K17 Two Cases of Suicide in Nurses by Atracurium: Revealed by LC/ESI/MS

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The goal of this presentation is to show two suicidal cases of atracurium in nurses, revealed by Liquid Chromatography/Electrospray Ionization/Mass Spectrometry (LC/ESI/MS). The analytical method and the postmortem toxicological concentrations of atracurium and laudanosine revealed in both fluids and tissues are discussed.

This presentation will impact the forensic science community by showing the importance of an analytical method developed for simultaneously quantifying postmortem of atracurium and its metabolite laudanosine in two suicidal cases.

Atracurium is a non-depolarizing skeletal muscle relaxant. It is a derivative of curare, a plant extract prepared from many different plants of the Amazon forest, used by the natives of the area as a poison arrow for hunting and war. It is used to facilitate endotracheal intubations and to relax skeletal muscles during surgery or mechanical ventilation. It is available as a 1% solution of the besylate salt for intravenous administration. It can be fatal in any concentration due to respiratory failure, so controlled ventilation is necessary. Following an intravenous dose, the muscles begin to relax within about two minutes and the effect lasts for 15 min – 35 min, depending on the dose. The drug is excreted in urine and bile, and its elimination half-life is around 20 min.

This presentation concerns two lethal cases of polydrug intoxication, both positive for the atracurium:

- The first case (named "A") involved a nurse of the Emergency Unit found dead in his home. Near his body, a syringe containing few cc's of colorless liquid and an empty blister pack of tablets of midazolam were found.
- The second case (named "B") involved to a nurse found unresponsive in the hospital where he was employed. Near his body, a syringe containing 11cc's of colorless liquid and an empty bottle showing the words "sodium pentothal" were found.

A comprehensive toxicological screening was performed on postmortem cardiac blood, urine, bile, and tissue homogenates (liver, heart, and kidney) using a combination of immunoassay and chromatographic techniques.

In detail, in both cases, lethal concentrations of midazolam were confirmed in biological fluids and tissues of the body A, while the presence of thiopental was revealed in biological fluids and tissues of the body B.

Since atracurium degradation occurs rapidly *in vitro* by the same hydrolysis mechanism observed *in vivo*, and it is accelerated by an alkaline pH and high temperatures, and given its simultaneously precharged yet lipophilic nature, detecting low atracurium levels in human postmortem samples is a challenge.

A method was developed for simultaneously quantifying low levels of atracurium and its less polar metabolite laudanosine in postmortem blood, bile, urine, and tissues by LC/MS in an ion trap mass spectrometer under positive ion ESI conditions. Analytes were isolated from blood and tissues by solid-phase extraction using Bond-Elut Certify columns. The method proved selective and sensitive, and was validated in postmortem blood, bile, urine, heart, kidney, and liver in the range of 1 – 2000ng/mL (blood) and 5 – 5000ng/g (tissues). The proposed method was fully validated with respect to previously published LC/MS methods.

Lethal concentrations of atracurium and laudanosine were confirmed in all the biological fluids and tissues of both bodies. The presence of atracurium was also confirmed by toxicological examination of the colorless liquid found in syringes.

Based on the autopsy findings, case history, and toxicology results, the forensic pathologists ruled that the cause of death in both cases was an overdose of atracurium in combination with midazolam for body A and thiopental for body B; the manner of death was suicide.

Atracurium and Laudanosine, Liquid Chromatography, Toxicological Finding

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