

More Facts and Fallacies: Diagnostic Ultrasound and the Musculoskeletal Practitioner

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The authors of "Facts and Fallacies of Diagnostic Ultrasound of the Adult Spine" (published in the 4/22/96 issue of "DC") are to be complimented for expanding discussion on the applications of diagnostic ultrasound (DUS) to the musculoskeletal practitioner. As a significant imaging modality of neuromusculoskeletal disorders DUS, is an important adjunct to all practitioners treating musculoskeletal conditions, including chiropractic. This addendum to the current discussion is to address the positive and proven uses for the musculoskeletal practitioner in private practice and bring to light some specifics of appropriate uses and information on this technology.^{1,2,7,8,14,21-64,73}

As a long established imaging modality in obstetrics, internal medicine, cardiology, oncology and extra-spinal musculoskeletal diagnosis, a major benefit of DUS is its non-invasive, non-radiation properties. Other benefits include cost effectiveness, ease of use and patient comfort and safety. It has been noted that DUS does not image pathology of the spinal canal, spinal canal contents including disc, posterior longitudinal ligament, nerve roots and the measuring of the spinal canal.^{1,6} DUS is complementary, but not competitive, with appropriately prescribed plain film x-ray, CT or MRI.

DUS capability does apply globally to all muscles, tendons, ligaments and periarticular soft tissue within view of sonogram and not obscured by bony or other hard surfaces. This ability to accurately visualize, and more specifically identify trauma and pathology involving soft tissues, helps establish the etiology of pain or pain syndromes (not to be confused with imaging pain).

Clearly, it would be unscientific to close the door on this rapidly growing technology. Chiropractors should and do welcome this safe modality and opportunity to contribute to its expanding fund of information. We owe it to our patients to maintain currency in relevant scientific procedures.

Imaging of superficial soft tissue structures of the back is not yet widely practiced by the general medical community although imaging of the same structures in extra-spinal areas is an accepted practice!^{1,2,7,8,14,17,19-24,27-41,43-54,56-64,69,70,73} Nevertheless, large conferences on DUS, are sponsored by the American Institute of Ultrasound Medicine (AIUM) and Society of Diagnostic Medical Sonographers (SDMS) with thousands in attendance. Lectures by prominent medical radiologists covered DUS imaging of all areas of the musculoskeletal system. Most major ultrasound equipment companies are represented, including those with "lower end" \$20,000 to \$50,000 ultrasound machines. We do not know whether authors of the "Facts" article are members or were present at the March AIUM conference in New York.

Many refereed journals have references to normal superficial anatomy of soft tissues in the adult back.^{2,3,4,5,12,13,68,72} There is ample clinical and empirical evidence showing superficial paraspinal soft tissue structures in normal and injured states. New studies are scheduled for publication, covering both normal anatomy and changes occurring with injury, by prominent radiologists, neurologists and other specialists from across the country who employ musculoskeletal imaging with DUS.

As is stated in the "Facts" article, DUS has a long learning curve which varies, depending on the technician's abilities and background. DUS is operator dependent in all fields of ultrasound medicine and does require a detailed, three dimensional knowledge of anatomy. Studying DUS can be both challenging and exciting. A radiology residency involves three to four years. An ultrasound fellowship is not a requirement. More than 95 percent of radiologists who use DUS routinely have not had ultrasound fellowships. Proficiency in DUS, including for musculoskeletal imaging, comes from scanning, literature review, reading cases and attending seminars.

In learning any imaging modality, understanding anatomy and pathophysiology are critical. Once this is understood, it is a matter of knowing how disorders alter the visualized pattern of imaged tissues, plus the technician or physician's experience in performing and viewing hundreds of studies. Chiropractic physicians, as with other medical specialties, graduate from many of the colleges with a high degree of knowledge and ability in performing and reading plain film x-ray, without an additional radiologic residency.

In the case of DUS, the spectrum of information is less broad than in most other areas of imaging. The parameters for identifying changes in soft tissue architecture are not extensive. Musculoskeletal tissues are identified by only a small number of echo-patterns. Thus, if the physics of DUS, pathophysiology, and especially the detailed anatomy and cross-sectional anatomy are understood, with diligent study a physician can learn to scan musculoskeletal areas proficiently and eventually be able to understand the changes associated with injury and pathology.

In musculoskeletal imaging with DUS, medical practitioners in all radiologic specialties including ultrasound are having to learn new aspects of imaging that have little direct relation to their current specialties. It is unlike imaging with any other modality or even imaging with ultrasound in other areas of the body. DUS requires diligent study in technical imaging, understanding of anatomy and interpretation.

Sonographers become certified in a single area of DUS (e.g., abdomen, cardiac, obstetrics), taking programs lasting between several weeks to one year. Musculoskeletal imaging will soon be a part of their regular studies. Physicians can audit the DUS certification examinations without any formal ultrasound training. The sonographer will eventually be able to scan and even interpret (though not in

their scope of practice) the images and those of the physicians ordering the studies, just as they have in all other areas of DUS medicine. DUS is underutilized in musculoskeletal imaging, not merely because of a long learning curve, but because it is simpler for a practitioner to order an MRI, which has a seemingly clearer soft tissue picture to the untrained eye, and a full cross-section of anatomy, but commands a much higher fee. The ultrasound beam cannot penetrate bone, and thus does not compete with MRI where a global assessment of all tissues is required. DUS has often been described by radiologists as unexciting. The most appropriate diagnostic imaging modality should be prescribed based on obtaining the most specific and greatest amount of information, and the least invasive, and the most cost effective.

It is hoped, as stated in the "Facts" article, that vendors are not sponsoring weekend programs that give doctors and sonographers the impression that they will learn enough to become proficient in performing DUS examinations and interpretation. These types of courses could only be considered introductory or supplementary. It requires diligent study, performing and viewing hundreds of scans to begin understanding the intricacies of DUS images, knowledge that cannot come from any single seminar.

The "Facts" article speaks of equipment cost and its relation to quality of image. Expensive DUS machines have greater software and programmable components. They have the capability of quad rather than dual images. Costly DUS equipment has frozen and scroll memory for still and video images, Doppler and color flow processing, stress echo features, multi-format cameras, all of which are expensive components. The higher price also include the cost of multi-frequency transducers, multiple transducers, cineloop video with super VHS, pan-zooming, audio, hardware and software features for complicated calculations, components which are extensive but by no means essential to basic gray scale imaging. Additionally, these high-end DUS machines include a large amount of live technician support which is built into the cost of the equipment.

Most companies who manufacture high priced equipment, also build lower priced DUS machines in the \$20,000.00 to \$50,000.00 range. The major components of gray scale imaging are similar in all DUS machines. DUS equipment, regardless of cost, must pass the same stringent guidelines in the manufacturing of transducers, processors and other essential components before FDA approval is granted. Fifty years ago a computer was the size of a large apartment building and unavailable at any cost. Today most all of those features fit in a laptop microprocessor. The technology used in DUS 12 or 15 years ago costing hundreds of thousands of dollars are little match for today's \$20,000 to \$50,000 machines in standard gray scale imaging of superficial soft tissue structures.

"Facts" describes companies which are making ridiculous claims of being able to "image pain" with DUS. In a recent review of companies marketing DUS equipment, we found no available ads claiming pain could be imaged. One practice management promotion recommended DUS imaging as a means of raising the cost of an injury. This type of "practice building" promotion is condemned and not the fault of ethical DUS vendors. Early sales tactics by some DUS vendors were based on claims made by physicians and not by the companies themselves. Fortunately, it appears that most vendors have found those claims to be untrue and now avoid such statements.

DUS equipment has been placed in colleges by vendors for the purposes of using and researching this technology. To date, there have been no studies published. In some cases it is rumored that positive research on musculoskeletal imaging and so-called "spinal area imaging" have actually been somehow discouraged or suppressed.

Radiology, MRI, and ultrasound organizations are separate departments in teaching hospitals. As a result, combined research from academic departments has been slow in forthcoming, sometimes because of turf issues. Regrettably, ultrasound and MRI departments, each with separate funding for research, have not been freely joining forces for side by side studies.

DUS is not intended to compete with appropriately prescribed CT or MRI when a global view is required, nor with plain film x-ray to image bone. But the specialized field of view with DUS, permits better identification of smaller soft tissue lesions within certain musculoskeletal structures at three to four times lower cost than MRI.^{1,2,8,14,33,54} Further comparative published studies of DUS and MRI on the adult spine are needed and forthcoming. These will clarify some of the questions regarding normal anatomy and its variants, reproducibility, reliability, sensitivity and specificity. The skilled or unskilled injudicious use of plain film x-ray, MRI or other imaging modalities brings a greater cost and risk to public health than does possible misuse of DUS by a selected few, neither of which are advocated. In this early stage of DUS moving into the private practitioner's office, and the certainty of its continued development, there is an opportunity to create appropriate guidelines and protocols, thereby avoiding further or later abuses.

The recommendations of the Mercy Conference Guidelines were not negative with regard to DUS for the musculoskeletal system. Because these guidelines were finalized in 1992, it is apparent that all published DUS material subsequent to the Mercy Conference Guidelines was not available to the committee. There may at the time have been a lack of all the available and essential information on DUS imaging because of more pressing issues and a simple lack of interest.

The "Facts" article mentions concern for the proliferation of DUS "amongst chiropractors." If that were the case, who better to use a noninvasive, cost effective musculoskeletal imaging modality than a chiropractor? DUS equipment for practitioners in musculoskeletal arenas has proliferated because of the recent portability of equipment, cost effectiveness and the definitive, specific information derived from this noninvasive modality.

It is clear that the allopathic community has greater interest in the application of DUS for the musculoskeletal system than chiropractic. A recent university-sponsored 40 hour seminar on musculoskeletal imaging with DUS (10 to 15 minutes of the 40 hours included case studies on superficial paraspinal soft tissue structures post-trauma) was limited to 25 doctors; only two chiropractors were present, neither from any of the chiropractic specialties!⁷⁴

Ideally, physicians making statements pro or con with regards to musculoskeletal imaging with DUS have extensive hands on experience in performing and reading these type of images. Organizational policy statements on the other hand are opinions based on current literature, which may not include large numbers of empirical studies, hands-on experience, or expert testimony. These statements are not meant to preclude DUS evaluation of muscle tissue, which is well-established in medical literature.

There is a definite need to define appropriate application, guidelines, and protocol for this accepted imaging modality. Public and aggressive attacks by our colleagues create a negative impact not only in the apparently intended DUS arena, but on chiropractic in general. Rather than create new problems based on one specific and defined use of DUS, all parties should be participating in correlative studies showing both uses and limitations of this sonographic application. DUS technology will not disappear. It is important for musculoskeletal imaging and will only grow, with or without the support of the chiropractic community.

It is time that chiropractors start working together on such issues rather than hold public duels that gain little ground on either side and create more problems in the community than they will ever help.

In conclusion, we offer this quote from the excellent and appropriately titled textbook, *Musculoskeletal Ultrasound*, by radiologist Bruno Fornage, MD published by Churchill Livingstone in 1995. In his preface he says:

"Musculoskeletal sonography has been under-used in the United States because of the availability of magnetic resonance imaging. However, sonography can often provide similar diagnostic information for only a fraction of the cost of MRI, and in this era of cost containment, sonography should be -- as it is in Europe and other parts of the world -- the first-line examination technique for many pathologic conditions of the soft tissues."

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