

**Perspectives on Image Performance
Assessment II**

"Primum non Nocere"

Tuesday, August 12th

Room 26A

CE – Ultrasound 2

Perspectives on Image Performance Assessment II

***"The Impact of Compromised Elements Within An
Ultrasound Transducer On Image And Doppler Quality."***

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Our research has shown that up to 25% of all diagnostic ultrasound transducers currently in clinical use have some form of performance compromising service issue. Problems related to dead elements within an array may go unnoticed by clinicians as early symptoms have a more dramatic effect on Doppler performance than on imaging performance. Our experience has shown that very few hospitals, if any, in The United States have a program in place that routinely tests transducers in an objective, evidence-based manner. If tested at all, hospital or OEM personnel typically use a tissue mimicking phantom to evaluate probe and system performance. Our data demonstrates that this is a seriously flawed approach and results in clinicians using compromised transducers unaware, thereby potentially producing erroneous

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Results: “As few as 2 consecutive dead elements can materially impact the beam profile; four or more can significantly reduce resolution and penetration, increase the noise floor, and cause Doppler peak velocity errors, flow ambiguity and spectral broadening. Tissue phantoms proved to be equivocal in spotting defective elements.”

Conclusion: “...array health is critical to high-quality, efficacious ultrasound

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The Methods and Effects of Transducer Degradation on Image Quality and the Clinical Efficacy of Diagnostic Sonography

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Transducer “health” is key to diagnostic efficacy. It is known that individual transducer element failure within an array is critical to overall system performance and over time, with normal use, elements can cause working or loose sensitivity, leading to a potentially negative impact on the clinical efficacy of the ultrasound examination. Investigating this issue, the authors evaluated transducers with selected elements disabled compared to fully functioning arrays, examined how dead elements affected ultrasound images, acoustic parameters, flow phantom / tissue phantom results as well as human imaging. Results: As few as 2 consecutive dead elements can

significantly impact the overall quality of the image. Key words: ultrasound transducers, quality assurance, image quality, Doppler, artifacts and performance.

Diagnostic ultrasound, like many other medical technologies, has a long history of being a critical factor in the overall quality and efficacy of the examination. Unfortunately, the transducer is also the one component in the imaging chain that is subjected to the most potential for damage. Because a compromised transducer can produce some level of B mode image, spectral Doppler, tissue flow, highly skilled and call users can sometimes be confused when an adequate study cannot seem to be performed, for example, on a patient with a large body habitus or even on a standard basis across a large cross section of patients. Often, the result is unnecessary and expensive service calls, rescheduling of the patient, referring the patient to another facility for additional testing, increased examination time, etc. In the worst case, a potentially missed diagnosis. In our transducer testing and repair laboratory, the data indicate that as many as 25% of all ultrasound transducers currently in clinical use may have some

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*"...if element-to-element uniformity is not good enough,
we effectively create a random array with random
element spacing. Grating lobes are not well defined
in this case; their angles are also random..."*

Joe Guess, Ph.D.
Acoustic Noise from Arrays is Grating - 1993

*"Sidelobes of the beam can also allow interference
from flow outside the vessel under interrogation
and may change the spectral mean velocity."*

Bjorn Angelsen, *Doppler Ultrasound in Cardiology*, 1985