

Gross Anatomical Features of Calcarine Sulcus



Medical Science

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ABSTRACT

Visual area lies in relation to the Calcarine sulcus in the Occipital lobe. Calcarine sulcus makes first appearance during the fourteenth week of gestation. The anterior part of the sulcus is the first to appear and is an extension of the Parieto-occipital sulcus. The gross anatomical feature of Calcarine sulcus, its relation to Parieto-occipital sulcus was studied in 33 cerebral hemispheres collected from the cadaver during the routine dissection is made use for the study. 14 specimens were from the right cerebral hemispheres & 19 were from the left side. In 18 specimens (54.5%) anterior part of Calcarine sulcus appeared as the extension of the Parieto-occipital sulcus. Gyrus intervened between the Calcarine sulcus and splenium in 15 specimens (45.4%) as part of Cingular gyrus or unnamed gyrus. Calcarine sulcus did not reach the occipital pole in 8 specimens (24.1%) and hence was not limited by Lunate sulcus on the superolateral surface artery. In lesions of Occipital lobe though vision is affected macular sparing occurs due to dual supply from middle cerebral artery mainly supplying the superolateral surface and from posterior cerebral artery mainly supplying inferior surface and Occipital lobe on all the surfaces. In cases where the Calcarine sulcus is stopping short of Occipital pole, the dual supply is not possible and macular sparing is doubtful.

Introduction:-

Visual area lies in relation to Calcarine sulcus and area surrounding it in the occipital lobe. Primary visual area, area 17, or visual area) is situated along the lips and walls of the posterior part of Calcarine sulcus and includes the cuneus and lingual gyrus. Anteriorly it extends up to the Parieto-occipital Sulcus; Posteriorly it appears on the outer surface of the occipital pole and it is limited by the Lunate sulcus and superior and inferior polar sulci.

The visual association area include area 18 (parastriate, visual area II) & area 19 (Peri striate, visual area III) which surround the primary visual area on the medial and lateral surfaces of occipital lobe. The Lunate sulcus, when present lies just in front of the occipital pole. It is placed vertically and occasionally joined to the Calcarine sulcus. Its lips separate striate from Peristriate areas; the Parastriate area is buried in the sulcus between the other two striate areas.

Aim:-

A descriptive account on the time of appearance of major sulci in foetal brains is given in standard text books [Gray's anatomy (1989)]. Several studies have been conducted on the central sulcus of Australian, Japanese and south Indian brains by Wollard (1931), Slome (1932), Saradadevi and Sanjeeva rao (1985). A detailed study regarding the macroscopic appearance of the Calcarine sulcus and its relation to Parieto-occipital sulcus was undertaken as it showed lot of variations from that of standard text book description. In lesions of occipital lobe though vision is affected macular sparing occurs due to dual supply from middle cerebral artery mainly supplying the superolateral surface and from posterior cerebral artery mainly supplying inferior surface. In cases where the Calcarine sulcus is stopping short of occipital pole, the dual supply is not possible and macular sparing is doubtful. Keeping this in mind the extent of the Calcarine sulcus was also studied.

Materials & Methods:-

33 cerebral hemispheres collected from the cadaver during the routine dissection are made use for the study. 14 specimens were from the right cerebral hemispheres & 19 were from the left side.

Calcarine sulcus was observed after removing the Pia mater from the surface of the brain and the following features will be

studied

- The extent of Calcarine sulcus,
- Its relation to Parieto-occipital sulcus and
- The impression caused by the Calcarine sulcus in the medial wall of posterior horn of lateral ventricle.

Observation:-

- On the right side 4 specimens showed typical 'y' (Fig: 1) shaped appearance (Parieto-occipital joined the Calcarine sulcus). In 10 specimens, Calcarine sulcus joined the Parieto-occipital sulcus (Fig: 2). On the left side 6 specimens showed typical 'y' shaped appearance Parieto-Occipital joined the Calcarine sulcus. In 8 specimens, Calcarine sulcus joined the Parieto-occipital sulcus.
- In 8 right sided hemispheres and 7 left sided hemispheres Calcarine sulcus was not reaching the Splenium of the Corpus Callosum and extension of Cingular gyrus intervened between the Splenium and Calcarine Sulcus (Fig:3 & 4).
- In 2 specimens Calcarine was not joining the Parieto-occipital (Fig: 5) and in 3 specimens Parieto-occipital was not meeting the Calcarine sulcus (Fig: 6).
- The impression caused by the Calcarine sulcus in the medial wall of posterior horn of lateral ventricle was prominent in some of the specimens (Fig: 7) and less prominent in others, whereas few of the specimens showed 4 impressions (Fig: 8) in the medial wall caused by the adjacent sulci
- Calcarine sulcus was not reaching the occipital pole in 6 right sided hemispheres and of them two showed branching pattern (Fig: 9 & 10). Calcarine sulcus was not reaching the occipital pole in 2 left sided hemispheres and both of them showed branching pattern (Fig: 11 & 12).

Discussion:-

- According to Vathsala et al. Calcarine sulcus makes first appearance during the fourteenth week of gestation. The anterior part of the sulcus is the first to appear and is an extension of the Parieto-occipital sulcus. In the present study in 18 specimens (54.5%) anterior part of Calcarine sulcus appeared as the extension of the Parieto-occipital sulcus and this coincides with the above finding.
- Calcarine sulcus meets the Parieto-occipital sulcus resembling the letter 'y'. The triangular area of cortex intervening between the Parieto-occipital and Calcarine sulcus forms

the Cuneus and the area below the Calcarine sulcus forms the lingual gyrus (Datta A.K). In the present study a gyrus intervened between the Calcarine Sulcus and Splenium in 15 specimens (45.4%) and appeared as the continuation of the Cingular gyrus.

- The Striate or Calcarine cortex (area 17 of Brodmann) is the primary sensory visual cortex. Surrounding it are areas which function as visual association areas - area 18, the para striate or para receptive cortex, receiving and interpreting impulses from area 17 and area 19, the peri striate or peri receptive cortex, having connections with areas 17 and 18 and with other parts of the cortex. Its functions in more complex visual recognition, perception, revisualization, visual association, size and shape discrimination, color vision, and spatial orientation. Fibres which carry visual impulses from the peripheral portions of the retina terminate on the anterior third or half of the visual cortex of the occipital lobe in concentric zones. Those from the fovea centralis, or macular area, terminate on the posterior portion of the occipital cortex. The macula has a wider cortical distribution than the peripheral portion of the retina and it is represented in a wedge-shaped area, with its apex anterior and base near the occipital pole in the striate cortex.
- According to Ananth (1998) Post Calcarine sulcus terminated at occipital pole in 73 of the 99 sides. The position of the Lunate sulcus marks the posterior end of the Calcarine sulcus (Velmurugan et al 1990). In the present study, Calcarine sulcus did not reach the occipital pole in 8 specimens (24.1%) and hence was not limited by Lunate sulcus on the superolateral surface.
- The occipital pole gets blood supply from both middle cerebral artery (artery of the supero lateral surface) and posterior cerebral artery (artery of the medial surface) When the Calcarine sulcus falls short of occipital pole it will be supplied only by the posterior cerebral artery. In such cases the macular area will suffer not only by the size of the area of representation but also because of lack of dual blood supply.

Conclusion:-

A unilateral lesion of area 17 due to thrombosis of posterior cerebral artery produces partial blindness of the type of homonymous hemianopia. Macular vision is however retained due to dual supply from middle cerebral and from posterior cerebral arteries. When the Calcarine sulcus stops short of occipital pole it is the macular area that will suffer not only by the size of the area of representation but also because of lack of dual blood supply.

For confirmation of this hypothesis – i) MRI study with contrast is required ii) Histological study of the visual area is required iii) Mapping by electrical stimulation is needed.

Fig: 1- Typical 'y' shaped appearance Parieto-occipital joined the Calcarine sulcus



Fig: 2 - Calcarine sulcus joined the Parieto-occipital sulcus



Fig: 3 & 4- Calcarine sulcus was not reaching the Splenium of the Corpus Callosum and extension of Cingular gyrus intervened between the Splenium and Calcarine sulcus



Fig: 5 - Calcarine was not joining the Parieto-occipital sulcus



Fig: 6 - Parieto-occipital was not meeting the Calcarine sulcus

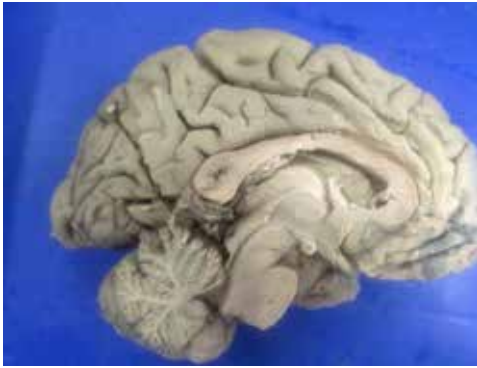


Fig: 7 - The impression caused by the Calcarine sulcus in the medial wall of Posterior horn of lateral ventricle was prominent



Fig: 8 - 4 impressions in the medial wall



Fig 9& 10 - Calcarine sulcus was not reaching the occipital pole in 6 right sided hemispheres and of them two specimens showed branching pattern



Fig 11 & 12- Calcarine sulcus was not reaching the occipital pole in 2 left sided hemispheres and both of them showed branching pattern



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