



Pathology & Biology Section – 2005

G66 Autopsy Findings in Hypothermia: A Five Year Retrospective Study

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After attending this presentation, attendees will understand the anatomic, toxicological, and investigatory findings associated with hypothermia deaths during the past five years in Maryland.

This presentation will impact the forensic community and/or humanity by providing information on the findings associated with hypothermia deaths with special emphasis on the gross autopsy findings.

To date, there are no recognized pathognomonic findings in hypothermia-associated deaths. Certain findings have been seen in greater frequency in hypothermia. These include paradoxical undressing, gastric mucosal ulcers, hemorrhagic pancreatitis, and pulmonary edema. It has been suggested that gastric ulcers and pancreatic changes are seen more frequently following resuscitation. Paradoxical undressing occurs when the body temperature is low, presumably causing mental confusion, possibly giving the sensation of extreme warmth, and leading to the removal of one's clothing. This confusion may also lead to a characteristic pattern of bruising on the extremities (elbows, wrists, hands, knees) as one wanders about in a confused state.

This poster will present the findings from a retrospective review of 145 cases investigated by the Office of the Chief Medical Examiner for the state of Maryland during the years 1999-2003, in which hypothermia was the cause of death or a contributory cause of death. The cases were assessed for association with drowning, natural disease, ethanol and drug intoxication, appearance of gastric ulcers, gross hemorrhagic changes of the pancreas, combined lung weights, evidence of paradoxical undressing, and contusions of the extremities.

Of the 145 cases, 19 were not included due to incomplete available data. Of the remaining 126 cases, 13 (9.7%) were associated with drowning. Only one of the drowning cases showed evidence of gastric ulcers. None had pancreatic changes. As expected, average combined lung weight was increased at 1067 grams (range 410-2310). Five of the 13 (38.5%) had ethanol levels over 0.08 g/dL. Drug intoxication was not noted in any of the drowning cases. Natural disease contributed in one case. Paradoxical undressing and contusion patterns on the extremities were not observed in the drowning cases.

Of the remaining 113 non-drowning cases in which full autopsy examinations had been performed, 83 (73.5%) were male with an average age of 56 years (range 19-91). Natural diseases such as cardiovascular disease, acetonemia, and dementia were associated with 59 (52.2%) of cases. Ethanol levels were over 0.08 g/dL in 33 (29.2%) cases. In 17 (15%) cases, drug intoxication contributed to death. Drugs involved included morphine, cocaine, methadone, meperidine, trazadone, oxycodone and acetaminophen.

Stomach ulcers were seen in 39 (34.5%) of the cases. Of these 39, 11 (28.2%) had been resuscitated. Sixteen (14%) of the 113 cases had gross visible changes in the pancreas. Of these 16, 5 (31.3%) had been resuscitated. Resuscitation occurred in 14 (12.4%) of the 113 cases in which no changes in the pancreas or stomach were noted. The average combined lung weight was 1050 grams, with a range of 400 to 2710 grams.

Paradoxical undressing occurred in 6 cases, with an additional 8 more potential cases (combined 12%). Pink-brown bruising was noted on the upper extremities in 24 (21%) cases and on the lower extremities in 25 (22%) cases. The contusions were often on the elbows, posterior wrists, the backs of the hands, and knees. Of the 14 total cases of potential paradoxical undressing, only 4 were associated with these contusions. Therefore, this pattern of bruising may represent a different type of confusional state possibly different than the thermoregulatory disturbances.

Hypothermia as a cause of death can only be determined through thorough investigation, as there are no autopsy findings which are noted in all cases. However, this study does provide further confidence in the diagnosis with the presence of other findings. The gastric ulcers were the most frequently associated finding. The contusions on the upper extremities and lower extremities, especially on the posterior surfaces of the arms, wrists and hands, are the next most common findings. Gross changes of the pancreas, visible as hemorrhage, were also noted, but less frequently. The pulmonary edema was difficult to assess as many of the hypothermia cases also had heart disease and drug and alcohol intoxication contributing to the cause of death. Paradoxical undressing, while uncommon, remains a real phenomenon that is potentially confused with criminal acts.

Hypothermia, Paradoxical Undressing, Gastric Ulcers