K23   Cases of Insulin Poisoning

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After attending this presentation, attendees will be briefed on cases of poisoning due to exogenous insulin administration and the measurement of insulin in forensic specimens.

This presentation will impact the forensic community and/or humanity by demonstrating the identification of insulin and C-peptide in forensic specimens.

Hypoglycemia caused by deliberate or inadvertent administration of insulin is a potentially lethal disorder. Self-induced hypoglycemia by clandestine use of insulin was reported in 1982 by a nurse seemingly with the sole purpose of attracting attention and sympathy. Since that report, similar cases have been described in diabetics as well as non- diabetics. Although it is clear that insulin induced hypoglycemia can cause death, in most cases of death occurring within 24 hours of proven hypoglycemia, classic autopsy procedures reveal no unique pathophysiologic abnormalities. After B-cell stimulation by carbohydrate intake, insulin and C-peptide are secreted in 1:1 molar ratio. A large portion of insulin is cleared by the liver, while the C- peptide which is primarily cleared by the kidney has a lower metabolic clearance. In normal physiology, the molar ratio of insulin to C-peptide in endogenous secretion should be less than one. Hypoglycemia caused by exogenous insulin is associated with high serum levels of insulin and low serum levels of C-peptide. Thus, the ratio of insulin to C-peptide should be greater than one. The following four cases were recorded as possible overdose of insulin.

Case Study 1: A 53-year-old white female was found unresponsive in a motel room with numerous syringes lying around the body along with Humulin. An alleged suicide note was recovered by the police. Medical records indicated that the deceased was an insulin dependant diabetic with cardiac history. Police reports also indicated that the decedent's girl friend reported that the decedent was going to commit suicide with an overdose of insulin if she broke off their relationship.

Case Study 2: A 20-year-old black female living with her male companion made statements regarding suicide on several occasions. The male companion who was a diabetic reportedly moved out with his supply of insulin and syringes and did not leave any behind. He called the police when he was unable to contact her, fearing she had committed suicide. Police found a secured house. There was no evidence of injury, but an empty insulin bottle was found on the scene. Autopsy revealed a gravid uterus with a normally developed fetus.

Case Study 3: A 34-year-old white female was discovered deceased in her motor vehicle. Inside the vehicle were found insulin packages and syringes, including some empty insulin bottles. A hand written note to her psychiatrist was also found stating "forgive me Dr." According to the spouse, the decedent made prior suicide attempts; one of them with overdose of insulin.

Case Study 4: A 38-year-old white male with morbid obesity was found deceased in his residence. The decedent had a history of diabetes and had accidentally sustained a gun shot wound several years ago. The projectile was still believed to be in his back. The decedent was depressed and told his relatives that if he continued to not feel well he was going to kill himself with an over dose of insulin.

Insulin and C-peptide results are shown in the table below.

Case Number	Insulin uIU/mL	C-Peptide ng/L	Insulin/C-Peptide Ratio	Diagnosis
Case 1	4.3	0.3	0.3	Cardiovascular disease
Case 2	88.5	0.1	18.7	Suicide Insulin
Case 3	524	0.1	110.6	Insulin Overdose
Case 4	5.0	0.1	1.1	Cardiomegaly

Specimens were analyzed for Insulin and C-Peptide by RIA, using commercially available reagent kits from Diagnostic Systems Laboratories (Webster, TX). Since post-mortem specimens were highly hemolyzed, the protocols were modified to include standard addition recovery and serial dilution for each specimen analyzed. Further validations included comparison between duplicate results of insulin and C-peptide on the same specimens analyzed by the authors' laboratory and Mayo Clinic Laboratories; correlations by Pearsons r were 0.82 and 0.99, respectively. The ratio cutoff was validated from clinical specimens. For example, a specimen was obtained from a patient suspected of insulinoma and

analyzed for insulin and c-peptide; insulin concentration was 18.1 uIU/mL, and C-peptide was 19.7 ng/mL, providing a molar ratio of 0.02. Eleven specimens obtained from diabetic patients who are on insulin therapy were also analyzed for insulin and C-peptide. All of them had C-peptide levels approaching the assay's detection limit, and insulin:C-peptide ratios were 1 or less. Typical units for insulin and C-peptide levels are as number of moles. The ratio was calculated with the formula Insulin:C-peptide Molar Ratio = (Insulin uIU/mL ÷ C-peptide ng/mL)(0.0211). The ratios obtained were consistent with the literature. Moreover, the ratios from appropriate medical use of insulin can be distinguished from insulin overdose. These results confirm the use of "Insulin/ C-peptide" ratio in suspected insulin overdose, using commercial RIAs.

Insulin Poisoning, Syringes, Suicide