Evaluation of Frontal Sinus and Skull Measurements in Gender and Age Determination among Iraqi sample using Spiral CT Scanning

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Abstract

Background: The personal identification of an unknown person by the matching of antemortem and postmortem radiographs has gradually gained popularity among forensic scientists, since the technique was first successfully applied by Culbert and Law in 1927 (Tatlisumak et al, 2007). Positive identification can easily be achieved by medical examiners through visual comparison of the antemortem with the postmortem cranial and facial structures, even of bodies severely damaged by fire. In these bodies the radiographs of the skull can graphically depict structures which are oftenly unique to the individual, such as the frontal sinus pattern (Campobasso et al, 2007). The asymmetry of the frontal sinuses has stimulated several attempts to identify persons by analyzing measurements of the sinuses obtained from plain x-ray films (Ribeiro, 2000).

The aims of the study: This study was undertaken to provide the normal base line data of frontal sinus measurements, features and skull dimensions of an Iraqi sample, as a reliable standardized method for measurements using spiral Computed Tomography (CT) scans that can be filed for later comparison and to assess the variation in frontal sinus anatomy in relation to certain skull dimensions for the prediction of gender and age.

Materials and Methods: This study was conducted on 90 patients (45 females and 45 males) with age range from 20-49 years, who were admitted to the radiology CT clinic for paranasal sinus in Al-Kadhymia teaching hospital in Baghdad city for the period between 1/1/2008-30/6/2008. The present study included patients who had complaints of sinusitis, in whom no radiological findings were detected. Three features and two groups of measurements of frontal sinus and three skull dimensions were obtained from the direct coronal scans and lateral view (topogram), all of the measurements in this study were done directly on the CT based films size (35x43 cm) by using pencil 0.5 mm diameter and vernier caliper utilizing the scale present within each section as the measurement technique.

Three basic features were F (presence or absence of frontal sinus), S (septum) and S (scalloping) and named as FSS system. Two groups of measurements were divided as:

Group 1: measurements of width, height and anteroposterior length.

Group 2: measurements of total width, the distance between the highest points of the two sinuses, the distance between the highest points of the right sinus to its maximum lateral limit and the distance between the highest points of the left sinus to its maximum lateral limit.

Skull dimensions measurements included; maximum skull length, prostio-bregmatic height and maximum skull width.

The data were subjected to a descriptive and discriminative analysis using the SPSS package program (Version 13).

Results: After calculating the total percent of agreement between the first and second readings, first and second examiner, the pre-post comparison (number of discordant items) resulted in 87.5% accurately predicted perfect match (no discordant items) for intra-examiner calibration and 82.5% accurately predicted perfect match (no discordant items) for inter-examiners calibration and the result for one discordant item was 12.5% for intra-examiner calibration and 17.5% for inter-examiners calibration. The discriminative analysis showed that the overall accuracy of frontal sinus measurements—i.e. the ability of the frontal sinus to identify gender was 76.9 %, adding the skull measurements to the frontal sinus measurements gave a higher overall classification accuracy for gender (85.9%), using skull measurements alone to discriminate between males and females resulted in the highest overall accuracy of 88.9%.

Conclusions: Frontal sinus measurements can be of great value in differentiating gender. Adding skull measurements to the frontal sinus measurements can significantly improve accuracy of gender determination using discriminant analysis. Skull measurements can be used alone or with other craniometric measurements to identify gender of unknown decomposed corpses. Both frontal sinus and skull measurements tend to stabilize in their dimensions after the second decade of life, so one can not depend on them for age estimation of unknown. CT based films can provide valuable and precise measurements not only for frontal sinus but even for the whole skull that cannot be approached by other means.