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Opinion

Postmortem Biochemistry in Forensic Pathology

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Abstract

The purpose of this study is to demonstrate some helpful postmortem biochemistry applications to highlight the value of this field and to reaffirm the need of conducting biochemical investigations as a crucial step in the autopsy procedure. In five case reports, diabetic ketoacidosis in an adult with multiple psychoactive drugs present and no history of diabetes, fatal flecainide intoxication in a poor metabolizer with impaired renal function, diabetic ketoacidosis with severe postmortem changes, primary aldosteronism with intracranial hemorrhage, and severe postmortem changes in hypothermia are all discussed. The cases discussed in this article serve as illustrative examples of the significance of postmortem biochemistry investigations. These investigations may yield important data that is useful in determining the cause of death in routine forensic casework or contribute to understanding the pathophysiological mechanisms involved in the death process.

Keywords: Post-mortem biochemistry • Cause of death • Death process forensic pathology

Introduction

The 1940 publication of one of the earliest publications on forensic biochemistry dealt with the analysis of postmortem blood glucose levels. In this study (Postmortem glycolysis), Hamilton-Paterson and Johnson investigated fifty cases, including eight diabetics, seven of whom passed away in a coma, and measured the glucose concentrations in a variety of substrates, such as blood taken from various sampling sites (right auricle, pulmonary artery, and aorta), cerebrospinal fluid, and liver samples [1]. The findings of these investigations showed that blood from peripheral veins had undergone glycolysis, but glucose levels in cardiac blood from the right auricle were higher because of liver glycogenolysis [2]. Additionally, in diabetic people, blood from the extremities had greater glucose concentrations and postmortem glycolysis moved more slowly than usual [3]. Nineteen years later, Naumann published the first study on the chemical components of human vitreous humour (Postmortem chemistry on the vitreous body in man), which was previously only known from animal studies and research on eyes that had been removed [4]. This study compared the post-mortem chemistry of left heart blood, vitreous humour, and cerebrospinal fluid to the antemortem chemistry of cerebrospinal fluid and venous blood using 211 dead human bodies. Coe published an article titled "Postmortem" in 1993 [5]. In Chemistry Update: Emphasis on Forensic Application, he examined postmortem biochemistry and 15 years' worth of literature on the topic.

Coe emphasized the significance of systematic analyses of vitreous electrolytes, glucose, and urea nitrogen as useful methods that can provide significant information for establishing the cause of death and resolving forensic issues in many cases of natural death in his introduction, defining forensic biochemistry as "one of the more important ancillary procedures for the forensic pathologist." After an initial start of a diabetic coma, sudden death is quite uncommon. Normal diabetes symptoms include polydipsia, polyuria, polyphagia, and weight loss, however in extreme cases, untreated diabetes can cause a diabetic coma [6-8]. Based on the presence of high glucose values in vitreous (and cerebrospinal fluid) and ketone body increases in numerous substrates, including blood and vitreous humour, postmortem chemical studies can quickly identify fatal diabetic ketoacidosis patients. In the case at hand, a 37-year-old man named "A." was discovered dead at 9 p.m. on a Friday in a friend's ("B.") apartment, where he had been staying ever since arriving back in Switzerland. B. uncovered the fact that both people had smoked cocaine the day before. The day of the passing, A. B. spent the entire day in bed, where he was extremely exhausted and frequently passed out, did not experience any physical issues.

A. had lived in Switzerland up until five years before his death, when he made the decision to return to the United Kingdom, his own country. As a result, the person's most current medical records were unavailable. The medical professional who adopted A. in Switzerland said that he had prescribed mirtazapine for his patient's bipolar mania and psychosis, who also had hepatitis B and C, alcohol, cannabis, and heroin addiction. Additionally, he had been receiving 50 mg of methadone daily for two years before to leaving Switzerland [9]. The doctor acknowledged that this patient had undergone his last examination five years prior and that, since then, he had not heard from the patient.

These findings were supported by medical data that came from the neighborhood health services. A. was twice taken to the hospital after suffering minor injuries. He revealed to the doctors that he often consumes alcohol and cannabis, and that he continues to use heroin despite receiving methadone treatment. There was no medical information available for his last five years in the UK. But according to his parents, A. was not afflicted by any specific illness. His body was found face down in a bed when he was discovered dead, and a macroscopic external view at the scene of the death showed no signs of trauma [7]. The deceased was 62 kg and 177 cm tall. External inspection and radiology did not reveal anything noteworthy. His 350 g heart had a small amount of left ventricular hypertrophy and petechial hemorrhaging underneath the pericardium (average thickness, 1.6 cm). Overall, there were no fibrosis or ischemia regions in the myocardium, and the coronary arteries showed no morphological abnormalities. Each lung was obstructed (left, 700 g; right, 670 g). The liver was yellowish brown in color and weighed 2170 g, however no nodular lesions were discovered. There was 1020 ml of urine in the bladder.

Discussion

Is post-mortem biochemistry genuinely helpful, and if so, why aren't forensic pathologists using it more frequently? Can we respond to A's inquiries in his article, Luna? Our opinion is that post-mortem biochemistry perspectives need to be modified initially. When other investigative techniques (autopsy, neuropathology, histology, or immunohistochemistry after post-mortem computed tomography and angiography, for example) are unable to determine the cause of death, post-mortem chemistry should be used instead [9].

Given the reliability of this diagnosis using vitreous glucose, glycated haemoglobin, urine glucose, and blood or vitreous ketone bodies, it is now necessary to assess the ability to identify deadly diabetic ketoacidosis within the context of normal forensic pathology.

Additionally, all forensic pathologists must comprehend and take into account issues related to post-mortem procedures, artefacts that may arise during autopsy and sample collection, analytical methods, normal ranges, and result interpretation. It is impossible to misdiagnose deadly diabetic ketoacidosis in 2011.

Additionally, post-mortem biochemistry needs to be more commonly used. Employed in a variety of other forensic settings, notably to assist in determining the manner and cause of death as well as determining contributory factors and predisposing diseases. Additionally, it is important to keep in mind that post-mortem chemistry findings must be interpreted with extreme caution and that a single biochemical finding, taken independently, is useless without the support of other forensic findings [10]. We are adamant that post-mortem biochemical analyses must be incorporated into regular forensic investigations. Doing so would enable users to build rigorous databases with a large enough sample size to establish normal ranges for forensic autopsies and would enable this field to further develop its diagnostic potential.

Never should forensic pathologists give in to the urge to draw a straight connection between a single biochemical finding and a potential cause of death. Furthermore, it must always be remembered that biochemistry is a complimentary field that needs to be integrated with and evaluated in light of overall results. Thus, we draw the following conclusions: (1) routine use of post-mortem biochemistry should be encouraged; (2) wide integration of these procedures into forensic practises should be supported; and (3) post-mortem biochemistry can undeniably be valuable in forensic pathology operations [11].

Acknowledgments

We thank the patient for allowing the case description.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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