

Diagnostic Ultrasound and More Unproven Spinal Imaging Data

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Editor's note: A 1982 graduate of LACC, Dr. Futoran is a Fellow of the Academy of Chiropractic Orthopedists and first vice president on the executive board of the American College of Chiropractic Orthopedists. He is a member of the Musculoskeletal Ultrasound Society, Society of Diagnostic Medical Sonographers, and the American Institute of Ultrasound Medicine, among others. He serves on the postgraduate faculty of the Univ. of Bridgeport College of Chiropractic, and is a California QME.

The Jan. 27, 1997 article in Dynamic Chiropractic on so-called "spinal imaging" with ultrasound is one of the reasons this technology has met resistance by chiropractic associations, medical associations and now insurance carriers for imaging superficial structures of the back.

The article in question, "Diagnostic Ultrasound: PLL and ALL Fibrosis" (hence referred to as the PLL article), claims that the posterior longitudinal ligament and anterior longitudinal ligament can be imaged with ultrasound, and that pathology could be identified.

Current chiropractic and medical literature does not support diagnostic ultrasound (DUS) imaging in its ability to accurately and reproducibly visualize the PLL, ALL, or other intraspinal canal anatomy. Of all the spine related DUS studies conducted since mid 1980s, none reference the PLL or ALL as normal or in a state of pathology.^{1,2,3,4,5,6,7,8}

Extensive experience in the application of musculoskeletal imaging with ultrasound, teaching the subject and regularly performing Medline and other database searches in this technique, I have concern for this type of misinformation being distributed. I presented a lecture last September at the annual conference for the American College of Chiropractic Radiologist at their request titled, "Facts and Fallacies of Adult Spine imaging with Ultrasound." I have lectured on this subject at the Bowman Gray School of Medicine in Winston Salem and conferred there with Dr. Knappertz and Dr. Tegeler on spinal imaging and their study in this arena.⁷ The "Paraspinal ultrasonic and anatomical correlation" article by Dr. Knappertz and Tegeler as referenced in the PLL article does not profess to image either, PLL, ALL or other intra-canal contents.^{7,8}

Several recent chiropractic papers referencing the PLL with DUS use the term "soft tissue inflammation" interchangeably with "soft tissue fibrosis" when describing DUS tissue characteristics. This has created confusion for many practitioners learning ultrasound imaging as "inflammation" relates to an acute tissue change while "fibrosis" is referred to in more chronic or healing stages of soft tissue injury. These terms are not interchangeable and do not appear the same on ultrasound.

Categories of fibrotic change to the PLL referenced from work by Stipkovich in the PLL article are

theoretical and speculative, and are based on general anatomical regions. There is no current documentation or research to support these findings or any other with regards to imaging a normal PLL or one in a state of pathology.

The following are some of the numerous reasons diagnostic ultrasound imaging of the PLL and ALL should be considered, at minimum, premature and potentially improbable with current DUS technology:

1. In most spinal areas, the spinous process and lamina are in the line of the DUS sound beam, overshadowing the PLL and blocking visualization.^{9,10}
2. Ligaments have the properties of anisotropy, an artifact that presents if the angle of the sound beam is not exactly perpendicular to the ligamentous tissue (2-5 degrees can create the artifact). It will appear anechoic or dark rather than hyperechoic or white as a ligament normally would appear.^{12,13,14}

In scanning the back, in order to obtain the density described as PLL fibrosis, the transducer must be significantly angled (as much as 30-40 degrees). This angling of the probe would cause the PLL to be dark, or not visualized at all rather than present as echogenic (white).¹⁴

3. If the PLL were imaged from P to A with a cephalward angle, as is the case for most practitioners imaging back structures, a measurement could not be accurate, as it would be too oblique a slice for clinical relevance.
4. The anatomical structure referred to in the PLL article is consistent with that of bone, casting a shadow. If it were a ligamentous reflection, the sound wave would not only show the tissue, but also pass through the ligament reflecting deeper structures which it does not.^{1,6}
5. Another sign of this structure's rigidity, unlike ligament, is its ability to evoke a reverberation artifact or ring-down effect as described by sonographers.¹²
6. The densities described in the PLL article appear by consensus and anatomical location to be the posterior vertebral body silhouette. These densities which are regularly identified by some as fibrotic, bulging or calcific PLL, ALL will appear normally at every level of most every pediatric spine. It is in fact a density that can be imaged in most adult spines without clinical correlation.
7. There are no anatomical studies to support these findings even by Dr. Knappertz and Dr. Tegeler who scanned 1mm cross-sections embedded in Plexiglas for measuring and identification.^{7,8}

It is apparent that a serious lack of information and documentation prevents the application of DUS in imaging spinal canal and its contents, including the PLL and reference to pathology of these structures. I would not venture as suggested in the PLL article to consider the so-called PLL findings suggestive of disc herniation or other pathology. This ligament has not been appropriately identified in any state by DUS.

Imaging of the extremities is an important medically accepted application of DUS with references too numerous to list. All areas of musculoskeletal imaging, including forms of spinal imaging with DUS, should continue to be studied and explored. Current literature and research have identified superficial paraspinal soft tissue anatomy with an abundance of clinically correlated information, though it has

yet to be widely accepted. This area of DUS imaging continues to grow. As noted in previous articles, diagnosis of these regions are more a question of efficacy than ability of technology.¹⁵

I continue to be a strong advocate of DUS imaging for musculoskeletal structures throughout the body. But I am an opponent to its misguided and premature uses. I have reviewed scans and reports referred to me by insurance carriers not uncommonly to find many types of misuse and over interpretation. This is an important imaging modality for the musculoskeletal practitioner and their patients. I am dedicated to moving this technology forward in the private practice in an ethical and appropriate manner.

For those interested, I will be presenting a "Diagnostic Ultrasound of the Adult Spine: Facts & Fallacies" lecture at the conference for the American College of Chiropractic Orthopedists (ACCO) in New Orleans March 30, 1997. I will also give a paraspinal soft tissue lecture for the Neurosonology Research Group of the World Federation of Neurology during August of this year in Winston-Salem, North Carolina.

I welcome questions and information of the subject of musculoskeletal imaging with DUS.

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