Original Research Paper Medical Science

Variantions of Optic Canal in Human Skulls

A.Himabindu PROFESSOR,DEPARTMENT OF ANATOMY, GITAM INSTITUTE OF MEDICAL SCIENCES AND RESEARCH, RUSHIKONDA,VISAKHAPATNAM

Dr.V.Sunitha PROFESSOR,DEPARTMENT OF ANATOMY, MIMS,VIZIANAGARUM

ABSTRACT

The optic foramen (or) canal is present within the sphenoid bone and it transmits the optic nerve and ophthalmic artery. These neurovascular structures are important for the normal vision of the individual. A normal optic canal which is either oval or round transmits these structures without causing any disturbances. An abnormal optic canal may produce visual disturbances and creates difficulties during surgical procedure of that region. The present study was carried out on 50 dried human skulls to find out variations that are clinically significant. This study showed duplication of the optic canal, narrowing of the canal where there is an increase chance disturbance to the nerve of vision producing visual disturbances. As the optic canal is present at the apex of bony orbit, knowledge of variations of optic canal is useful to neurosurgeons while operating tumors of posterior orbit.

KEYWORDS optic foramen, optic nerve, ophthalmic artery

Introduction

The optic canal (or) foramen is the important foramen that is present in the roof of the orbit. It is situated in the posterior part of the roof between two roots of lesser wing and the body of the sphenoid bone. Optic nerve along with its coverings and ophthalmic artery passes through it. In the canal artery lies inferolateral to the nerve. The optic canal extends from cranial cavity to orbit, having two ends orbital end &cranial end. The orbital end may be round or oval and cranial end is flattened from above downwards. There are variations in the optic canal in the form of narrowing of the canal and rarely duplication of the canal. The optic canal is duplicated by a bony septum into a large one for the optic nerve and a small accessory foramen inferior to the main canal that allows the passage of ophthalmic artery. This rare feature of optic canal duplication may be unilateral or bilateral. Various appearances of duplication like keyhole and figure of eight was described in the literature.These variations are due to developmental anomalies of optic strut.(1) Knowledge of this anatomical variation is useful for neurosurgeons while dealing with vascular lesions of this region as it can injure the nerve of vision.

Materials &Methods

The present study was conducted on 50 dried human skulls of unknown age and sex that were taken for the study. The bony orbit was carefully observed for the shape of optic canal and its anomalies like duplication and narrowing of the foramen that are clinically significant.

Observations

The important opening of the orbit, optic foramen is either round or oval. In the present study , variationswere observed in five skulls in the form of duplication and narrowing of the optic canal .

Normally the optic canal is either round or oval in shape with an average measurement of 4-9mm.In the present study two skulls showed narrowing of the canal. The rare feature of duplication was seen in two skulls, in which a bony septum dividing the canal into upper large and lower small accessory canal. The duplication is a unilateral feature in this study. (Fig.1)

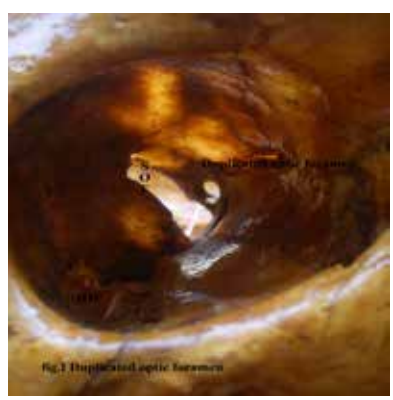

Fig.1 showing duplication of optic canal

One skull showed bilateral variations in the form of narrowing and closure of the canal by a bony septum. On the right side the canal is narrowed and on the left side it is closed by a thin plate of bone.(Fig.2&Fig.3)

Fig.2 showing Narrowing of optic canal

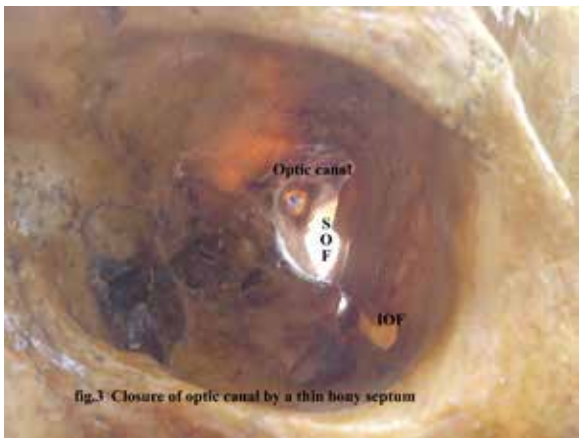

Fig.3 showing closure of optic canal

SOF-superior orbital fissure
IOF-inferior orbital fissure

Discussion

The optic canal that attains adult position by 3 years can be easily demonstrated in the skull. They are of different shapes-oval (42.4%), circular (28.4%), a quadrant of a circle (19.8%), and elliptical (9.4%).(2)

Normally the size of the foramen ranges between 4-9mm but it may be up to 12mm.Irrespective of age and sex the average optic canal measures 4.6mm and a canal less than 2.8mm cannot contain a normal optic nerve.(3)

In the narrowed optic canal, Neuro arterial structures need special attention because minimal injury leads to visual disturbances in this non expandable optic canal.(4)

In case of severe neuritis the chance of permanent visual impairment is more in abnormally small canals in comparison with optic canal of normal dimensions.(5)

Leon White opined that extensive pneumatisation of lesser wing of sphenoid is associated with narrowing of the optic canal. So the diminished calibre of the optic canal renders the contents more susceptible to infections from the surrounding sinuses. His observations on x-rays stated that patient with optic nerve disturbances had abnormally small optic canals.

In optic canal duplication, an accessory canal was found inferolateral to the main canal. The feature of duplication may be unilateral or bilateral.Zoja described five cases of optic canal duplication .Of them four had unilateral and one had unilateral duplication.(6).Orhan &Kaynak in their study on 369 skulls found this rare variation in two skulls.(7)

The reason behind this duplication was described by many authors.Calori & Le Double stated that ossification of duramater between optic nerve and ophthalmic artery is the cause for optic canal duplication.(8,9).This was contradicted and said it is developmental in origin. It is the result of anomalous growth of the optic strut separating the optic canal into two compartments allowing the contents to pass separately in two canals.(10,11).Closure of the optic canal by a thin bony plate was another variation of present study. Similar variation was described in an Indian skull.(12)

Conclusion

The optic nerve is the chief content of optic canal. Normally it does not encounter any difficulties in its course. But variations of optic canal like narrowing of the canal and its duplication needs special attention during interventional procedures of optic canal especially in endoscopic tumor removal and optic nerve decompression. In case of narrowing of optic canal, any infection in from nearby sinuses cause optic neuritis that may increases the chances of visual impairment.

Reference

1. Kier EL embryology of the normal optic canal&its anaomalies.An anatomic &roentgenographic study.(1966)Invest.Radiol.1:346-362
2. Kwon OW,Choi O observations of normal optic foramen in Korean. J Korean Ophthalmol Soc. 1980 Dec;21(4):473-479.
3. J Gray Clegg The optic foramenThe British Journal of Ophthalmology-,pg.667-673
4. Shankreppa Doddappa desai ,Sunkeswari sreepadma partial closure of right superior orbital fissure with narrow optic foramen International Journal of Anatomical Variations (2010) 3: 188–190
5. Leon E.White-Treatment of optic nerve involvement as determined by optic canal Radiographs.Amer.Acad. of ophthal. And otolaryng.,p.20,1923
6. Zoja,G.(1885).Spora il foro ottico doppio.Bollettino scientific,Pavia ,7,65-69
7. Orphan MA,Kanyak S.Bilateral duplication of optic canals.AnnAnat 1996;178(1):61-64
8. Calori,L (1891).Su varie particolarita osteologiche della base del cranio umano. Mem.R.AAcad.Bologna (ser.V),2,85-109
9. Le-Double AF,Traite'des variartions des Os du Crane de l'Homme Paris:Vigot Fre'res.1935;1903pg.372
10. Leon KE (1996).Embrology of normal optic canal and its anomalies-An anatomic and roentgenographic study .Investigative Radiology,1(5):346-362
11. Scheuer L,Black S,Chirstie A.Developmental juvenile osteology in Head Neck and Dentition,Elsevier 2000,pg.90
12. Berlis A,Putz R,Schumacher M.Measurements and variations in the region of the optic canal.CT and Anatomy Radiologe (1992)Sep:32(9):436-40..