

Title: PATHOLOGICAL CONSEQUENCES OF REPEATED EPIDURAL ANESTHESIA IN THE CAT

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**Introduction.** Recent clinical observations indicate that lumbar epidural anesthesia (LEA) for multiple extracorporeal shock wave lithotripsy (ESWL) treatments may be unreliable and behave abnormally when repeated serially.<sup>1</sup> The anesthesia obtained is sometimes incomplete and limited in cephalad spread. In addition, problems of pain on injection of local anesthetic into the epidural space, decreased compliance of the epidural space, and aspiration of unusually bloody local anesthetic via the needle or catheter have been reported.<sup>1</sup> These problems suggest that repeated LEA may cause pathologic changes in the epidural space. The purpose of this study was to determine whether commonly used local anesthetic solutions cause pathology of the epidural space when administered repeatedly.

**Methods.** This protocol was approved by the institution's animal investigation committee. Twenty-four healthy, randomly selected, adult male and female cats, each weighing 2.5-5 kg, were divided into four groups of six animals. Using a previously described technique,<sup>2</sup> the cats received percutaneous epidural injections via a 22 g. 3.8 cm short beveled needle at the lumbosacral interspace consisting of 0.5 ml of the experimental solutions as follows: Group 1, normal saline; Group 2, 1.5% lidocaine with 1:200,000 epinephrine pH-adjusted with sodium bicarbonate 1 mEq per 10 ml of lidocaine solution (pH=7.3); Group 3, 1.5% lidocaine with 1:200,000 epinephrine (pH=4.5). Injections were performed for five consecutive days. All of the above animals were sacrificed on the seventh day. Group 4 received one injection of 1.5% lidocaine with 1:200,000 epinephrine (pH=4.5) and were sacrificed 72 hours later. The onset of hind limb paralysis was taken as evidence of anesthesia in Groups 2, 3, and 4. After placement of the needle into the epidural space, epidural pressures were measured during injection of test solution daily in all animals using a Gould 2800 Physiograph.

Following sacrifice of each animal, the lumbosacral junction, including the vertebral column and spinal cord, was immediately removed as a block and decalcified using a formic acid, sodium nitrate mixture, and embedded in paraffin. Each specimen was stained with hematoxylin and eosin, Brown-Hopps tissue gram stain, luxol fast blue stain for myelin and hematoxylin Van Gieson stain for connective tissue and bone. Light microscopy was performed by a neuropathologist blinded to treatment groups and any pathology recorded.

**Results.** All animals in Groups 2, 3, and 4 demonstrated loss of lower motor tone after each LEA, except for one animal in Group 2 on day 4. In this case, a satisfactory block was attained with repeated epidural injection. The success rate, therefore, was 96%. Proper identification of the epidural space in

Group 1 (normal saline) was assumed to be comparable. Computer analysis of epidural pressure decay curves following the injection of test solutions showed no change in epidural compliance in any animal or group of animals during the study period.

**Microscopic Examination.** Histologic analysis demonstrated unremarkable epidural and subdural spaces, meninges, spinal cord and nerve roots, ligaments and bone. Only two animals in Group 1 (normal saline solution) showed any pathological changes. One animal had small areas of granulation tissue containing giant cells and degenerating muscle cells in the dorsal skeletal muscle, as well as granulation tissue in the underlying tendon, with focal chronic vasculitis and fat necrosis adjacent to a nerve root. This lesion is interpreted as a resolving (healing) needle wound. The other animal had a focus of granulation tissue involving the periosteum and adjacent epidural fat, likely representing an old, healed (preexisting) injury.

**Discussion.** Possible causes of the difficulties reported with LEA's in patients undergoing ESWL therapy on repeated occasions may be considered as falling into two main categories: chemical and mechanical. Chemical factors may be due to irritating properties of the local anesthetics, epinephrine, preservatives, or pH of the solution. Also, blood in the epidural space could be considered as a possible chemical factor. Mechanical factors include repeated introduction of a needle, distention of the epidural space with LA solution, or energy dissipated into the epidural space by the lithotripter shock wave.

Our data suggest that the chemical properties of the various local anesthetics (including those containing epinephrine and those pH-adjusted with sodium bicarbonate) cause no pathological changes of the epidural space, even after repeated administration. Except for the single needle track injury observed, the mechanical factors of repeated needle introduction and distention of the epidural space also do not appear to cause any significant pathology. It seems likely, therefore, that the clinical evidence of epidural pathology observed in patients undergoing repeated LEA for lithotripsy is due to either the lithotripter shock wave or an interaction between the shock wave and the LEA. Further study of the pathological effects of ESWL upon epidural tissue is needed.

#### References.

1. Korbon GA, Lynch C, Arnold WP, Ross WT, Hudson SB: Repeated epidural anesthesia for extracorporeal shock wave lithotripsy is unreliable. *Anesth Analg* (in press)
2. Soma LR (ed): Textbook of Veterinary Anesthesia. Baltimore, The Williams and Wilkins Co., 1971, pp 451-467