First assumptions and overlooking competing causes of death

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INTRODUCTION:

Determining the most probable cause of death is important, and it is sometimes tempting to assume an obvious cause of death, when it readily presents itself, and stop looking for other competing causes of death. The case story presented here illustrates this dilemma. The first assumption of cause of death, which was based on results from bacteriology tests, proved to be wrong when the results from the forensic toxicology testing became available. This case also illustrates how post mortem computed tomography (PMCT) findings of radio opaque material in the stomach alerted the pathologist to the possibility of tablet ingestion.

CASE STORY:

A 13-year-old girl was one morning found dead in bed by her older brother. Her parents were divorced, and she and her older brother lived with their father, but were at the time visiting their mother. The girl had no history of physical or psychiatric illnesses, and did not use any prescription medication except ointment for psoriasis. According to her mother, she was healthy and happy, and had not spoken of suicide. They had been at a family party followed by an uneventful evening at home watching TV together before bedtime. The girl showed no signs of discomfort, and had not complained of any symptoms. The scene was unremarkable. There were no empty pillboxes at the scene or in the waste container. No suicide note was found, and there were no suicidal messages on her cell phone. PMCT showed pulmonary edema and precipitation of a radio opaque material in the stomach. A full autopsy, that was performed 50 hours after she was found dead, showed no injuries and no signs of pathology apart from a 3 cm ovarian cyst and few spots of psoriasis on the skin. The precipitate in the stomach could not with certainty be identified as tablet residues at the autopsy. C-reactive protein (CPR) was low (<8 mg/l). Tissue samples were taken for histology. Central blood, cerebrospinal fluid and tissue from lungs, liver, spleen and heart were taken for bacteriology and virology. Peripheral blood, liver tissue and stomach content were taken for toxicology. A fibroblast culture was grown from an Achilles tendon biopsy and frozen for genetic testing if needed. After a week the forensic pathologist received a telephone call from the department of clinical microbiology at Odense University Hospital informing him that toxin-producing group A

β -hemolytic streptococcus (GABHS, *Streptococcus pyogenes*) had been found in all samples, and that this was a probable cause of death. At this time a full histological examination of all organs, muscle and skin had been performed. A benign ovarian cyst and psoriasis were diagnosed, but no infectious foci were found. The organs were somewhat decomposed and areas of post-mortem bacterial growth were noticed in the lungs. The microbiologist suggested that the infectious focus could be a spot of psoriasis not sampled for histology. The police investigator, who had shown great interest in the case, was informed of this finding, but it was agreed not to inform the relatives until all test results were available. Toxicology results emerged a few weeks later and disclosed a lethal concentration of nortriptyline, a tricyclic antidepressant (TCA), in liver tissue (51,3 mg/kg) and blood (5,3 mg/kg) and a small amount of amitriptyline (0,01 mg/kg) in blood, probably as a degradation product. The finding of radio opaque material in the stomach at PMCT prompted requisition of a toxicological analysis of the stomach content, which showed an extraordinary high concentration of nortriptyline (976 mg/kg), thus confirming that the radio opaque material in the stomach was tablet residues. The cause of death was then assumed to be nortriptyline poisoning, and after further police inquiries the mode of death was established as suicide.

Figure 1. CT-scanning of the abdomen showing radio opaque material in the stomach (green arrow)

DISCUSSION:

Nortriptyline can, apart from its use as an antidepressant, also be used in the treatment of chronic pain [1], which the mother had suffered from since a whiplash injury. The medication was kept in an unlocked cupboard in the kitchen. The concentrations of nortriptyline in liver and blood were similar to those found in other cases of lethal nortriptyline overdose [2]. The manner of death still remained unclear: it could be a homicide, an accident or a suicide, but natural death could be ruled out. Further police inquiries did not suggest homicide, and the finding of a very high concentration of nortriptyline in the stomach favored the opinion that she had ingested the pills purposefully with suicidal intent. The analysis of the stomach content was requested because of the PMCT finding of radiopaque sediment in the stomach. We were the first to publish a case of such a PMCT finding [3]. Burke et al. [4] found a well-defined basal layer of radio dense material within the stomach in 19 of the 61 intentional overdose cases (31%) with a mean value across all cases of 146 Hounsfield Units (HU). In 3 of the 61 control cases (5%) an ill-defined increase in radio density was seen toward the basal layer of the stomach. They found a statistically significant difference in HU densities between the controls and the overdose case groups.

The question remained whether she had a concomitant septic infection or if the bacteriological finding of toxin producing group A hemolytic streptococci was a post mortem phenomenon?

Group A hemolytic streptococcus are reported to cause severe disease, including streptococcal toxic shock syndrome because of its toxin producing ability. The clinical presentation in a Canadian study [5] was most commonly that of soft-tissue infection, bacteremia with no septic focus or pneumonia,

whereas necrotizing fasciitis and toxic shock syndrome were less common. The study found the overall mortality rate to be 15%, and 81% in case of toxic shock. The mortality rates were highest for young children, elderly people, and individuals with underlying medical conditions such as HIV infection, cancer, diabetes, alcohol abuse or chickenpox.

Abundant growth of group A hemolytic streptococcus in post mortem samples will often represent true bacteremia [6], but in the present case post mortem spread of bacteria seem more likely. The girl was healthy and presented no symptoms on the evening before she died. It must be considered highly unlikely that she had developed a fulminant and lethal sepsis in such a short timespan. It is also not in accordance with the low CRP found at autopsy. CRP is predominantly synthesized in the liver and is secreted in increasing amounts within six hours of an acute inflammatory stimulus, and the plasma concentration will double at least every eight hours [6,7]. She was furthermore a young and healthy girl with no liver problems, alcohol abuse, or other medical conditions that could delay a CRP-response. The result of the histology confirms this opinion. No inflammation was found, but post mortem bacterial growth was discovered in the lungs.

CONCLUSION:

This case story demonstrates the importance of performing a full investigation before accepting a seemingly obvious cause of death. This is a particularly important point in a situation where the police due to budget cuts tends to cancel toxicology whenever possible. The PMCT finding of radio opaque material in the stomach alerted the pathologist to the possibility of tablet ingestion, and this use of PMCT is another important point.

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