G74 Microscopic Soft Tissue Decomposition and Time Since Death

Murray K. Marks, PhD, and Mariateresa A. Tersigni, MA, University of Tennessee, Department of Anthropology, 250 South Stadium Hall, Knoxville, TN 37996; and Darinka X. Mileusnic, MD, PhD, University of Tennessee Medical Center, Knox County Medical Examiner's Office, 1924 Alcoa Highway, Knoxville, TN 37920*

After attending this presentation, attendees will understand the histological soft tissue demise associated with long-term understanding of rigor mortis.

This presentation will impact the forensic community and/or humanity by qualifying the changes that occur at a histological level as a body decomposes; specifically, the temperatures at which each of the layers of tissue lyse during this process.

Introduction: The stages of human soft tissue decomposition are universally accepted as autolysis and putrefaction with subsequent macroscopic disfigurement. While the visual signals have been long recognized and appreciated by pathology, the schedule and precise histological deterioration of epidermal, dermal, fat, and muscle tissue have never been quantified let alone qualified. And, even though biochemistry characterizes these events, this study focuses only on structure. This study provides a longitudinal histological validation of the process in order to more accurately design future research regarding soft tissue decomposition.

Materials and Methods: At the outdoor decomposition research facility at The University of Tennessee, eight identical landmarks on six cadavers were biopsied for two weeks following death, and examined with light and electron microscopy for temporal patterning. These sites were the ventral chest (pectoral region), shoulder (deltoid region), ventral upper arm (biceps), ventral forearm (flexors), lateral hip (gluteal), ventral upper leg (rectus femoris), dorsal lower leg (gastrocnemius/soleus), and sole of foot (plantar aponeurosis/flexor digitorum brevis). Each site was biopsied once each day for the 14 day period. Biopsy sites were paraffin sealed, and adjacent puncture sites selected during the decomposition process. Biopsies were prepared by routine formalin-fixed histological methods at The University of Tennessee Medical Center and examined using a Leica ZX900 light microscope and an Olympus XNC environmental scanning electron microscope.

Results: The cell death associated with decomposition more closely resembles the characteristics of clinically documented cell necrosis as opposed to the apoptotic events of programmed cell death. That is, the cells of decomposing tissue go through an expansion and explosion process, which causes a breakdown of the cell membrane resulting in the expulsion of their cytoplasmic contents into the extracellular matrix rather than simply shriveling into a condensed mass and breaking apart as in apoptosis. Each of the layers (epidermis, dermis, lipid and muscle fibre) experience the same type of cell death, although they do not occur in the same temporal period. The loss of muscle fibre structure was observed at 270 degree days. The epidermis structure was lost at 150 degree days. The dermis cell structure was maintained until 230 degree days. Fat cell structure was last to fail at 450 degree days.

As part of a recent endeavor to understand the cellular aspect of soft tissue decomposition, this study provides validation of the cellular death process that is the hallmark of initial decomposition. Thus, this research provides a baseline for future experimental design.

Time Since Death, Soft Tissue Decomposition, Histology

 ** Presenting Author*