

Gender Estimation by Means of Quantitative Measurements of Foramen Magnum: An Analysis of CT Head Images

Authors : Thilini Hathurusinghe, Uthpalie Siriwardhana, W. M. Ediri Arachchi, Ranga Thudugala, Indeewari Herath, Gayani Senanayake

Abstract : The foramen magnum is more prone to protect than other skeletal remains during high impact and severe disruptive injuries. Therefore, it is worthwhile to explore whether these measurements can be used to determine the human gender which is vital in forensic and anthropological studies. The idea was to find out the ability to use quantitative measurements of foramen magnum as an anatomical indicator for human gender estimation and to evaluate the gender-dependent variations of foramen magnum using quantitative measurements. Randomly selected 113 subjects who underwent CT head scans at Sri Jayawardhanapura General Hospital of Sri Lanka within a period of six months, were included in the study. The sample contained 58 males (48.76 ± 14.7 years old) and 55 females (47.04 ± 15.9 years old). Maximum length of the foramen magnum (LFM), maximum width of the foramen magnum (WFM), minimum distance between occipital condyles (MnD) and maximum interior distance between occipital condyles (MxID) were measured. Further, AreaT and AreaR were also calculated. The gender was estimated using binomial logistic regression. The mean values of all explanatory variables (LFM, WFM, MnD, MxID, AreaT, and AreaR) were greater among male than female. All explanatory variables except MnD ($p=0.669$) were statistically significant ($p < 0.05$). Significant bivariate correlations were demonstrated by AreaT and AreaR with the explanatory variables. The results evidenced that WFM and MxID were the best measurements in predicting gender according to binomial logistic regression. The estimated model was: $\log(p/1-p) = 10.391 - 0.136 \times \text{MxID} - 0.231 \times \text{WFM}$, where p is the probability of being a female. The classification accuracy given by the above model was 65.5%. The quantitative measurements of foramen magnum can be used as a reliable anatomical marker for human gender estimation in the Sri Lankan context.

Keywords : foramen magnum, forensic and anthropological studies, gender estimation, logistic regression

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