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Ultrasound May Be An Effective Tool for Predicting Clinical Loss of Resistance in Lumbar Epidural Steroid Injections

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Correlation of Ultrasound Epidural Space Depth Measurements and Clinical Loss of Resistance in Epidural Steroid Injections

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INTRODUCTION

Epidural Steroid Injections (ESI) rely on fluoroscopic guidance as the standard of care to provide knowledge of the patient's epidural space and appropriate administration of therapeutic medications.

Accurate assessment of the distance the Touhy needle must travel to the epidural space is essential in reducing potential procedure risks such as intrathecal puncture and improving outcomes related to procedure time.¹ Prior studies have examined the use of supplemental imaging methodologies to provide knowledge of the depth of skin to ligamentum flavum and posterior epidural space, which can improve accuracy.²

OBJECTIVE

Assess the efficacy of ultrasound, a more accessible point of care modality, to describe the dimensions of the epidural space.

Determine the reliability of ultrasound for measuring cervical and lumbar epidural spaces for ESIs in chronic pain patients and compares these to MRI measurement.

METHODS

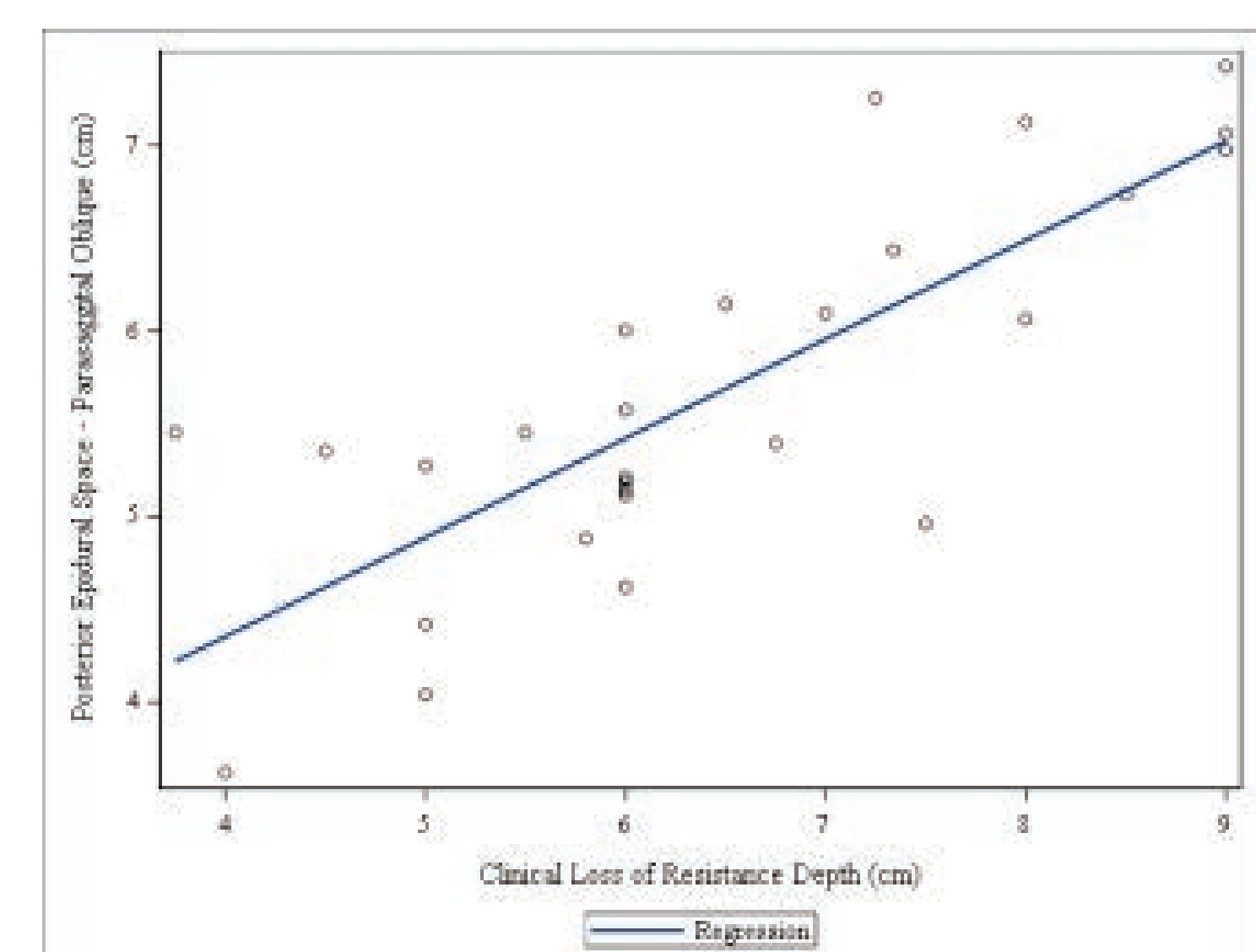
University of California, Davis IRB approval for this prospective interventional study was obtained for patients >18 years y/o who are receiving epidural injections at the Pain Clinic.

Transverse and parasagittal oblique ultrasound epidural measurements were obtained using a curvilinear probe in prone patients undergoing lumbar ESI procedures (Figure 1). Using the electronic medical record, T1 lumbar epidural measurements were obtained from preexisting MRI images (Figure 2).

The skin to posterior epidural space measurements via ultrasound and supine MRI will be compared to the clinical loss of resistance depth (CLORD) documented during the ESI performed by a different clinician. Differences in the measurements for the lumbar space will be compared using a non-inferior one-way ANOVA to determine which is more accurate to the CLORD. At the time of poster preparation, an interim analysis comparing the ultrasound measurements to CLORD was available (Graph 1 & 2, Table 1).

RESULTS

Graph 1: Correlation between Lumbar Parasagittal Oblique Ultrasound View and CLORD



Graph 2: Correlation between Lumbar Transverse Ultrasound View and CLORD

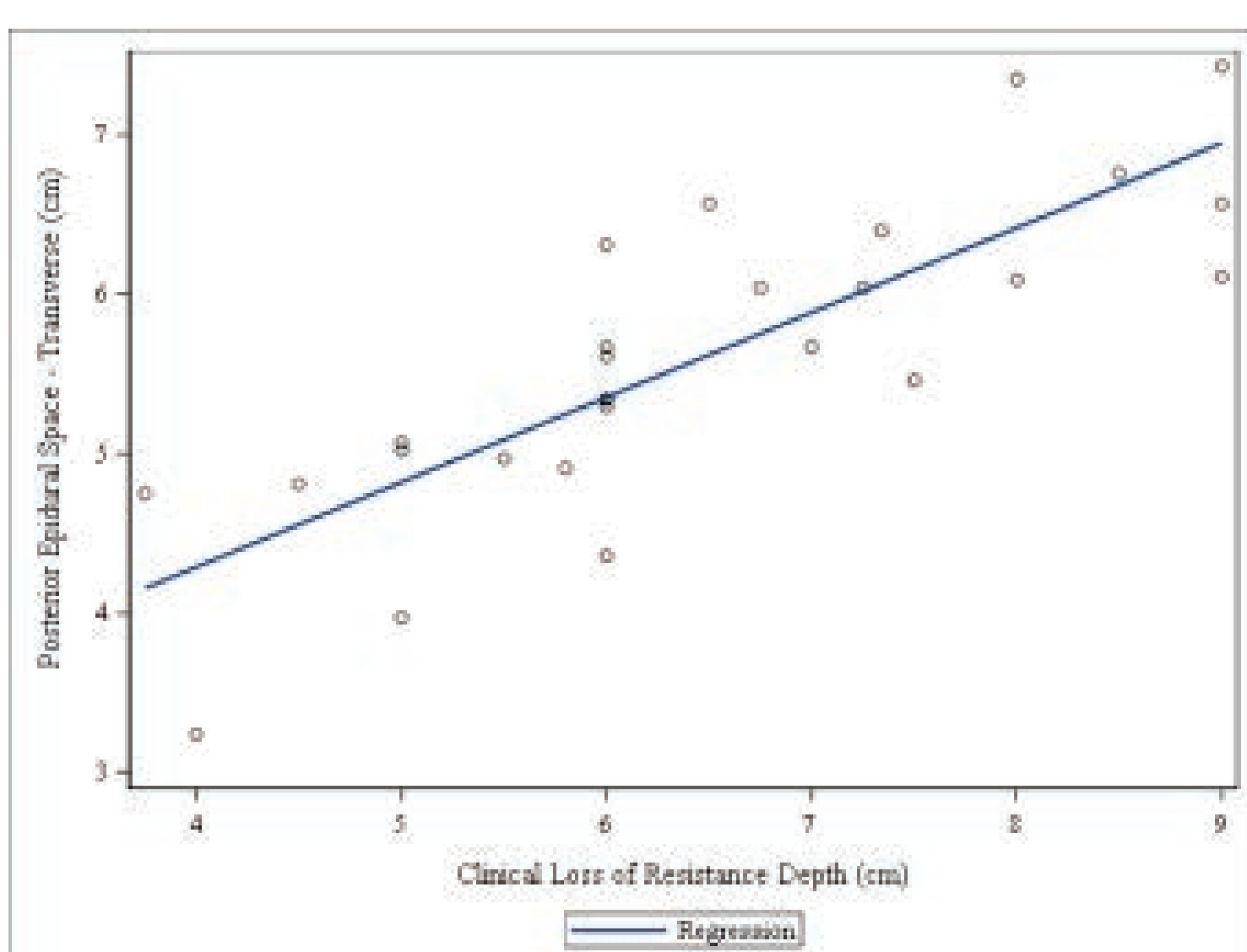


Table 1: Pearson Correlation Coefficients between Lumbar Ultrasound measurements (transverse and parasagittal oblique) and CLORD

Pearson Correlation Coefficients, N = 27 Prob > r under H0: Rho=0			
	Parasagittal Oblique	Transverse	CLORD
Parasagittal Oblique	1.00000	0.87223 <.0001	0.79715 <.0001
Transverse	0.87223 <.0001	1.00000	0.81520 <.0001
CLORD	0.79715 <.0001	0.81520 <.0001	1.00000

We found significant correlation between the ultrasound measurements and CLORD. The transverse measurement had a Pearson's correlation of 0.82 (p-value < 0.001) and the oblique measurement had a Pearson's correlation of 0.80 (p-value < 0.001) (Table 1)

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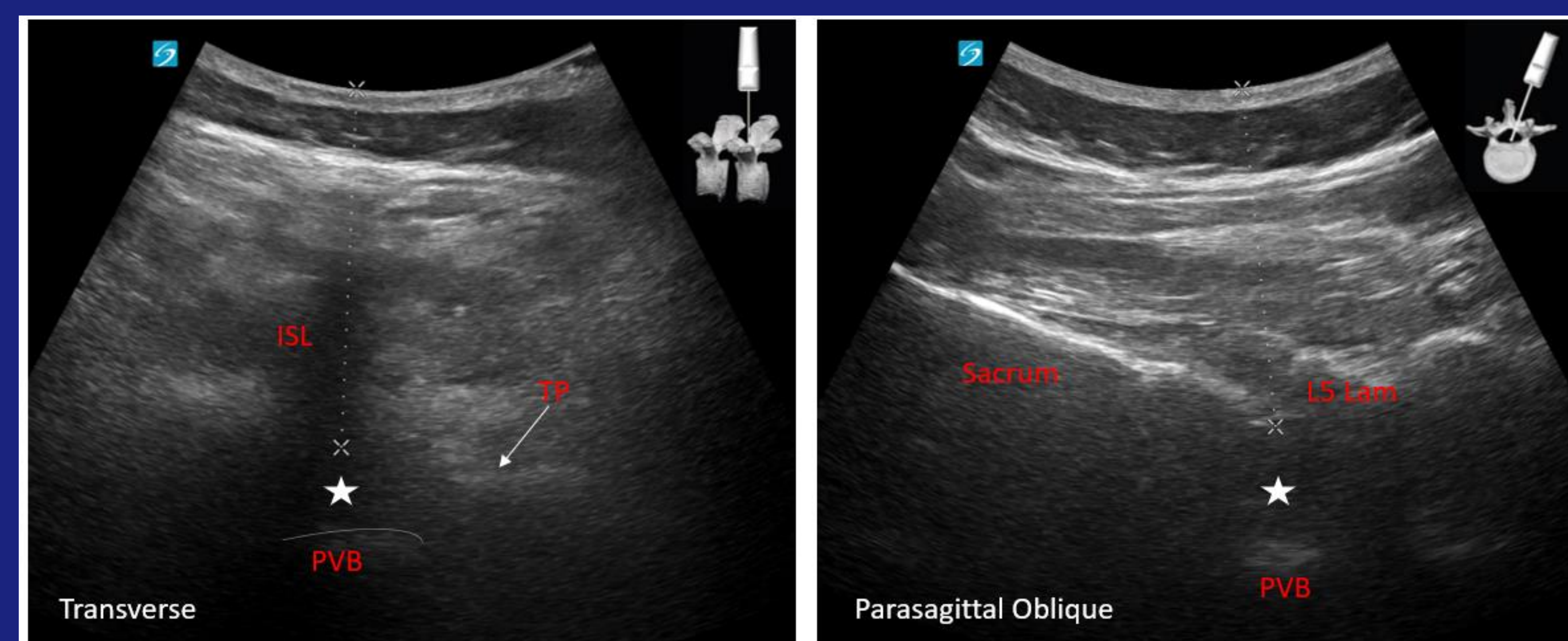


Figure 1 Transverse (left) and parasagittal Oblique (right) measurements of the epidural space. In the transverse view, the interspinous ligament (ISL) is visualized. The posterior vertebral body (PVB) and transverse process (TP) can be seen surrounding the intrathecal space (☆). In the parasagittal oblique view, the sacrum and L5 lamina are seen clearly at the L5-S1 interspace.

RESULTS (cont.)

We found that ultrasound measurements underestimate clinical loss of resistance depth by a mean difference of .89 cm in Lumbar ESIs



Figure 2. Measurement of L4-L5 ligamentum flavum depth (LFD) on MRI. Line extends from skin surface to anterior border of ligamentum flavum.

DISCUSSION

- Preliminary data from this study suggest that ultrasound measurements in the lumbar spine are useful to estimate clinical LOR during ESI.
- Patient body habitus (morbidly obese), misidentification of the levels, operator error, prior surgery, and/or significant degenerative changes in the spine may impede the ability to use ultrasound and obtain accurate measurements.
- Ultrasound measurements may be affected due to compression of tissue while patients are in prone position, but is a point of care modality
- Some of these ultrasound-specific limitations would not necessarily apply to MRI measurements although MRIs are performed supine while these interventional procedures are performed prone.
- The study will also look at MRI and ultrasound measurements in cervical ESIs.
- Future analysis to replace pearson correlation with agreement analysis

References

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