H139   Personal Identification Using Part-to-Part Comparison of the Third Lumbar (L3) Vertebra From Antemortem and Postmortem Computed Tomographic (AMCT and PMCT) Scans

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Learning Overview: After attending this presentation, attendees will have gained a deeper understanding of the usefulness of part-to-part comparison of anatomical features comparing AMCT and PMCT.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing the results of the initial findings of an ongoing study utilizing part-to-part comparison of the lumbar vertebra for personal identification. This presentation will examine the real-world application of using CT-derived 3D models of the L3 vertebra of AMCT scans of known individuals and compare them against true PMCT scans to establish the validity of using this technology for personal identification.

The confirmation of identification for an unknown individual is a critical part of forensic practice. The comparison of antemortem and postmortem imaging for the purposes of personal identification is a common tool in a variety of techniques such odontology and other radiographic comparisons. An earlier pilot study was conducted as a proof of concept using antemortem and simulated postmortem 3D-rendered lumbar vertebra comparisons as a means for identification of an unknown individual.[1] The current study utilizes AMCT scans of known individuals and compares them against true PMCT scans of the same individuals.

The University of Leicester, East Midlands Forensic Pathology Unit utilizes PMCT extensively as part of their daily forensic practice. As part of this ongoing project, Leicester acquired ten matching antemortem scans for individuals that passed through their facility for PMCT scanning. The University of Leicester anonymized the scans so researchers at the University of South Florida were blinded to the identities of the AM and PM scans. Each scan was imported into the Mimics Innovation Suite v. 24 (Materialise) for 3D modeling. The L3 vertebra was then isolated and modeled via segmentation and thresholding. Each series of ten AM vertebra were registered with a target PMCT-derived vertebra. A part-to-part comparison was conducted for each vertebra, and a percent match was measured. A threshold of +/- 1mm was set for the part comparison. Every unknown PMCT L3 was correctly matched to the corresponding AMCT L3, signifying complete accuracy for this sample.

A Receiver Operator Curve (ROC) curve was calculated to determined 100% sensitivity and specificity with a cutoff point of 73.5% percent match. True identifications had an average percent match of 94.8% +/- 5.6%. Negative identifications had an average percent match of 35.7% +/- 11.4%.

The results of this study indicate a positive correlation with using part-to part comparison for identification purposes. The next phases of this study will examine all lumbar vertebrae from L1 through L5. Additionally, future directions will examine other regions of the body as well as other imaging modalities. With the increased usage of PMCT, there is an equal increase in the availability and opportunity to utilize 3D tools, such as part-to-part comparison, for the successful identification of unknown individuals in a forensic setting.

Reference(s):

1.   Decker S.J., Ford J.M. Forensic personal identification utilizing part-to-part comparison of CT-derived 3D lumbar models. *Forensic Science International*. 2019 Jan 1;294:21-6.

Postmortem CT, Disaster Victim Identification, Lumbar Vertebrae

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