H123 The Utility of Postero-Anterior Chest Radiographs and the Cervico-Thoracic Junction for Human Identification

Carl N. Stephan, PhD*, *JPAC-CIL, 310 Worchester Ave, Bldg 45, Joint Base Pearl Harbor-Hickam, HI 96853; Pierre Guyomarc'h, PhD, JPACCIL, 310 Worchester Ave, Bldg 45, Joint Base Pearl Harbor-Hickam, HI 96853; and John E. Byrd, PhD, 95-033 Hokuiwa St, #51, Mililani, HI 96853-5530*

After attending this presentation, attendees will have an appreciation for the accuracy, sensitivity, specificity, and predictive values that postero-anterior chest radiographs offer for identification using osteology of the cervico-thoracic junction (clavicles and the C3 – T3 vertebrae).

This presentation will impact the forensic science community by providing key validation data for the aforementioned methods in respect to a large radiographic sample (1,178 antemortem chest radiographs) and 10 analysts (five trained and five untrained).

Comparisons of Antemortem (AM) and Postmortem (PM) chest radiographs have long been undertaken for human identification purposes. The number of radiographs used in past validation tests has often been small ($n<100$) and the opportunities for true positive matches limited (i.e., small samples of known individuals with correctly matching radiographs have been used ($n<50$)). This also applies to recently proposed and standardized methods that employ the clavicles and the C3 – T3 vertebrae. This study aims to redress this situation with a blind test that employs 589 pairs of postero-anterior AM chest radiographs (299 pairs representing the same individual or correct matches) and ten individuals who served as analysts. Five of the analysts were trained in the chest radiograph comparison methods (Joint POW/MIA Accounting Command Central-Identification Laboratory (JPAC-CIL) competency certified), and five analysts had not successfully completed the training and/or were yet to undertake it (untrained). The pairs of radiographs, which were 1940s photoflurographs of military inductees, were sequentially presented on a computer to each analyst, one at a time, with the question: do these radiographs represent the same or different individuals? None of the 1,178 radiographs represented duplicates; that is, radiographs of the same individual were taken by different radiographers on different days. A mask was applied to each chest radiograph to limit the analyst's view of the radiographs to the clavicles and the C3 – T3 vertebrae. Analysts conducted their examinations of the pairs back-to-back wherever possible and a 10 min break every hour was awarded.

Trained analysts completed the radiograph array in a mean time of 206 min (breaks not included; sd=24 min). Untrained analysts completed the array in a mean time of 256 min (breaks not included; sd=97 min). Untrained analysts, therefore, held the fastest and the slowest times. Trained analysts possessed: a mean efficiency (correct classification rate)=0.89; sensitivity=0.93; specificity=0.85; positive predictive value=0.89; negative predictive value=0.92. The total number of correct and incorrect responses for the trained group differed to chance at statistically significant levels (c^2 1074, df=1, $p<0.01$). The untrained analysts performed slightly worse, mostly due to a higher rate of false positive calls: mean efficiency=0.85; sensitivity=0.86; specificity=0.83; positive predictive value=0.87; negative predictive value=0.88. This result was also different to chance (c^2 =1074, df=1, $p<0.01$) and different to the results of the trained analysts (c^2 =24, df=1, $p<0.01$) at statistically significant levels. Two of the untrained individuals who could spare the time to be trained increased their performances on the test two-weeks later by significantly reducing their false positive rate, to call true negatives: mean efficiency=+0.11; sensitivity=-0.04; specificity=+0.27; positive predictive value=+0.19; negative predictive value=-0.02. This degree of improvement was not observed by the four trained analysts who repeated the trial after a two-week period: mean efficiency=-

0.03; sensitivity=+0.03; specificity=-0.10; positive predictive value=-0.06; negative predictive value=+0.02.

These results indicate that clavicles and the C3 – T3 vertebrae, visible on AM postero-anterior chest radiographs, can be used as accurate markers of an individual's identity. Untrained individuals can undertake the methods with a high degree of certainty for correct answers; however, trained analysts perform better with fewer false positive responses overall. With training, untrained analysts are observed to improve in the same direction as trained analysts. These results hold significant ramifications for the identification of unaccounted for individuals from the Korean War, 72% of whom are represented by chest radiographs, buried as unknowns at the National Memorial Cemetery of the Pacific.

Validation Test, Chest Radiographs, Human Identification