



## Pathology Biology Section – 2011

### **G1 Fatality Involving Complications of Bupivacaine Toxicity and Hypersensitivity Reaction: A Case Report**

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After attending this presentation, attendees will understand the complications from use of bupivacaine local anesthesia when administered in the head and neck region, including CNS, cardiac sequelae, and death.

This presentation will impact the forensic science community in understanding the possible adverse effects of local nerve block anesthesia when administered in the head and neck region, the actions, pharmacokinetics, contraindications, and toxicity of bupivacaine are detailed. In addition a hypersensitivity reaction may result from bupivacaine as measured by postmortem tryptase. The importance of a complete forensic autopsy and forensic toxicological analysis to accurately certify the cause and manner of death is emphasized.

This case represents unusual findings of elevated bupivacaine and tryptase concentrations following local anesthetic, bupivacaine, administered as a scalene nerve block for elective rotator cuff repair surgery. The patient exhibited almost immediate seizure activity, bradycardia, and cardiac arrest following bupivacaine injection. Resuscitative efforts including cardiopulmonary bypass restored a cardiac rhythm. However, the clinical medical status of the decedent progressively declined and he died seven hours following administration of the local anesthetic. An autopsy was performed and various biological specimens were collected for toxicological analysis. Autopsy revealed several abnormalities of the heart including cardiomegaly, myocardial bridging, and lipomatous hypertrophy of the intra-atrial septum. The cardiac findings may have contributed to bradycardia and arrhythmia. Autopsy findings associated with hypersensitivity reactions such as urticaria or laryngeal edema were not observed at autopsy. The absence of these findings alone does not rule out a suspected case involving a hypersensitivity reaction.

Postmortem toxicology results revealed an elevated cardiac bupivacaine and tryptase concentration. An elevated concentration of bupivacaine in the blood taken seven hours post-injection is indicative of an intravascular injection. When taking into account that the patient was alive for seven hours post-injection of bupivacaine and the half-life of bupivacaine is about two hours, it was estimated that the subclavian blood concentration of bupivacaine was most likely much higher at the time of seizure activity than at the time of sample collection. However, the postmortem cardiac blood analyzed had a similar bupivacaine concentration at the time of seizure activity due to intraventricular blood stasis resulting from cardiopulmonary bypass for approximately five hours.

Patients receiving local scalene nerve block anesthesia that is in close proximity to the carotid artery may be at greater risk of CNS and cardiac toxicity due to a greater risk of inadvertent intravascular injection or an injection into a highly vascular tissue area. This would result in rapid absorption of the local anesthetic into the systemic circulation causing cardiac and CNS sequelae. Therefore, this type of

injection may increase the risk of adverse effects including seizures, bradycardia, and cardiac arrest as seen in this case.

Postmortem toxicology also included analysis of tryptase. This analysis revealed an elevated cardiac total tryptase concentration and a normal subclavian total tryptase concentration. The discrepancy between the cardiac and subclavian tryptase concentrations may also be due to intraventricular blood stasis resulting from cardiopulmonary bypass; whereas subclavian blood was actively circulating throughout intervention. Furthermore, tryptase peaks within 15 to 120 minutes post exposure to the allergen and follows first-order kinetics with a half life of 1.5 to 2.5 hours; therefore, approximately 3 half-lives had elapsed between symptomatic onset and blood collection. Thus, obtained subclavian serum tryptase concentrations are expected to be much lower than values at symptomatic onset if in fact an anaphylactic reaction occurred. The moderately elevated cardiac tryptase concentration in conjunction with the cardiac arrest and rapid onset of seizure activity post injection of bupivacaine indicates the possibility of an anaphylactic reaction. However, it is possible that the moderate increase in cardiac tryptase is due to lysis of mast cells in the tissue of the chest. At autopsy the chest had massive hemorrhages due to prolonged cardiopulmonary resuscitation.

In summary this unintentional death of a 37-year-old male during elective shoulder surgery was determined to be due to complications of bupivacaine. The moderately elevated cardiac tryptase concentration raises the possibility of anaphylaxis that may have contributed to the cause of death.

Forensic Pathology, Bupivacaine Toxicity, Postmortem Tryptase