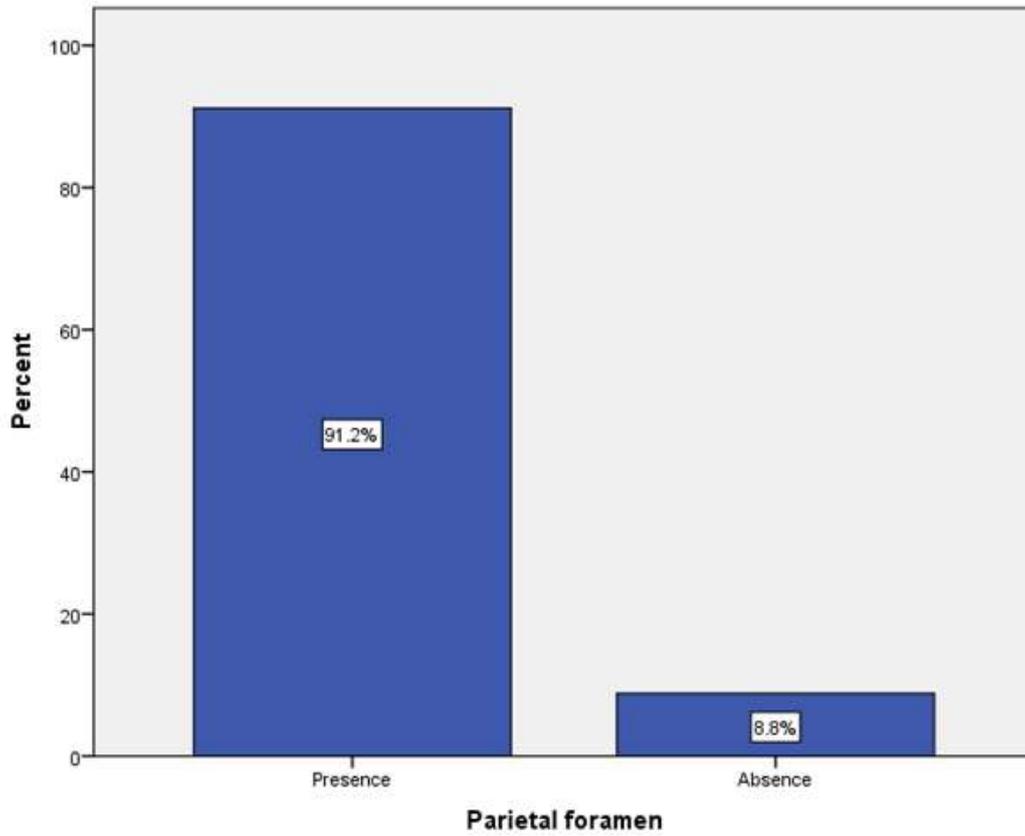


Figure 1: Bar chart represents the incidence of parietal foramen X axis represents its presence or absence and Y axis represents the percentage of occurrence. Among 34 dry human skulls, parietal foramen was present in 91.2% (31 skulls) and it was absent in 8.8% (3 skulls).

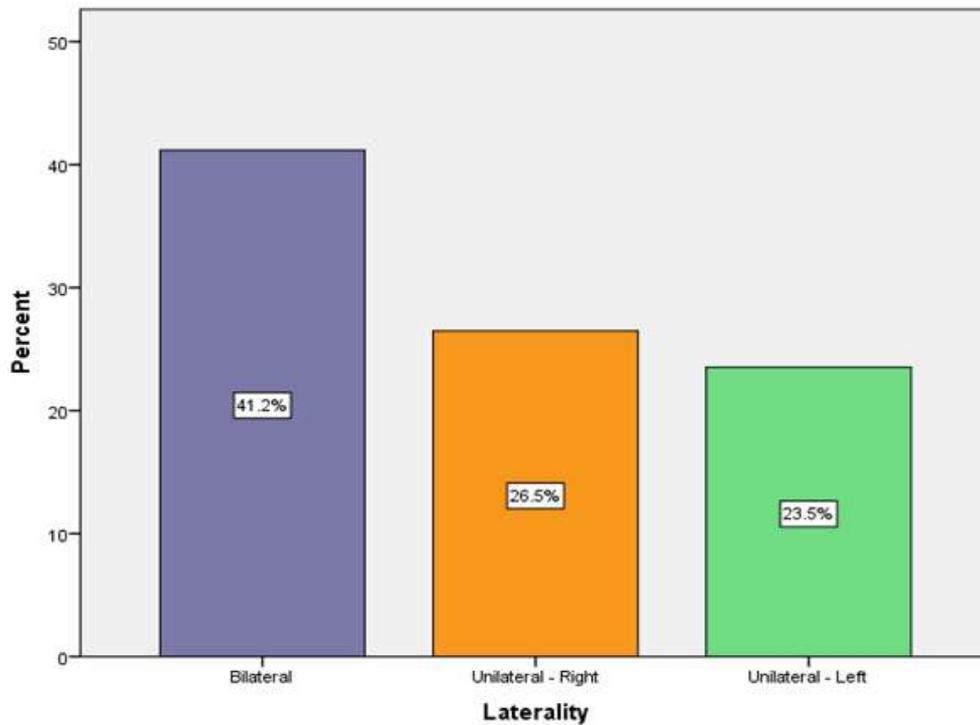


Figure 2: Bar chart represents the incidence of parietal foramen based on laterality in South Indian skulls. X axis represents its laterality and Y axis represents the percentage of occurrence. Among 34 skulls observed, it was seen bilateral (violet) in 41.2% (14 skulls), right unilateral (orange) presence was 26.5% (9 skulls), left unilateral (green) presence was 23.5% (8 skulls).

Table 1: Comparative values in dry skull between previous and current study

Author, Year	Bilateral %	unilateral%	Total % of occurrence
(Boyd, 1929)	19.9	40.5	60.4
(Yoshioka, Rhoton and Abe, 2006)	40	20	60
(Murlimanju <i>et al.</i> , 2015)	55.2	32.7	87.9
Present Study	41.2	50	91.2

The parietal bone develops from the intramembranous ossification at the 8th week of intrauterine life. The parietal foramen may alter and change the direction of the tensile and compressive forces which would lead to a simpler sagittal suture. It has been reported that the frequency of the parietal foramen varies from 50% to 80% of individuals in different population groups and has been shown to vary little in its number, location, size, and shape (Boyd, 1929) (Scott, 1893). It has been reported that, if a parietal foramen is larger due to its delayed ossification, the area surrounding it may become thinner and flatter. The variability in the number of parietal foramen is due to the difference in the ossification of the anterior fonticulus (Freire *et al.*, 2013). It has been reported that the prolonged ossification of the posterior parietal region near the obelion would lead to the formation of a v-shaped notch, which is known as, sub sagittal suture of Pozzi (Hamilton, 1965). The parietal foramen as of position is reported to be located in the posterior one-fifth or one-third of the parietal bone. Similarly, its location is approximately 2cm anterior to the Lambda in new-borns and 2-5cm

anterior to the lambda in adults and an average distance of 83mm from the Inion (Yoshioka, Rhoton and Abe, 2006).

The knowledge about the parietal emissary foramen is clinically important as it transmits the parietal emissary vein connecting the extra cranial veins with the superior sagittal dural venous sinus. This plays a role in the spread of infection into the dural venous sinuses as the dangerous area of the scalp is located on the fourth layer in which the parietal emissary vein is lodged (DuBrul, 1988). The veins may be responsible for the spread of infections like meningitis and the bacterial infection to the central nervous system. The emissary veins sometimes get enlarged if there is any underlying space bearing lesion as it acts like safety valves in equalizing the intracranial pressure. It is advised that, during the surgical procedures and the clinical examination the possibility of an enlarged parietal foramen should be kept in mind.

The parietal foramen is considered as a normal finding of the skull however it becomes abnormal if it is found with a larger opening. The emissary veins act like safety valves in equalizing the intracranial

pressure and sometimes they get enlarged if there is any underlying space occupying lesion. It is advised that, during the clinical examination and the surgical procedures, the possibility of an enlarged parietal foramen should be kept in mind. The knowledge about this foramen is clinically essential since it transmits an emissary vein connecting the extra cranial veins with the superior sagittal dural venous sinus. This plays a role in the spread infection into the dural venous sinuses. The veins may be responsible for the spread of infections like meningitis and the bacterial infection of the central nervous system. Our institution is passionate about high quality evidence based research and has excelled in various fields (Pc, Marimuthu and Devadoss, 2018; Ramesh *et al.*, 2018; Vijayashree Priyadharsini, Smiline Girija and Paramasivam, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai *et al.*, 2019; Sridharan *et al.*, 2019; Vijayashree Priyadharsini, 2019; Chandrasekar *et al.*, 2020; Mathew *et al.*, 2020; R *et al.*, 2020; Samuel, 2021). We hope this study adds to this rich legacy.

CONCLUSION

In the present study, the bilateral presence of the parietal foramen was found to be in 14 skulls (41.2%), the unilateral (right) presence was found to be 9 (26.5%), the unilateral (left) presence was found to be 8

(23.5%). There were 3 skulls (8.8%) which showed no presence of the parietal foramen. The knowledge of parietal foramen is important during surgeries to prevent the blood loss and in clinical examination the possibility of an enlarged parietal foramen and the foramen acting as an easy route of infection to spread to dural venous sinuses should be kept in mind.

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CONFLICT OF INTEREST

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

REFERENCES

- [1] Abitha, T. and Santhanam, A. (2019) 'Correlation between bizygomatic and maxillary central incisor width for gender identification', *Brazilian Dental Science*. Available at: <https://bds.ict.unesp.br/index.php/col/article/view/1775>.
- [2] Azeem, R. A. and Sureshababu, N. M. (2018) 'Clinical performance of direct versus indirect composite restorations in posterior teeth: A systematic review', *Journal of conservative dentistry: JCD*, 21(1), pp. 2–9.

- [3] Boyd, G. I. (1929) *The Emissary Foramina of the Cranium in Man and the Anthropoids*.
- [4] Chandrasekar, R. *et al.* (2020) 'Development and validation of a formula for objective assessment of cervical vertebral bone age', *Progress in orthodontics*, 21(1), p. 38.
- [5] Chen, F. *et al.* (2019) '6-shogaol, a active constituents of ginger prevents UVB radiation mediated inflammation and oxidative stress through modulating Nrf2 signaling in human epidermal keratinocytes (HaCaT cells)', *Journal of photochemistry and photobiology. B, Biology*, 197, p. 111518.
- [6] Currarino, G. (1976) 'Normal variants and congenital anomalies in the region of the obelion', *AJR. American journal of roentgenology*, 127(3), pp. 487–494.
- [7] Dhinesh, B. *et al.* (2017) 'An experimental analysis on the influence of fuel borne additives on the single cylinder diesel engine powered by Cymbopogon flexuosus biofuel', *Journal of the Energy Institute*, 90(4), pp. 634–645.
- [8] Dixon, A. F. and Jamieson, E. B. (1937) *Dixon's Manual of human osteology*. Oxford University Press.
- [9] DuBrul, E. L. (1988) *Sicher and DuBrul's Oral Anatomy*. Ishiyaku Euroamérica.
- [10] Ezhilarasan, D., Apoorva, V. S. and Ashok Vardhan, N. (2019) 'Syzygium cumini extract induced reactive oxygen species-mediated apoptosis in human oral squamous carcinoma cells', *Journal of oral pathology & medicine: official publication of the International Association of Oral Pathologists and the American Academy of Oral Pathology*, 48(2), pp. 115–121.
- [11] Freire, A. R. *et al.* (2013) 'Emissary Foramina of the Human Skull: Anatomical Characteristics and its Relations with Clinical Neurosurgery', *International Journal of Morphology*, pp. 287–292. doi: 10.4067/s0717-95022013000100045.
- [12] Girija, S. A., Jayaseelan, V. P. and Arumugam, P. (2018) 'Prevalence of VIM- and GIM-producing *Acinetobacter baumannii* from patients with severe urinary tract infection', *Acta microbiologica et immunologica Hungarica*, 65(4), pp. 539–550.
- [13] Govindaraju, L., Neelakantan, P. and Gutmann, J. L. (2017) 'Effect

- of root canal irrigating solutions on the compressive strength of tricalcium silicate cements', *Clinical oral investigations*, 21(2), pp. 567–571.
- [14] Hamilton, W. J. (1965) 'Frazer's Anatomy of the Human Skeleton', *BMJ*, pp. 1536–1536. doi: 10.1136/bmj.2.5477.1536.
- [15] Hoheisel, W. F. (1930) 'An anomalous Indian occiput', *The Anatomical record*, 45(2), pp. 129–135.
- [16] Manohar, J. and Abilasha, R. (2019) 'A Study on the Knowledge of Causes and Prevalance of Pigmentation of Gingiva among Dental Students', *Indian Journal of Public Health Research & Development*, p. 95. doi: 10.5958/0976-5506.2019.01859.x.
- [17] Mathew, M. G. *et al.* (2020) 'Evaluation of adhesion of Streptococcus mutans, plaque accumulation on zirconia and stainless steel crowns, and surrounding gingival inflammation in primary molars: Randomized controlled trial', *Clinical oral investigations*, pp. 1–6.
- [18] Murlimanju, B. V. *et al.* (2015) 'Morphology and topography of the parietal emissary foramina in South Indians: an anatomical study', *Anatomy & Cell Biology*, p. 292. doi: 10.5115/acb.2015.48.4.292.
- [19] Muthukrishnan, A. and Warnakulasuriya, S. (2018) 'Oral health consequences of smokeless tobacco use', *The Indian journal of medical research*, 148(1), pp. 35–40.
- [20] Pc, J., Marimuthu, T. and Devadoss, P. (2018) 'Prevalence and measurement of anterior loop of the mandibular canal using CBCT: A cross sectional study', *Clinical implant dentistry and related research*. Available at: <https://europepmc.org/article/med/29624863>.
- [21] Priyadharsini, J. V. *et al.* (2018) 'In silico analysis of virulence genes in an emerging dental pathogen A. baumannii and related species', *Archives of Oral Biology*, pp. 93–98. doi: 10.1016/j.archoralbio.2018.07.001.
- [22] Priyanka, S. *et al.* (2017) 'Detection of cytomegalovirus, Epstein-Barr virus, and Torque Teno virus in subgingival and atheromatous plaques of cardiac

- patients with chronic periodontitis’, *Journal of Indian Society of Periodontology*, 21(6), pp. 456–460.
- [23] Ramadurai, N. *et al.* (2019) ‘Effectiveness of 2% Articaine as an anesthetic agent in children: randomized controlled trial’, *Clinical oral investigations*, 23(9), pp. 3543–3550.
- [24] Ramesh, A. *et al.* (2018) ‘Comparative estimation of sulfiredoxin levels between chronic periodontitis and healthy patients - A case-control study’, *Journal of periodontology*, 89(10), pp. 1241–1248.
- [25] R, H. *et al.* (2020) ‘CYP2 C9 polymorphism among patients with oral squamous cell carcinoma and its role in altering the metabolism of benzo[a]pyrene’, *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology*, pp. 306–312. doi: 10.1016/j.oooo.2020.06.021.
- [26] Samuel, S. R. (2021) ‘Can 5-year-olds sensibly self-report the impact of developmental enamel defects on their quality of life?’, *International journal of paediatric dentistry / the British Paedodontic Society [and] the International Association of Dentistry for Children*, 31(2), pp. 285–286.
- [27] Scott, J. H. (1893) *Contribution to the Osteology of the Aborigines of New Zealand and of the Chatham Islands*.
- [28] Sheriff, K. A. H., Ahmed Hilal Sheriff, K. and Santhanam, A. (2018) ‘Knowledge and Awareness towards Oral Biopsy among Students of Saveetha Dental College’, *Research Journal of Pharmacy and Technology*, p. 543. doi: 10.5958/0974-360x.2018.00101.4.
- [29] Sitharthan, R. *et al.* (2019) ‘Automated power management strategy for wind power generation system using pitch angle controller’, *Measurement and Control*, 52(3-4), pp. 169–182.
- [30] Sridharan, G. *et al.* (2019) ‘Evaluation of salivary metabolomics in oral leukoplakia and oral squamous cell carcinoma’, *Journal of oral pathology & medicine: official publication of the International Association of Oral Pathologists and the American Academy of Oral Pathology*, 48(4), pp. 299–306.
- [31] Todd, L. C. *et al.* (1990) ‘The

- Anatomy and Biology of the Human Skeleton', *Journal of Field Archaeology*, p. 337. doi: 10.2307/530029.
- [32] Venu, H., Dhana Raju, V. and Subramani, L. (2019) 'Combined effect of influence of nano additives, combustion chamber geometry and injection timing in a DI diesel engine fuelled with ternary (diesel-biodiesel-ethanol) blends', *Energy*, pp. 386–406. doi: 10.1016/j.energy.2019.02.163.
- [33] Vijayashree Priyadharsini, J. (2019) 'In silico validation of the non-antibiotic drugs acetaminophen and ibuprofen as antibacterial agents against red complex pathogens', *Journal of periodontology*, 90(12), pp. 1441–1448.
- [34] Vijayashree Priyadharsini, J., Smiline Girija, A. S. and Paramasivam, A. (2018) 'In silico analysis of virulence genes in an emerging dental pathogen *A. baumannii* and related species', *Archives of oral biology*, 94, pp. 93–98.
- [35] Wang, Y. *et al.* (2019) 'Synthesis of Zinc oxide nanoparticles from *Marsdenia tenacissima* inhibits the cell proliferation and induces apoptosis in laryngeal cancer cells (Hep-2)', *Journal of photochemistry and photobiology. B, Biology*, 201, p. 111624.
- [36] Wu, F. *et al.* (2019) 'Biologically synthesized green gold nanoparticles from Siberian ginseng induce growth-inhibitory effect on melanoma cells (B16)', *Artificial cells, nanomedicine, and biotechnology*, 47(1), pp. 3297–3305.
- [37] Wysocki, J. *et al.* (2006) 'The size of selected human skull foramina in relation to skull capacity', *Folia morphologica*, 65(4), pp. 301–308.
- [38] Yoshioka, N., Rhoton, A. L., Jr and Abe, H. (2006) 'Scalp to meningeal arterial anastomosis in the parietal foramen', *Neurosurgery*, 58(1 Suppl), pp. ONS123–6; discussion ONS123–6.