CASE REPORT

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Fatal Bupivacaine Intoxication Following Unusual Erotic Practices

ABSTRACT: A fatal drug overdose is described which involved unusual erotic practices. A 54-year-old male was discovered supine on the floor surrounded by sexual paraphernalia, syringes, and medications including three empty bottles of bupivacaine. Acute and chronic injection sites of the external genitalia with contusions, scarring, focal necrosis, and calcification were present at autopsy. Toxicology revealed femoral blood, heart blood, and vitreous bupivacaine concentrations of 3.8, 2.8 and 1.3 mg/L, respectively. The urine bupivacaine concentration was 11.4 mg/L. The cause of death was attributed to bupivacaine intoxication and the manner of death was accidental.

KEYWORDS: forensic science, toxicology, bupivacaine, toxicity

Bupivacaine (Marcaine) is a local anesthetic that is related structurally to cocaine and lidocaine. It is of special interest because of its long duration of action of up to 7 hours. After its synthesis and subsequent introduction in 1965, central nervous system (CNS) and cardiovascular toxicity have been reported. When administered intravenously, bupivacaine is reported to be several times more toxic than lidocaine (1). More recently, stereoselective isomers of bupivacaine (levobupivacaine) and ropivacaine have been identified as acceptable alternatives with improved margins of safety (2–4) and reduced cardiodepressant effects (5).

Long-acting local anesthetics primarily are used for regional anesthesia and analgesia. Bupivacaine typically is encountered as the hydrochloride salt (0.25–0.75%) for caudal, epidural, or peripheral nerve block. Doses are typically in the range 12–225 mg (6). Doses of 150 mg for peridural anesthesia produced mean peak plasma concentrations of 1.14 mg/L after 20 minutes (7). Blood/plasma concentration ratios are reported to be in the range 1.2–1.3 (8). Bupivacaine metabolism, which likely involves N-dealkylation and hydroxylation, has not been investigated fully in humans.

The practice of injecting various substances into the external genitalia for augmentation (enlargement), treatment of impotence, and drug abuse is well described in the medical literature. Scrotal inflation with saline appears to be a common practice described on the Internet; however numerous other liquids, drugs of abuse, oils, and gels have been reported (9–17). There are several websites that describe in detail what materials are needed, where to inject, what to expect after injection, and how to avoid infection by using sterile technique. These practices can cause local tissue damage (9–11,13,17) and occasionally death if the substance gets into the vascular system (12). A review of the literature did not reveal any previous reports of bupivacaine being used recreationally for auto-erotic purposes and resulting in death.

Case History

The decedent was last seen alive at 8:30 a.m. when his spouse left for church. On her return at 1:00 p.m., he was found dead in an upstairs den with his pants removed. Pornography was playing on the television and sexual paraphernalia in the vicinity included numerous pornographic magazines, collars, tubing, a rope, plastic bags, rubber rings, and metal clips. Syringes, Lidocaine cream, Xylocaine jelly, and three empty bottles of bupivacaine (Marcaine, 5 mg/mL) also were present.

The decedent was reported to have a high-stress job, a history of moderate alcohol use, and no history of serious medical or mental health problems. A postmortem examination was performed approximately 24 hours after the discovery of the body. Formalin-fixed paraffin-embedded tissue was taken according to the usual manner.

External examination was notable for a laceration and contusion of the lower lip, a superficial abrasion of the left knee, multiple needle punctures of the right and left aspects of the scrotum with surrounding contusions (Fig. 1), mild scrotal edema, and three small contusions of varying ages on the thorax and abdomen.

Internally there was congestion and edema of the lungs (right lung 710 g and left lung 650 g), diffuse fibrous adhesions within the scrotum, fibrous nodules of the right tunica vaginalis, paratesticular soft tissue hemorrhage, fibrosis of the corpora cavernosa of the penis, and yellow tan focally hemorrhagic and necrotic replacement of the epididymides (Fig. 2). There was a small contusion of the posterior deep scalp. The remainder of the postmortem examination was unremarkable except for focal mild atherosclerotic stenosis of the coronary arteries, nephrosclerotic changes of the kidneys, and mild steatosis of the liver.

Microscopically the testes had seminiferous tubules with focal autolysis, areas of normal spermatogenesis, diffuse edema, extensive areas of interstitial fibrosis with tubular atrophy, mild chronic

FIG. 1—*Scrotal injection sites and contusions.*

FIG. 2—*Granulomatous epididymides.*

inflammation, and scattered siderophages (Fig. 3). The tunica vaginalis had nodular areas of amorphous fibromyxomatous scar tissue. The corpora cavernosa had pronounced fibrous sclerosis. The epididymides had diffuse sclerotic granulomata with diffuse areas of amorphous eosinophilic material and numerous epithelioid macrophages and foreign body giant cells (Fig. 4). Additionally, there were areas of acute and remote hemorrhage with siderophages, extensive areas of fibromyxomatous scar tissue, patchy areas of chronic inflammation, focal areas of necrosis, but no significant polarizable particles. Random sections from all three lobes of the right lung and both lobes of the left lung had prominent congestion and edema. No other significant pathology was observed.

Methods

Femoral blood, heart blood, vitreous humor and urine were submitted for comprehensive toxicology analysis. Femoral blood was tested for alcohol using gas chromatography with flame ionization detection and common drugs of abuse by enzyme-linked immunosorbent assay. Bupivacaine was identified quantitatively using solid phase extraction and gas chromatography mass spectrometry (GC/MS) using mepivacaine as the internal standard.
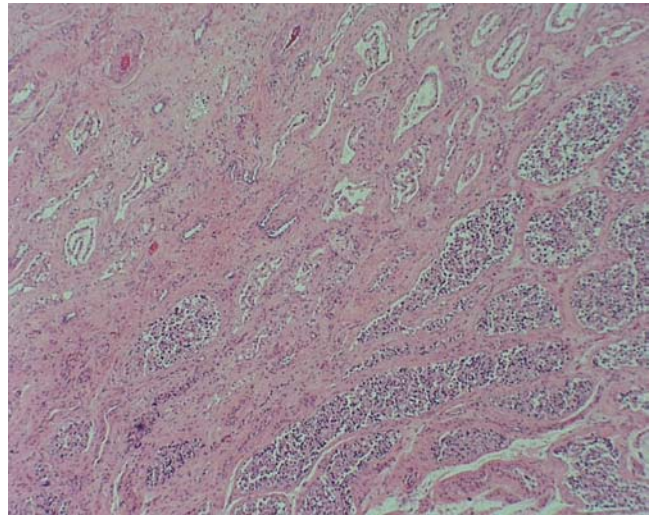

FIG. 3—*Testis. Seminiferous tubules with extensive fibrosis and tubular atrophy (hematoxylin and eosin stain).*
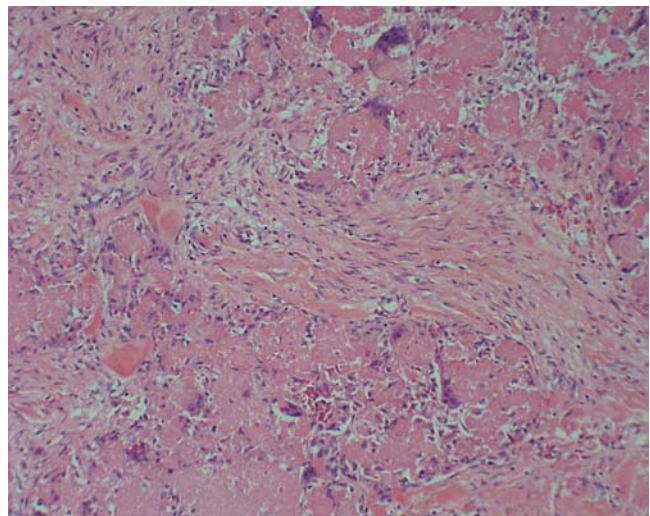

FIG. 4—*Epididymis. Granulomata with amorphous eosinophilic material and multinucleated giant cells (hematoxylin and eosin stain).*

Results

Femoral blood screened negative for volatiles and common drugs of abuse. Bupivacaine was the only drug of toxicological significance, yielding heart and femoral blood concentrations of 2.8 and 3.8 mg/L, respectively. Vitreous and urine samples contained 1.3 and 11.4 mg/L bupivacaine, respectively.

Discussion

Bupivacaine is currently the most widely used long-acting local anesthetic for surgery and obstetrics despite its association with potentially fatal cardiotoxicity and the identification of newer less toxic stereoselective isomers (4,5). Toxic reactions to bupivacaine can include cardiovascular collapse, respiratory depression or arrest, seizures, arrhythmias, and death (18). It is more cardiotoxic than many structurally related analogs and is eliminated from the myocardium more slowly than lidocaine. High concentrations of bupivacaine are known to produce myocardial depression and peripheral vasodilation leading to cardiovascular collapse.

Sudden onset of profound bradycardia and asystole during neuraxial blockade is associated with the drug via an unknown mechanism. Therapeutic concentrations overlap with concentrations that have resulted in adverse reactions and even death. For example, in an early clinical study of ten patients, bilateral intercostal nerve block with a high dose of bupivacaine (400 mg) produced peak arterial and venous plasma concentrations averaging 3.29 and 2.52 mg/L (19). More recent case reports, however, have reported hypotension, bradycardia, cyanosis, loss of consciousness, convulsions, and delayed respiratory arrest at blood and plasma concentrations between 0.3 and 1.8 mg/L (20–22).

Bupivacaine is the local anesthetic most frequently associated with seizures (23). It is also reported to produce skeletal muscle damage in clinical concentrations, possibly due to increased intracellular calcium levels (24).

In this case, the decedent appeared to have been injecting bupivacaine into his genitals to enhance or prolong sexual pleasure, or reduce the pain associated with his sexual endeavors. The contusions, and extensive internal scarring of the genitalia indicates that this had been a long-term activity. The sclerotic granulomata of the epididymides appear to be a result of repeated injection of foreign material into the area. The minor abrasion of the knee and the small contusion of the deep scalp were consistent with a terminal collapse. The minor laceration and contusion of the lip were consistent with the decedent biting his lip and suggests that he may have had seizure activity before death. The cause of death was attributed to bupivacaine intoxication and the manner of death was determined to be accidental.

We feel that it is important that the medical and forensic community be aware that the practice of injecting various substances into the external genitalia can be potentially fatal. This case also demonstrates interesting genitourinary pathology that is not typically observed in forensic histology.

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