H76 Postmortem and Perimortem Fracture Patterns in the Long Bones of Deer

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After attending this presentation, attendees will have more information on fracture patterns of long bones in deer to help elucidate the interval between perimortem and postmortem.

Forensic anthropologists need to be cautious in their determination of perimortem vs. postmortem trauma. This study of deer long bones suggests that some of the fracture patterns utilized in making a determination of perimortem or postmortem trauma may not be "cut and dry."

If perimortem breaks have green bone response due to their greater moisture content and if it is possible to preserve this moisture content in a postmortem environment, then postmortem bone breaks may mimic "perimortem" breaks.

The perimortem interval is of great interest to forensic anthropologists and the line separating it from postmortem trauma can be unclear, Maples (1986), for example, called "the perimortem interval an elastic interval at best and a vague concept at worst." The moisture content of bone is said to be a major factor determining fracture patterns (Johnson, 1989). So called green or "wet" bone is more flexible; it contains fresh marrow and has a greater energy-absorbing capacity than "dry" bone before failure. It has also been stated that the biomechanics of fractures on whole bones is rather limited (Lyman, 1994). A bone trauma experiment was designed to test these ideas and to provide further information on fracture patterns.

There are three samples of sub-adult and adult white-tailed deer that were obtained from local deer processing plants and broken on Feb. 7, 2003. Group 1: Femora and humeri from 17 animals killed on the 15th or 16th of December, 2002. These bones were never frozen and they were put outside on a wooden platform on Dec. 24th for 44 days before they were fractured. The average low for that period was 32.5 degrees F. and the average high was 51 degrees F. The temperature went below freezing on 20 days. The postmortem interval is 52-53 days. Group 2: Femora and humeri from 8 animals killed on Jan. 20th were frozen and then thawed before they were broken. The postmortem interval is 18 days. Group 3: Femora and humeri from 5 animals killed on Jan. 31st, and from 2 animals killed on Feb. 7th, and from one animal killed on Feb. 3rd. These bones were never frozen and the postmortem interval is less than one week.

Measurements made before breakage include: total length, lateral and anterior-posterior width, and weight. Video of the breakage and photographs of the bones after breakage were recorded. A Dynatup 8250 Drop Weight Impact Test Machine applied a compressive force weighing
11.3 kilograms. The drop height varied and variables, such as load/velocity curves to impact, load to failure, time to failure, and energy to failure were recorded. The striking surface of the impactor is three inches by four inches. The proximal end of the bone was held in a vice and the other end was placed on a platform. The bones were cleaned and processed with Biz, baking soda and ammonia.

Fracture patterns of the proximal and distal ends of the long bones were examined. Only one bone in the sample broke in half and the features of this bone were only scored once. The following features that are sometimes said to indicate perimortem trauma were examined (Villa and Mahieu, 1991). Some of these are: fracture angle on the z axis, fracture surface morphology, fracture outline, sharp edges, and the presence of fracture lines. The attribute states recorded for fracture angle are 1) oblique (obtuse or acute); 2) right; 3) oblique and right (mixed). Fracture surface or edge morphology was classified as smooth or rough. Fracture outline was classified as: 1) transverse, fractures are straight and transverse to the long axis of the bone; 2) curved, spiral or helical fractures, and V-shaped or pointed fractures, and 3) intermediate, fractures have a straight or single plane morphology but are diagonal, and fractures with a stepped outline. Fractures on or near epiphyses were not considered. Fracture edges were classified as sharp or right angle and fracture lines were recorded as present or absent.

The results are as follows. In regards to the first feature, Group 1) bones exhibited 2 oblique fracture angles, 24 right angles and 6 mixed. Group 2) bones exhibited 3 oblique angles, 7 right angles and 6 mixed and Group 3) exhibited 9 oblique angles, 3 right angles, and 4 mixed angles. The fracture surface morphology of all three groups was rough. While some bones had a fine surface they also had uneven surfaces with crests and waves. In regards to fracture outline, Group 1) bones had 9 transverse, 7 curved, and 16 intermediate outlines. Group 2) bones had 5 transverse, 5 curved, and 5 intermediate outlines and Group 3) had 1 transverse, 15 curved, and 0 intermediate outlines. In regards to fracture edges, all 17 of the Group 1) bones had some sharp edges while 12 of the bones had some right angles. Eight of the Group 2) bones had some sharp edges and 6 of them had some right angles. All of the Group 3) bones had some sharp edges and 5 of them had some right angles.

Fracture lines were present on 8 of the Group 1) bones and absent on 9 of them. Five of the Group 2) bones have fracture lines and 3 do not and all of the Group 3) bones have fracture lines.

The determination of perimortem or postmortem trauma is difficult based on the fracture patterns of deer long bones examined in this study. Some of the bones fractured almost two months after death exhibit

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patterns that are sometimes said to indicate perimortem trauma. These patterns are: oblique angles, curved or helical fracture outlines, sharp edges, and fracture lines. Further study of fracture patterns and their depositional environment is necessary.

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