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Developments in the use of Micro Ultrasound (MUS) as a Diagnostic and Biopsy Tool.

Good evening.

Likely you've had some sort of ultrasound (US) procedure to diagnose a condition. It's a fast, easy, economical, accurate, portable way to aid diagnosis or suggest the need for other diagnostic tools. There's no noise, no claustrophobia and no contrast although a few techniques for prostate ultrasound use contrasting agents. Prostate US uses a probe inserted into the rectum that sends and receives signals. Preparation for this procedure is not complicated nor is the procedure itself very uncomfortable. However, several different ultrasound techniques have been used to detect prostate cancer including color Doppler ultrasound. Generally, they are regarded by most experts as inferior to Multiparametric Magnetic Resonance Imaging (MRI).

Basically, prostate ultrasound works like this. When sound waves echo off an object such as a tumor or a calcium deposit, they change slightly. The ultrasound machine can interpret these very tiny changes in the character of the returning sound wave to make determinations about the object (such as the prostate) that it has hit. Measurements can be made about the size and shape of the object, how far from the probe it is, and what its makeup is. For instance, ultrasound can determine whether an object is solid, full of liquid, or a little of both. There are some forms of US that measure blood flow speed. Blood moves faster through a tumor than it does in surrounding tissue.

Ultrasound is used to survey the prostate for other abnormalities and measure its size. It can be used with other imaging techniques as well for accuracy. Think of accuracy this way. Good ultrasound technology should show clear tumor characteristics without confusing them with other prostate issues such as calcium deposits. The US technician (urologist or diagnostic radiologist) needs skill and practice to know what to look for on an image. Since US images are real time, it is used to guide tissue sample taking in prostate biopsies.

The advantages of US over MRI pushed researchers towards developing an US that can create images that are 3 to 4 times higher resolution than traditional Us and at least as clear as MRI images. The result of their labor is Micro-Ultrasound (MUS). And not too far away, Artificial Intelligence enhanced Micro-Ultrasound (AIMUS). The latter will lead to more accurate and complete reading of the sound generated image. MUS uses smaller sound waves than the

previous technologies used and that's thought to help with accuracy and image quality. Plus, MUS may be able to detect prostate cancer in areas of the gland missed by MRI.

MUS without AI is in use in Great Britain but not on a wide scale. The British radiological community hopes for controlled studies of MUS to compare its performance to MRI. AIMUS is being developed by a team led by a computer scientist at the University of Florida. I've attached a hyperlink to an article you may find interesting, below.

Once MUS's usefulness is certain, the government certification process can proceed, and prostate MUS will someday find its way into clinics, hospitals and urologist's offices. Operator education will be essential towards making micro ultrasound successful. Ultimately, prostate MRI might not be needed. Micro-ultrasound could save patients and insurance companies a lot of money

CHECK OUT THESE INTERESTING ARTICLES.

Micro-ultrasound's emerging role in diagnosis:

<https://journals.sagepub.com/doi/full/10.1177/17562872221145625>

Ultrasound and Urology: <https://ncbi.nlm.nih.gov/pmc/articles/PMC4495491/>

Color Doppler Ultrasound (University of Minnesota):

<https://experts.umn.edu/en/publications/quantitative-colour-doppler-and-greyscale-ultrasound-for-evaluati>

Color Doppler Ultrasound and why many urologists are not using it:

<https://onlinelibrary.wiley.com/doi/abs/10.7863/jum.2004.23.5.623>

MRI Vs. Color Doppler Ultrasound: <https://sperlingprostatecenter.com/mri-vs-color-doppler-in-detecting-prostate-cancer/>

Prostate Cancer Biopsy with micro ultrasound (From Johns-Hopkins):

https://clinicalconnection.hopkinsmedicine.org/news/micro-ultrasound-a-new-approach-to-prostate-biopsy?trk=public_post_comment-text.

Artificial Intelligence and Micro ultrasound:

<https://www.sciencedirect.com/science/article/pii/S089561112400003X>.

Have a great Sunday and we at Prostate Forum look forward to seeing you at our zoom presentations and our support groups.

