

Title: ULTRASONIC LOCALIZATION OF THE LUMBAR EPIDURAL SPACE
Authors: R.C. Cork, M.D., Ph.D.; J.J. Kryc, M.D.; R.W. Vaughan, M.D.
Affiliation: Department of Anesthesiology, University of Arizona Health Sciences Center, Tucson, Arizona 85724

Introduction. Diagnostic ultrasound technology has been developed to the point where application to the task of localizing landmarks for regional anesthesia now seems feasible. The purpose of this communication is (1) to demonstrate the utility of ultrasound in identification of landmarks for lumbar epidural anesthesia, and (2) to compare the depth of the ligamentum flavum as seen by ultrasound with the distance traversed by the needle in performing an epidural block.

Methods. Prior to the selection of 26 patients, consent was obtained from the Arizona Health Sciences Center Human Subjects Committee. During preoperative rounds the evening prior to anesthesia, ultrasonic scanning of the lumbar epidural space was performed at both the L2-L3 and L3-L4 interspace. Real-time scanning was performed with an Aloka portable unit equipped with electronic calipers. Ultrasonic scans were obtained in the sagittal and transverse planes. Subsequently, the distance between the skin surface and ligamentum flavum was measured. The following day, lumbar epidural anesthesia was performed by an anesthesiology resident at either the L2-L3 or L3-L4 interspace using the loss-of-resistance technique. Measurements obtained ultrasonically the night before were not available to this resident. Epidural anesthesia proceeded in the routine manner with or without the use of a continuous catheter. Prior to removal of the epidural needle, markers were placed at the skin surface on the needle. With needle removal, measurement was taken of the distance from marker to needle tip. Success or failure of the epidural anesthetic was noted.

Results. In the 22 successful epidural anesthetics, a good correlation between predicted distance (ultrasound) and measured needle distance occurred ($r = 0.99$, $p < 0.0001$. See Figure.). Average distance to the epidural space was 4.6 cm by both a priori ultrasound and a posteriori needle measurements.

Among the 26 lumbar epidural anesthetics, four blocks were unsuccessful. Two unsuccessful blocks were characterized by a centimeter difference between the ultrasound measured distance and the needle measured distance. The other two unsuccessful blocks were due to accidental dislodgement of the catheter from the epidural space with removal of the needle.

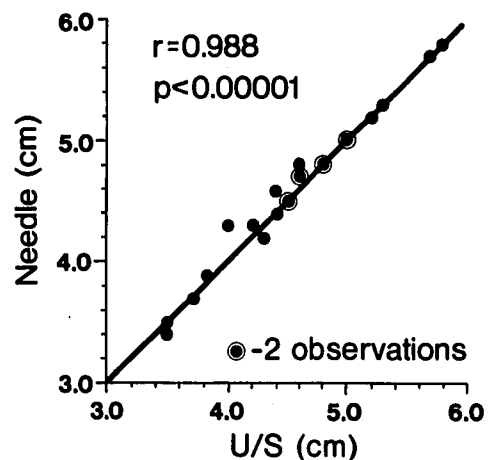
Discussion and Conclusions. The present study focuses on the utility of ultrasound in lumbar epidural anesthesia. Excellent correlation between predicted and measured distance to the epidural space was found. Gutierrez¹ compiled a series of 2967 successful epidural anesthetics, and after each block measured the distance to the epidural space. Although he did not report a mean distance, the mean value calculated from his reported data is 4.0 cm.

Since most regional anesthetics are (1) performed in ultrasonically accessible areas, and (2) associated with soft tissue or skeletal landmarks that are ultrasonically detectable, this new imaging modality should have an expanded role in anesthetic practice. Certain advantages commend its use. The technique is non-invasive, rapidly performed, and no harmful effects exist at the energy levels and time frames presently utilized. All these attributes contribute to a high degree of patient compliance. Some minor disadvantages are also apparent. Both sophisticated equipment and scan interpretation can be difficult due to poor imaging. Solution to these problems is progressing with portable real-time imaging employing computer assistance.

References

1. Gutierrez A. Anestesia extradural. Revista de Cirugia de Buenos Aires 18:349-89, 1939.

Figure.



Distance to the epidural space measured by ultrasound as correlated with measured needle distance in 22 successful epidural anesthetics.