RADIOGRAPHIC STUDY OF CERVICAL SPINE INTER-PEDICULAR DISTANCE AND CANAL DIAMETER IN ADULT POPULATION OF IGBO PEOPLE RESIDENT IN ONITSHA ANAMBRA STATE SOUTH-EASTERN NIGERIA

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Abstract: The conditions of Cervical Spine radiographs can be assessed by mere evaluating the alignment of bones and cartilages that make up the spine. Various radiographic parameters of the cervical spine including the Inter-pedicular Distance (IPD) and Canal Diameter, can be evaluated for diagnostic and treatment of ailments associated with the Cervical region, which, often times, manifest in the form of neck and back pain. The aim of the present study was to elucidate the normative values of IPD and Canal Diameter in adult population of Igbos in South Eastern Nigerian. The Cervical X-ray images of patients whose age ranges were between 18-45years, and a total of 100 images were measured of which males were 57 and females 43. For the IPD, the distance measured was the shortest distance between the medial surfaces of the pedicles of individual Cervical vertebra. For Canal Size (Mid-Sagittal diameter) the measurement was carried out from the posterior surface of the mid-vertebral aspect of the body to the nearest surface of the same segmental spinolaminar junction. The widest mean interpedicular distance of the cervical spine in this study was observed at C6 (30.0 ± 1.2 and 29.0 ± 1.2) for the male and female subjects' X-rays respectively. Smaller mean interpedicular distances were observed at C3 (27.2 ± 1.5), C4 (27.0 ± 1.2) and C5 (29.2 ± 1.8) in this study. The study also found out that the average canal diameter at different vertebral levels to be; C3 (18.83), C4(18.60), C5(18.92), C6(19.38), and C7(19.70). The mid-sagittal spinal canal was widest at C7 at C4. Result is presented in millimeters (mm) and statistical analysis was done to obtain mean $\pm$ standard deviation (mean $\pm$ SD) and were analyzed using graphical prism5. $P < 0.05$ represented statistical significance. The results of this study confirm the general believe that normative reference values for certain Spine parameters such as Interpedicular Distance and Canal Diameter vary from one ethnic group to another, and also among both sexes.

Key words: Inter-Pedicular distance, Canal Diameter, Cervical vertebrae, Medial Border of Pedicle

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INTRODUCTION

The shortest distance measured between the medial surfaces of the pedicles of a vertebra is referred to as the Inter-Pedicular distance (IPD), (Hinck *et al.*, 1966). The IPD has been established to be of tremendous assistance to medical practitioners in the diagnosis of Cervical Spine stenosis and intraspinal neoplasms (Tatarek, 2005; Yochum and Rowe, 2005). It is also useful in post-operative assessment for Trans-pedicular screw fixation (Ugur *et al.*, 2000). Discrepancies in standard values for selected radiographic parameters in the Cervical spine when assessed across ethnic groups and gender are described by several authors (Lim and Wong, 2004; Tatarek, 2005; Tossel, 2007). Some researchers also recommended that the Canal Diameter be based on ethnicity and gender because the significant differences between ethnic groups may affect the diagnosis of cervical spine stenosis (Lee *et al.*, 1994; Lim and Wong, 2004; Tatarek, 2005). Significant differences in the IPD were observed in the lumbar spine between gender as well as in two South African ethnic groups (Eisenstein, 1976; Naidoo, 2008). Nirvan *et al.* (2005) reported significant differences in the lumbar spine IPD between north and south Indian ethnic groups and emphasized the importance of obtaining the normal ranges for IPD in different populations. The aim of this study therefore, is to obtain the normal values of IPD of Igbos, in South East region of Nigeria and to compare the values to those obtained from other regions. Obviously, these values will not only assist Medical practitioners in the treatment of spinal stenosis, but also will be equally useful to teachers of Anatomy in the Medical schools in Nigeria.

MATERIALS AND METHOD

Human subjects were not used, rather, subject's X-rays and CT scan of known age and gender were measured considering the age bracket of 18-45 years of age. Computed films were measured directly from the computer system using a certain kind of software application known as ISSA PACS DICOM VIEWER. The vertebrae considered was the cervical vertebrae 3-7. Those of C1 and C2 were not included in the study because of their atypical nature. Moreover, according to David. *et al.*, (2010), Cervical stenosis are more common between cervical vertebrae C3-C6. The measurement of IPD was done by placing the cursor at the medial surface of one pedicle and dragging it to the other medial surface of the other pedicle of the same vertebral level. Canal Diameter was similarly measured by placing the cursor at the posterior surface of the mid-vertebral aspect of the body and dragging it to the nearest surface of the same segmental spinolaminar junction. Result is presented in millimeters (mm). Statistical analysis was done to obtain mean $\pm$ standard deviation (means $\pm$ SD) and were analyzed using graphical prism5. $P < 0.05$ represented statistical significance.

RESULTS

At C3, the mean value for the interpedicular distance for the males and females were 27.2 ± 1.5 and 27.0 ± 2.2 respectively. Fig.1 shows the comparison between the male and female subjects. There is no significant difference in the male and female cervical interpedicular distance, at C3. Fig.2 shows the mean value for the Cervical Interpedicular distance of the male and female at C4, were 28.9 ± 1.2 and 28.2 ± 1.6 respectively. No significant difference in the cervical interpedicular distance between the male and female of C4. Fig.3 represents the mean value for the cervical interpedicular distance at C5, of the male and female, to be 29.2 ± 1.8 and 29.2 ± 1.3 respectively. There was no significant difference in the male and female cervical interpedicular distance of C5. Fig.4 shows the interpedicular distance of the cervical spine between the male and female subjects at C6 level. From the result the mean value for the IPD of the male and females were 30.0 ± 1.2 and 29.2 ± 1.1 respectively. There was no significant difference in the mean value of the male and female interpedicular distance of C6. Fig.5 shows the interpedicular distance of the cervical spine between male and female subjects at C7 level. The mean value SD(mm) for the cervical interpedicular distance for the males and females were 29.4 ± 1.7 and 29.0 ± 1.5 . Result also show that the average canal diameter of C3 (18.83), C4 (18.60), C5 (18.92), C6 (19.38), and C7 (19.70). The mid-sagittal spinal canal diameter was widest at C7 and narrowest at C4.

Fig.1 gender difference in Interpedicular distance and Canal Diameter of the cervical spine of C₃

Fig.2 Gender difference in Interpedicular distance and Canal Diameter of the cervical spine of C4

Fig.3 gender difference in interpedicular distance and Canal Diameter of the cervical spine of C₅.

Fig.4 Gender difference in interpedicular distance and Canal Diameter of the cervical spine of C₆.

Fig 5: Gender difference in Interpedicular Distance and Canal Diameter of the Cervical spine of C₇

DISCUSSION

The results of this study showed an increase in mean Interpedicular distance value at C₄, C₅ and C₆ which also confirms the cervical enlargement at these levels (Bland, 1994). The widest mean interpedicular distance of the cervical spine in this study was observed at C₆ (30.0 ± 1.2 and 29.11) for the male and female subjects respectively. This is in line with the finding of Tatarak (2005) who observed that the mean interpedicular distance is widest in C₆ (25.46 ± 1.44) for the male and (24.49 ± 1.60) for the African American females. Hinck *et al.* (1966) also recorded the largest Interpedicular distance at C₆ and C₇ for the Indian ethnic group. Smaller mean interpedicular distance were observed at C₃ (27.2 ± 1.5), C₄ (28.9 ± 1.2) and C₅ (29.2 ± 1.8) in this study. This finding also corresponds to the study conducted by Tatarak (2005) who reported a smaller value of C₃, C₄ and C₅ with C₆ and C₇ having a higher value in both gender. In contrast, Yochum and Rowe, (2005) reported mean interpedicular distance of the cervical spine at C₄(29), C₅(29mm) C₆(29mm) to be the same and the largest while C₃(28mm) and C₇(28mm) to be the smallest. The values of sagittal Canal diameter have also been elucidated. Sexual dimorphism in Canal diameter has been established. These similarities and variations confirm the assertion that certain parameters such as Inter-pedicular distance vary from one region to the other. The results of this study have successfully, elucidated the normative reference values for Interpedicular distance and Canal diameter in the region studied.

CONCLUSION

The study has made available the hitherto non-existing normative reference values of the Cervical Inter-pedicular distance(IPD) and Canal diameter of the Igbos of South Eastern Nigeria. These values will provide the data for medical practitioners for the diagnosis and treatment of spine related ailments such as stenosis and tumors. Gender differences has also been elucidated. This will also assist teachers of Anatomy in the Medical Schools in Nigeria and the world at large.

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