

## REAPPRAISAL OF THE DIMENSIONS OF THE DIAPHRAGMA SELLAE

Kevin Ongeti, Hemed El-Busaidy, Nelson Fundi

**Correspondence:** Dr. Kevin Ongeti, Email: [kongeti@aol.com](mailto:kongeti@aol.com). Department of Human Anatomy University of Nairobi P.O. Box 00100 30197 NAIROBI.

### SUMMARY

Morphometric dimensions of diaphragma sellae influence the extent of instrumentation and tumour exposure in the hypophyseal fossa, and the degree of compression of visual fibres from an expanding pituitary tumor. The dimensions show inter-population variations but data from Africans is scarcely available in literature. We aimed to investigate the morphometric dimensions of diaphragma sellae in an adult Kenyan population. One hundred and forty wet open crania (96 males, 44 females) obtained from the Department of Human Anatomy, University of Nairobi were studied. The shape of diaphragma sellae was classified as round or elliptical (elliptical was further classified as coronal elliptical or sagittal elliptical). The sagittal and coronal dimensions of the sellae were also determined. The diaphragma sellae was round in 60% of cases, coronal elliptical in 34% and sagittal elliptical in 6%. It was significantly wider in females than males ( $10.26 \pm 2.61$ mm vs  $8.37 \pm 1.82$ mm respectively),  $p = < 0.05$ . It was also wider in the coronal than sagittal dimension ( $20.01 \pm 2.00$ mm vs  $18.45 \pm 2.97$ mm) and this difference was statistically significant. The significantly wider diaphragma sellae in females may provide better tumor exposure during surgery and may protect the visual fibres from a suprasellar extension of an expanding pituitary tumour. On the other hand, the larger coronal than sagittal sellae dimension should be considered during instrumentation in the hypophyseal fossa to avoid inadvertent neurovascular injury.

**Key words:** Diaphragma sellae, Morphology, Morphometry

### INTRODUCTION

The sellar region is located in the centre of the middle cranial fossa, and is a common site for tumours, vascular, developmental, and neuroendocrine disorders (Isolan et al., 2009). The dura forming the roof of oculomotor trigones extends medially across the sellae to form the diaphragma sellae, which contains an opening for the pituitary stalk (Carmel, 1980; Gulsen et al., 2010). This structure, when fully formed, is a protective barrier against the pulsating action that the cerebrospinal fluid exerts on the sellae content (Ferreri et al., 1992).

The shape of diaphragma sellae may be round or elliptical (Rhoton et al., 2002) and this may influence the degree of tumour exposure during trans-sphenoidal pituitary surgery (Isolan et al., 2009). On the other hand, the coronal and sagittal dimensions of the sellae are important in determining the degree of compression of visual fiber from an enlarging pituitary tumour, instrumentation in the hypophyseal fossa and the extent of tumor invasion into cavernous sinus and chiasmatic cistern (Campero et al., 2008; Gulsen et al., 2010).

These dimensions display inter-population and ethnic variations although data from Africans is scarcely available in the literature and altogether absent from Kenya. This study is therefore aimed at determining morphometric dimensions of diaphragm sellae in an adult Kenyan population.

## MATERIALS AND METHODS

One hundred and forty wet calvaria (96 males, 44 females) of age range 18 to 60 years were removed by craniotomy during routine dissection at the Department of Human Anatomy, University of Nairobi. The brains were carefully removed from the bases of the skulls. Empty sellae, broken skulls and those with necrosed pituitary glands were excluded. The sellae region was examined under a magnified glass. The shape of diaphragm sellae opening was classified as round or elliptical (elliptical was further classified as coronal elliptical or sagittal elliptical). The coronal and sagittal dimensions of the sellae were measured using digital vernier calipers (ABC Mitutoyo Japan, accurate to 0.01mm). Data obtained was tabulated, coded and analyzed using statistical package for Social Sciences (SPSS, version 17 for Windows®). Means, ranges and standard deviations were calculated. Gender differences were determined

using independent student t- test and a p- value of  $\leq 0.05$  was considered significant.

## RESULTS

All diaphragm sellae were complete, covering the entire sellae turcica. They had a central aperture transmitting the infundibular stalk and its vessels (Fig. 1). Diaphragm sellae were concave and flat in 60 and 40 percent of the cases. The shape of diaphragm opening was round in 90 cases (60%). It was coronal elliptical in 51 cases (34%) and sagittal elliptical in 9 cases (6%). The average sellar diameter was  $8.97 \pm 2.24$ mm. The diameter was significantly wider in females ( $10.26 \pm 2.61$ mm) than males ( $8.37 \pm 1.82$ mm),  $p < 0.05$ . In four cases (2.86%) the diameter was less than 5mm.

The average sagittal sellae dimension was  $18.45 \pm 2.97$  mm. It was significantly wider in females ( $21.57 \pm 3.56$ mm) than males ( $17.20 \pm 1.56$ mm),  $P < 0.05$ . The average coronal sellae dimension was  $20.01 \pm 2.00$ mm. It was  $20.01 \pm 2.00$ mm and  $21.54 \pm 3.04$  mm in males and females respectively ( $P = 0.295$ ). The coronal sellae dimension was significantly larger than the sagittal dimension ( $p < 0.05$ ).



Fig 1: The sellar region showing a round aperture, the infundibular stalk (IS), Optic nerves (ON) and the oculomotor nerves (CNIII).

Table 1: Population differences in the shape of diaphragma sellae

Author	Population	Round diaphragma opening	Elliptical opening
Rhoton et al., 2002	British	60%	40%
Ju et al., 2010	Korean	60%	40%
Present study, 2012	Kenyan	64.3%	35.7%

## DISCUSSION

The diaphragma sellae was present in all samples examined. Partially developed or smaller hypophysis, always located at the inferior and/or posterior half of the sellae usually have greater fragility of its bony walls (Ferreri et al., 1992). A majority of these sellae were concave in shape consistent with previous observations (Sage et al., 1982; Rhoton et al., 2002). However, none of the diaphragma showed a convex orientation, as previously observed by Gulsen et al., (2010). In the current study the shape of diaphragma sellae opening was round in 90 cases (64.3%) and elliptical in 50 cases (35.7%). This was comparable with previous reports (Table 1).

The average diaphragma sellae diameter in the present study was  $8.97 \pm 2.24$ mm (range: 3.45 to 15.27mm), comparable with previous reports of 4 to 14mm (Nomura et al., 2002). However, the present study revealed that up to 97.1% of diaphragma sellae diameters were more than 5mm compared to 39-56% in previous studies (Bergland et al., 1968; Campero et al., 2008). This may reflect wider diaphragma sellae diameters in the study population. Additionally, the current results

showed that the average diameter and sagittal dimension of the sellae were significantly larger in females. This finding may be of clinical importance as it may ease instrumentation into the hypophyseal fossa and protect the visual fibres and chiasmatic cistern from an expanding pituitary tumour in females (Campero et al., 2008; Isolan et al., 2009; Gulsen et al., 2010). In the present study, the average coronal diaphragma sellae dimensions were significantly larger than the sagittal dimension. This finding should be considered during instrumentation and trans-sphenoidal approach for pituitary tumors to avoid inadvertent neurovascular injury.

In conclusion, the significantly wider diaphragma sellae aperture in females may provide better tumour exposure during surgery and protect the visual fibres from a suprasellar extension of an expanding pituitary tumour. On the other hand, the larger coronal than sagittal diaphragma sellae dimension should be considered during instrumentation in the hypophyseal fossa to avoid inadvertent neurovascular injury.

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