AUTOMATED PLATFORM FOR HISTOLOGICAL RACE AND SEX COMPARISON OF HUMAN CORTICAL BONE

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I would like to dedicate this work to the poor and needy people of the world who face neglect from the society. May Allah give me the courage and power to support them.

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ABSTRACT

Research on histological bone variation in population is in its early stages in Malaysia and limited information is available about age graded race and sex comparison. This research performed race and sex comparison of histological cortical bone parameters in the Malaysian population and presented an automated system which could be used as assistance tool by forensic experts. Human bone specimen were collected from Hospital Universiti Kebangsaan Malaysia Medical Centre (UKMMC), Kuala Lumpur, Malaysia. Haversian canals were measured and five parameters were calculated for comparison. Comparison test (t-test/u-test) showed that the size of Haversian canals were significantly greater ($p<0.05$) in females (HCM fifth, sixth decade: 5955.8 μm^2, 5788.0 μm^2) than males (HCM fifth, sixth decade: 4117.6 μm^2, 3965.1 μm^2). In race comparison, total area covered by Haversian canals (bone porosity) was significantly greater ($p<0.05$) in Indian samples (HCA: 0.457mm^2) compared to Chinese samples (HCA: 0.385mm^2) in the second decade. However in fifth decade, total area covered by Chinese samples (HCA: 0.894mm^2) was significantly greater ($p<0.05$) than Indian samples (HCA: 0.570mm^2). Three main steps of histological comparison were focused for automation i.e. parameter calculation, data management and statistical comparisons. The system was designed with GUI which utilizes aforementioned automation step. Validation of the system was divided into two main parts. In first part, parameter measurement and calculation performed by the system were compared with existing tools in terms of percentage error in measurement (DinoCapture: 5.3%, L-measure: 5.1%, ImageJ: 4.7%, designed system: 4.0%) and consumed time for measurement (DinoCapture: 15-20min, L-measure: 15-20min, ImageJ: 20-25min, designed system: 1-2min). Similarly automated race and sex comparison performed by the system were compared with comparisons performed manually using SPSS software. Significance and t/z values showed no differences and did not change overall hypothesis of the comparison tests. Which implies that the automated system is efficient for histological race and sex comparisons.

ABSTRAK

Penyelidikan mengenai variasi tulang histologi dalam perbandingan kaum dan jantina dalam populasi di Malaysia merupakan di peringkat awal dan maklumat adalah terhad. Kajian ini ialah pembinaan sistem automatik mengenai perbandingan parameter tulang kortikal histologi kaum dan jantina populasi Malaysia yang boleh digunakan sebagai alat bantuan pakar forensik. Spesimen tulang manusia telah dikumpulkan dari Pusat Perubatan Hospital Universiti Kebangsaan Malaysia (UKMMC), Kuala Lumpur, Malaysia. Terusan Haversian telah diukur dan lima parameter dikira sebagai perbandingan. Ujian perbandingan (t-test / u-test) menunjukkan bahawa saiz terusan Haversian lebih besar ($p < 0.05$) pada wanita (HCM kelima, dekad keenam: 5955.8 μm^2, 5788.0 μm^2) daripada lelaki (HCM kelima, dekad keenam: 4117.6 μm^2, 3965.1 μm^2). Dalam perbandingan kaum, jumlah kawasan terusan Haversian (porositas tulang) jauh lebih besar ($p < 0.05$) dalam sampel kaum India (HCA: 0.457 mm^2) berbanding sampel kaum Cina (HCA: 0.385 mm^2) dalam dekad kedua. Walau bagaimanapun pada dekad kelima, sampel kaum Cina (HCA: 0.894 mm^2) jauh lebih tinggi ($p < 0.05$) berbanding sampel kaum India (HCA: 0.570 mm^2). Tiga langkah utama parameter automasi iaitu, pengiraan data, pengurusan data dan perbandingan statistik. Sistem ini direka dengan GUI yang menggunakan langkah automasi yang disebutkan di atas. Pengesahan sistem dibahagikan kepada dua bahagian utama, yaitu di bahagian pertama, pengukuran dan pengiraan parameter sistem dibandingkan dengan alat yang sedia ada dari segi kesilapan peratusan dalam pengukuran (DinoCapture: 5.3%, ukuran L: 5.1%, ImageJ: 4.7%, sistem yang dirancang: 4.0%) dan penggunaan masa untuk pengukuran (DinoCapture: 15-20min, L-ukuran: 15-20min, ImageJ: 20-25min, sistem yang dirancang: 1-2min). Perbandingan sistem automatik kaum dan seks yang dibandingkan dengan kaedah secara manual menggunakan perisian SPSS. Nilai penting dan t / z tidak menunjukkan perbezaan dan juga tidak mengubah hipotesis keseluruhan ujian. Ini menunjukkan bahawa sistem automatik adalah cekap untuk histologi perbandingan kaum dan jantina.

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