

K15 New Perspectives in Postmortem Diagnosis of Acute Heroin Abuse

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Learning Overview: The goal of this presentation is to provide an overview of the methods useful for the postmortem diagnosis of heroin abuse, with particular reference to immunohistochemistry.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating that the availability of anti-heroin antibodies is able to take care of all situations in which there is no possibility of carrying out toxicological analyses.

Heroin, a semi-synthetic opioid drug synthesized from morphine, is the 3,6-diacetyl ester of morphine (diacetylmorphine). It is 2–3 times more potent than morphine, and the estimated minimum lethal dose is 100–200mg, but users may be able to tolerate up to 10 times as much. Compared to morphine, heroin is a more lipophilic compound and crosses the blood-brain barrier within 15–20 seconds and achieves relatively high brain levels; 68% of an intravenous dose is absorbed into the brain.

Heroin related-death can occur from: (1) absolute acute poisoning (intake of a quantity of heroin superior, in an absolute sense, to any tolerance); (2) acute intoxication related to tolerance (intake of a quantity of heroin greater than the degree of tolerance of the subject); and (3) first injection death (taking a lethal dose in a non-drug addict).

Toxicology data is certainly of greater importance for the diagnosis of heroin-related death, but, frequently, the conclusion of a heroin-related death is based upon a combination of scene investigation, physical examination of body, and the autopsy, as well as histological and toxicological findings. Postmortem diagnosis of heroin-related death, especially in the forensic field, could be a problem when it is not possible to perform toxicological data because blood or/and urine are absent.

The goals of this study are to evaluate the correlation between the concentration of heroin in the blood, bile, and urine in heroin-related death and an immunohistochemical study of heroin antibodies.

The toxicological data and the autopsy records of the 200 autopsies of drug related-deaths performed at the Departments of Forensic Pathology of the University of Rome over the period 2014–2020 were evaluated, and 14 cases of heroin-related deaths were selected (12 men, 2 women, mean age 44.4 years). The postmortem delay interval was ≤ 36 h in each case. Cases with toxicological data positive only for heroin and negative for other drugs (ethanol included) with postmortem examinations confirming diagnosis of heroin-related deaths were selected for this study. All cases presented high antemortem serum morphine values (a morphine concentration before death over 17ng/mL).

An experimental model and immunohistochemistry were used to investigate postmortem anti-heroin antibody expression in heroin-related deaths. The chosen analytes were morphine (free), morphine (total), and 6-monoacetylmorphine. Macroscopic and microscopic pathological findings in cases of heroin-related deaths are non-specific and may be inadequate to render a definitive diagnosis for forensic purposes. It is therefore evident that heroin-antibody positivity in kidney tubules, in hepatocytes, and in liver ducts would represent a normal physiological finding related to the elimination of metabolites of the heroin from blood circulation, and, in fact, an indirect finding of the elevated heroin concentration.

Finally, these findings on lung samples showed that positivity in the cytoplasm of myelomonocytes and in the intra-alveolar spaces can be correlated with acute respiratory depression heroin-related deaths.

Heroin-Related Death, Immunohistochemistry, Postmortem Diagnosis