G133 Cause of Death Following Opiate Overdose: A Forensic Epidemiologic Investigation of Comparative Risk

Michael Freeman, MD, PhD, 425 NW 10th Avenue, Ste 306, Portland, OR 97209; and Paul Cahn, MD, MSc*, 425 NW 10th Avenue, Ste 306, Portland, OR 97209

The goal of this presentation is to familiarize attendees with the concept of comparative risk, a method of causal assessment used in forensic epidemiology, and to demonstrate its application to the investigation of the cause of a death following an alleged act of medical negligence.

This presentation will impact the forensic science community by demonstrating a method of quantifying competing causes of death using epidemiologic data and comparative risk methodology.

An accurate determination of cause of death is central to the resolution of civil and criminal investigations of wrongful death. A fact-finder determination regarding the competing testimony is often reliant, in part, on the qualifications and persuasive abilities of the expert rather than an objective means of comparing the differing opinions. It is well established that a lack of evidence-based practice in forensic medical practice can lead to opinions that rely entirely on an expert's personal medical judgment, which is inherently biased by the experience, or lack thereof, of the clinician with the specific circumstances of a case.

Forensic epidemiology is the subdiscipline of both epidemiology and forensic medicine that is directed at quantifying competing risks of injury or disease that are present in a specific set of circumstances in order to provide an estimate of the likelihood of a specific cause of an injury or disease. The methodology is useful when there are competing causes acting on an individual and, thus, likelihood of causation can be quantified by a metric called "comparative risk." In cases of death following an alleged act of medical negligence, a common competing cause of death is the pre-existing co-morbidity of the patient. The central question in such cases often the "but for" question: But for the exposure to the alleged negligence, what is the chance the individual would have died at the same time?"

Case Presentation: A 55-year-old White male sustained a left distal tibia and proximal fibula fracture in a low-level fall from a ladder. His only significant medical history was of hypertension that was controlled with medication. He was taken to a local hospital and admitted for pain control with intravenous Dilaudid[®] (hydromorphone), then underwent Open Reduction and Internal Fixation (ORIF) for the fractures. Within the first 22 hours postoperatively, the man also was administered 60mg of OxyContin[®] and 50mg of regular-release oxycodone, along with temazepam, intravenous morphine, and hydromorphone. Less than 24 hours after the surgery, the man was discharged home, and approximately 10 hours later he was discovered non-responsive at his home, and could not be resuscitated.

Postmortem toxicology results indicated a serum oxycodone level of 0.31 micrograms per milliliter. It was also determined that the man had a dilated cardiomyopathy. The cause of death was ruled "cardiomyopathy and drug intoxication with oxycodone."

The comparative risk question consisted of the risk of death due to opiate intoxication versus the risk of death due to an asymptomatic dilated cardiomyopathy occurring coincidentally at the same time, but unrelated to the opiate exposure. In order to assess the death rate for cardiomyopathy, this study first estimated the cardiomyopathy-related death rate in the sex and age group of the decedent, and compared this to the prevalence of the condition in the same population.[1-3] The annual death rate is 12.3 per 100,000 among 237.6 men per 100,000 men of the same age. Thus, 1 in 19.3 men aged 55-64 years old with a diagnosis of cardiomyopathy die in a given year. Therefore, during a ten-hour time frame during the year, the death risk for such a man would be 1 in 16,907 (the annual rate divided by the number of ten-hour periods in the year).

In comparison, the 0.31mg/l of oxycodone is within the range of fatal reactions (lower boundary 0.25mg/l) and more than ten times the level when drug combinations present (lower boundary 0.025 mg/l).[4] Therefore, while the risk of death due to opiate toxicity in combination with temazepam in a man with cardiomyopathy, is not precisely known, it is certainly greater than 1 in 1,000, and likely greater than 1 in 100. Using the most conservative value, the comparative risk analysis favors the opiate toxicity as the cause of the death by nearly 17 times, versus the cardiomyopathy.

References:

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