



H10 “Hot Deaths”: A Review of Foggia Hyperthermia Cases

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Learning Overview: The goal of this presentation is to show that in deaths related to hyperthermia, even if caused by different situations, it is possible to reach a diagnosis through the study of some microscopic findings.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating that similar microscopic evidence can be found in heat-related deaths, suggesting the use of these postmortem analyses in similar cases.

Hyperthermia is a condition characterized by an uncontrolled increase in body temperature, which the human body can not dissipate. Exposure to excessive heat usually determines an activation of the hypothalamic thermoregulatory centers, which are activated to favor the dispersion of heat through vasodilatation and sweating. If this does not happen, there is a disruption of the thermoregulation systems, and, therefore, there is rapid multi-organ failure, which leads to death.

This study presents three cases of fatal hyperthermia, analyzed by the Department of Forensic Pathology of Foggia. The first case concerns a 26-year-old Romanian girl, treated for a depressive disorder, who was found immersed in hot water in a bathtub. The toxicological analyses performed on the girl's blood revealed the presence of high concentrations of alcohol. The intake of high doses of alcohol leads to a state of deep lethargy; therefore, the girl, not feeling the excessive heat of the water, in a state of acute intoxication, could not get out of the bathtub. During the crime scene investigation, conducted six hours after the discovery of the corpse, the water temperature was 30°C, while the cadaveric temperature was 43°C.

The second case is that of a 51-year-old man who worked aboard a fishing boat. During a very hot day, around 2:00 p.m., he began to be confused, with garbled speech, until losing consciousness shortly thereafter. Death was attributed to a heat stroke.

The third case is related to a 47-year-old man, a prisoner and ex-drug addict in methadone and neuroleptics therapy, who was found lying on the bed with a high fever while wearing nine wool sweaters. Subsequently, he was transported to the hospital in a comatose state, with a body temperature of 42.8 °C; he died a few hours later.

Presented are three different causes of death related to hyperthermia (immersion of the body in hot water, heat stroke, and intake of neuroleptics), but these all have in common some histological and immunohistochemical findings. Heat Shock Proteins (HSP 27, HSP 70, and HSP 90) were conducted on skin samples; anti-myoglobin antibodies were conducted on kidney and muscle tissue samples. There was widespread poly-visceral stasis. In the brain, edema and acute stasis were documented. The lungs had notable edema, acute stasis, and acute emphysema with septal rupture. The analysis of the skin demonstrated intense positivity to HSP 27 and HSP70. The muscles exhibited plenty of rhabdomyolysis and vacuolization of the muscle fibers. In the muscle and renal sample, tested with the anti-myoglobin antibody, intense positivity was demonstrated. The renal tubules were filled with myoglobin cylinders.

It is common to observe diffuse stasis and acute edema of the brain and the lungs, as well as the cutaneous positivity of HSP 27, HSP 70, and HSP 90. HSPs are proteins that are synthesized especially in response to various forms of cellular stress, such as high temperature, infections, free radicals, and biomechanical forces, to protect proteins from denaturation. In addition, HSP inhibits cell apoptosis induced by various stimuli, including the thermal stimulus, being detected early in case of exposure to heat. The expression of HSPs is related to the time of exposure to heat. Indeed, HSP 27 is the earliest to appear. The positivity to anti-myoglobin antibodies in muscle and the kidneys is also important to detect massive rhabdomyolysis.

Heat Shock Proteins, Hyperthermia, Anti-Myoglobin Antibodies