



## Pathology & Biology Section – 2004

### G33 Accidental Insulin Overdose

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After attending this presentation, attendees will understand the postmortem laboratory tests required to make a diagnosis of insulin overdose.

This presentation will impact the forensic community and/or humanity by using a case of accidental insulin overdose which occurred in a hospital setting as an example, this paper addresses the difficult task of attempting to diagnose an insulin overdose after death. Guidelines are presented regarding the proper collection, storage, and evaluation of postmortem blood samples in cases of suspected insulin overdose.

Exogenous insulin has been used for many years to treat diabetes mellitus. Over the years there have been numerous accidental overdoses by these patients. However, in other instances insulin has been used as an agent for suicide and homicide in diabetics as well as non-diabetics. Presented here is a fatal case of accidental insulin overdose in a nondiabetic.

An 82-year-old white male, postoperative day 12 from incarcerated hernia repair, was transferred to the hospital's rehabilitation unit for care of continuing medical problems. A week after admission to the unit, the patient's nurse entered his room to check on him and to flush his PICC line. One hour later, the patient was noted to be in distress and a "Code Blue" was called. During the code a rapid blood sugar was found to be low and the physician ordered one ampule of D50 to be given. Blood glucose was 13 mg/dl initially and 33 mg/dl (normal range 64-105 mg/dl) eighty minutes later. During the code, it was noted that the PICC line was not usable, as it had "clotted-off." The patient's clinical course became substantially worse following this event and he died two days later.

Autopsy, limited by previous embalming, revealed severe hypertensive and atherosclerotic cardiovascular disease. Laboratory testing on a blood sample stored from the night of the hypoglycemic event included a C-peptide level of 0.9 ng/ml (normal range 1.1-4.6 ng/ml) and an insulin level of 297.5 (normal range 0-22.7 mIU). The cause of death was determined to be insulin overdose. Investigations were conducted to detect the cause of this incident. It was deemed that the patient mistakenly received from 100 units to 500 units of insulin. No reason or evidence of malicious administration could be found during investigation. Investigation concluded that nursing personnel accidentally flushed the PICC line with insulin, instead of heparinized saline. The containers for heparinized saline and insulin are of similar size and appearance.

Insulin is a major regulatory hormone that serves to lower the serum concentration of glucose. A proinsulin molecule, consisting of a two peptide chain molecule (insulin) linked by a connecting peptide (C-peptide), is synthesized in the beta cells of the pancreas. Rising serum glucose causes cleavage of the proinsulin molecule and yields the active insulin molecule and the inactive C-peptide in a 1:1 ratio. A major difference between commercial insulin and endogenous insulin is the absence of C-peptide in commercial preparations. With a large dose of exogenous insulin, the expected laboratory values include an elevated insulin level and a low C-peptide level.

Considering the difficulty of making a diagnosis of hypoglycemia postmortem, the interpretation of insulin and C-peptide levels becomes a crucial aspect of making a diagnosis of insulin overdose. In the case of a diabetic individual, postmortem anti-insulin antibody levels and free and total insulin levels also are appropriate tests. Peripheral blood is preferred as blood samples from the right heart have much higher insulin levels than peripheral blood. All samples should be placed in red-top serum separator tubes, spun down, and frozen as soon as possible. Samples for insulin and C-peptide levels are also valid in green-top plasma tubes, when spun down and frozen as above. Samples in purple-top EDTA tubes are not valid for analysis, nor are hemolyzed specimens. Anatomic autopsy findings in cases of insulin overdose are often unremarkable.

In any case of insulin overdose a comprehensive scene investigation to document the amount and type of insulin used, along with information revealing the source of the insulin is crucial. In addition, a complete autopsy, including appropriate laboratory studies, is needed to make a firm diagnosis in these cases. Special attention should be given to properly collecting and storing blood samples, as these specimens often yield the strongest evidence of insulin overdose.

#### **Insulin Overdose, Accident, Complication of Therapy**