A study on anatomical variations in the relation of the optic chiasma and pituitary gland in a Sri Lankan adult population

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The Journal of the College of Ophthalmologists of Sri Lanka 2015; 21: 35-37

Abstract

Pituitary gland is an endocrine gland located in the base of the brain. An important relation to pituitary gland is the optic chiasma located superior to it. Variations of the relation between these two structures have been reported. Because of these variations, the lesions of the pituitary gland, especially those that exert mass effect on the surrounding structures result in different presentations, such as various visual field defects.

In this study the anatomical variations in the relationship between the optic chiasma and the pituitary gland were evaluated using 10 sagittally dissected adult brains. The distance between the pituitary gland and the centre of the optic chiasma was measured. From the 10 optic chiasma 10% was post fixed, 10% was pre fixed and 80% was overlying the pituitary gland. Mean distance between the pituitary gland and anterior border of optic chiasma was 8.31mm with a standard deviation of 1.16.

Keywords: Optic chiasma, pituitary tumours.

Introduction

Pituitary gland is considered as one of the most important endocrine gland in the body. It lies in the bony depression in the skull base, sella turcica, and is covered with the dural fold, diaphragma sellae. Pituitary stalk extends from base of the brain through the diaphragma sellae.

Due to the limited space inside the cranial cavity, many important structures lie closely related to each other. One such important relation to pituitary gland is the optic chiasma located superior to it.

One of the common pathologies in the gland is tumor[1]. There can be microadenomas and macroadenomas. Macroadenomas give rise to variety of clinical symptoms when compared with microadenomas, which are due to increased intracranial pressure caused by the growth, mass effect causing compression of surrounding structures and also due to the excessive or suppressed secretion of hormones by the gland. Later is the usual presentation of microadenoma and presents early.

Macroadenomas which grows upward are known to cause bitemporal hemianopia. Apart from this they might also present with complex sensory defects such as post fixational blindness and hemi field slide phenomenon[2]. This is a consequence of the enlarged pituitary gland compressing the nerve fibres that crossover within the optic chiasma.

Nevertheless there can be cases where the presentation of pituitary adenoma is not as typical as it is described, due to the differences in the directions of growth of adenoma or due to the differences in the relationship between the gland and the optic chiasma.

Variations of the relation between the optic chiasma and pituitary gland have been reported. Depending on the anatomical location of chiasma in relation to the pituitary gland, it can be defined prefixed, post fixed or overlying the pituitary gland.

In such instances the diagnosis of pituitary adenoma would be delayed, especially in a peripheral unit where imaging studies are not freely available. Thus the knowledge on the anatomical variations in the relationship of optic chiasma to pituitary gland can be utilized in early diagnosis of different presentations of visual field defects associated with pituitary adenoma, in turn improving patients' outcome and also quality of medical care.

Methodology

This was a descriptive study done at Department of Anatomy, Faculty of Medicine, Ragama, using adult cadavers donated to the Department of Anatomy, Faculty of Medicine, Ragama. The study was done with the approval of the Ethical Review Committee of Faculty of Medicine, Ragama.

10 adult cadavers were selected, age 40 years to 60 years, preserved in formalin for 3 to 6 months. Cadavers donated after head injury were excluded.

Routine dissections were done in the head and neck region including a sagittal sectioning of brain and the basal aspect of the skull.

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The relations of optic chiasma and pituitary gland were evaluated. Depending on the positioning of the optic chiasma in relation to the pituitary gland, antero-superior position (over tuberculum selle) was taken as a pre fixed chiasma, posterior-superior position (over dorsum selle) was taken as post fixed chiasma, and chiasma directly above the gland (over diaphragm sella) was taken as chiasma overlying the pituitary.

The distance between the centre of pituitary gland and the centre of the optic chiasma, antero-posterior length of pituitary, antero-posterior length of chiasma were marked off with a divider and transferred it to vernier calliper from which the measurements were taken.

Analysis of data was done using SPSS software.

Results

From the 10 optic chiasma in the study sample, 1 (10%) was post fixed, 1 (10%) was pre fixed, 8 (80%) were overlying the pituitary gland.

The measurements taken are shown in the table 1.

Table 1. Distance between the centre of the pituitary gland to centre of the optic chiasma, antero-posterior length of pituitary, antero-posterior length of chiasma and the position of optic chiasma

Antero-posterior length of pituitary	*Antero-posterior length of chiasma*	*Distance A**	*Position of the optic chiasma*
7.26	9.12	6.14	Pre fixed
8.22	8.38	7.24	Overlying
7.44	9.4	7.32	Overlying
8.06	8.46	8.16	Overlying
8.24	9.04	8.36	Overlying
8.18	9.34	8.44	Overlying
7.16	9.44	9.02	Overlying
8.12	8.46	9.1	Overlying
8.36	9.32	9.28	Overlying
9.18	9.22	10.1	Post fixed

*Distance from centre of the pituitary gland to centre of the optic chiasma

Mean antero-posterior length of the pituitary gland 8.02mm. Mean antero-posterior length of the optic chiasma 9.01mm.

Mean distance between the centre of the pituitary gland and centre of the optic chiasma was 8.31mm with a standard deviation of 1.16.

Discussion and conclusion

The pituitary, also known as ''the master gland'' is responsible for controlling most of the important endocrine functions in the body. This gland is subjected to certain pathological conditions similar to other organs in the body. The adenomas are considered as the most common pathological condition.

The adenomas are uncovered due to the specific symptoms and signs they show. These symptoms are related to the hormones secreted by the adenomas which secrete excessive amount of hormones (eg: growth hormone secreting adenomas), enlarging adenoma compressing the gland and causing hypopituitarism (eg: hypothyroidism), or due to the mass effect caused by the adenoma on surrounding structures. There is also a certain percentage of adenomas which do not manifest any symptom. The only approach of discovering such a tumour is by imaging studies. These kinds of adenomas are known as incidenomas.

Optic chiasma being closely related to the pituitary gland is known to create visual disturbances when compressed by a pituitary adenoma. Some of the common manifestations are bitemporal hemianopia, complex sensory defects such as post fixational blindness and hemi field slide phenomenon[2].

In this study we questioned the probability of the presence of variations in the relation of optic chiasma to the pituitary gland. The variations in their relationship can manifest different types of visual disturbances, which is to be further studied. These can be used for early diagnosis of pituitary adenomas.

The frequencies of the types of the optic chiasma in this study population were similar to the frequencies of the position of the optic chiasma in the literature. This concludes that the position of the optic chiasma in relation to the pituitary gland in Sri Lankan population is similar to the values in other regions of the world.

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