H86 Utilization of the Iscan Method on Multi-slice Computed Tomography Reconstructions for Assessment of Aging: A Preliminary Study

Fabrice Dedouit, MD, Stéphanie Bindel, David Gainza, MD, and Anthony Blanc, MD, Service de Médecine Légale, Hôpital de Rangueil, 1 Avenue du Professeur Jean Poulhès, TSA 50032, Toulouse Cedex 9, 31059, France; Francis Joffre, PhD, Service de Radiologie Générale, Hôpital de Rangueil, 1 Avenue du Professeur Jean Poulhès, TSA 50032, Toulouse Cedex 9, 31059, France; and Daniel Rouge, PhD, and Norbert Telmon, PhD, Service de Médecine Légale, Hôpital de Rangueil, 1 Avenue du Professeur Jean Poulhès, TSA 50032, Toulouse Cedex 9, 31059, France*

The goal of this presentation is to assess the possibilities of aging on two (2D) and three dimensional (3D) multi-slice computed tomography reconstructions of the sternal end of the fourth rib using the Iscan method.

This presentation will impact the forensic community and/or humanity by providing an example of anthropological application of the computed multi-slice computed tomography in forensic sciences.

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Background: Multi-slice computed tomography (MSCT) is uncommonly used in forensic pathology and anthropology. MSCT allows two (2D) and three-dimensional (3D) reconstructions, which can be helpful for osteoscopic analyses and consequently for age estimation.

Purpose: To evaluate the possibilities of aging adults by examination of MSCT 3D reconstructions the sternal end of the right fourth rib with the Iscan method.

Technique: Thirty-nine sternal ends of the fourth right rib were taken during medicolegal autopsies and examined before cleaning with a sixteen-detector row MSCT (Sensation 16, Siemens). Two filters of reconstruction were used: one “hard” for bone examination and the other one “smooth” for soft tissues examinations. The thickness of reconstruction was 1 millimetre and the collimation 1 millimetre. Two (with the MPR mode (Multi Planar Reconstructions)) and three–dimensional post-processing (with the VRT mode (Volume Rendering Technique)) were made in all cases. MPR reconstructions were performed in two planes: one along the long axis of the sternal end of the rib and one along short axis.

Using the Iscan technique, the phase of each subject (and consequently the range of aging) was assessed by three different observers. One observer was an anthropology student and two were forensic pathologists with anthropological qualifications.

The ribs were carefully cleaned with alternate baths of hot water and flesh removal. After a spontaneous drying, the phase of the sternal end of each rib was assessed by the Iscan technique by the three different observers.

A first statistical analysis was performed to evaluate intra and inter- observers variabilities on MSCT reconstructions and on dry bones by calculating the coefficient Gamma and the Krippendorff’s alpha reliability. A second statistical analysis was performed in order to compare estimations of phases performed on MSCT reconstructions and on dry bones by each observer (inter-method evaluation). Because of the little number of subjects studied, the statistical test used in this case was the Krippendorff’s alpha reliability.

Results: The sample studied consisted of thirty-eight subject. Two ribs were excluded because of their partial destruction during their cleaning.

The intra-observer variabilities on dry bones were excellent with the coefficient of Gamma equal to 0.87 and confirmed by a value of the Krippendorff’s alpha reliability equal to 0.79. The intra-observer variabilities on MSCT reconstructions were excellent with the coefficient of Gamma equal to 0.86 and confirmed by a value of the Krippendorff’s alpha reliability equal to 0.79.

The inter-observers variabilities on dry bones were good with the coefficient of Gamma ranging from 0.73 to 0.91 and confirmed by a value of the Krippendorff’s alpha reliability ranging from 0.68 to 0.83. The inter- observers variabilities on MSCT reconstructions were excellent with the coefficient of Gamma ranging from 0.82 to 0.88 and confirmed by a value of the Krippendorff’s alpha reliability ranging from 0.78 to 0.86.

Concerning the inter-method evaluation for the first observer (student), the value of the Krippendorff’s alpha reliability ranged from
1.55 to 0.71. The agreement between phase estimation for both methods was acceptable, even good.

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For the second observer, the value of the Krippendorff's alpha reliability was equal to 0.69. Consequently the agreement between estimations of phases for both methods was significant.

For the third observer, the value of the Krippendorff's alpha reliability was equal to 0.71. Consequently the agreement between phase estimations of phases for both methods was significant.

Discussion: Concerning the inter-observers variabilities, results were better on MSCT reconstructions.

Concerning the intra-observer variabilities, results were equal for both methods.

The inter-method error varied according to the observer. Evaluations of phases for both methods were seldom made with a perfect concordance. Percentage of evaluation with a difference of one phase (more or less) varied from 64% to 81%, what is correct.

For phases 4 or more analysed on dry bones, observers had tendency to under estimate the phases on the MSCT reconstructions.

Some explanations about this were made:

- the thickness of the wall of the sternal end of the rib is sometimes difficult to be evaluated on MSCT reconstructions;
- porosity of the bone is not estimable on MSCT reconstructions;
- but analysis of fragile osteophytes on MSCT reconstructions is excellent.

Conclusion: Using MSCT reconstructions of the sternal end of the fourth rib in order to estimate the phase and therefore the age of a person using the Iscan method is possible and seems to be efficient.

This study is a preliminary study and analysis on a larger population is necessary to evaluate real possibilities of age estimation on MSCT images.

Rib, Computed Tomography, Age Assessment

 ** Presenting Author*