Correlating Micro-Ultrasound Sonographic Features and PRI-MUS™ Ranking of Prostate Cancer Lesions with Underlying Histo-pathology

Jefferson Lin[1], Brian Wodlinger[2], Theresa McGrath[2], Gregg Eure[1]

[1]Urology of Virginia, Virginia Beach, Virginia, USA; [2]Exact Imaging, Markham, Ontario, Canada

Introduction & Objectives:

PRI-MUS™ (**p**rostate **r**isk **i**dentification for **m**icro-**u**ltra**s**ound) is an evidence-based risk identification protocol developed to identify suspicious regions of the prostate to enable improved targeting of prostate biopsies using micro-ultrasound.

Since high resolution micro-ultrasound – which operates at 29 MHz - has resolution down to 70 microns, it is reasonable to expect that the imaging findings would bear a correlation to the cellular and ductal structures identified in pathology.

Methods:

- 20 images of micro-ultrasound guided biopsies from the Exact Imaging clinical trial (NCT02079025) were selected
- These images were taken immediately preceding biopsy using the ExactVu™ micro-ultrasound system (ExactVu™, Exact Imaging)
- A detailed pathological review was performed to investigate the correlation between the detailed histological features with the identified imaging features

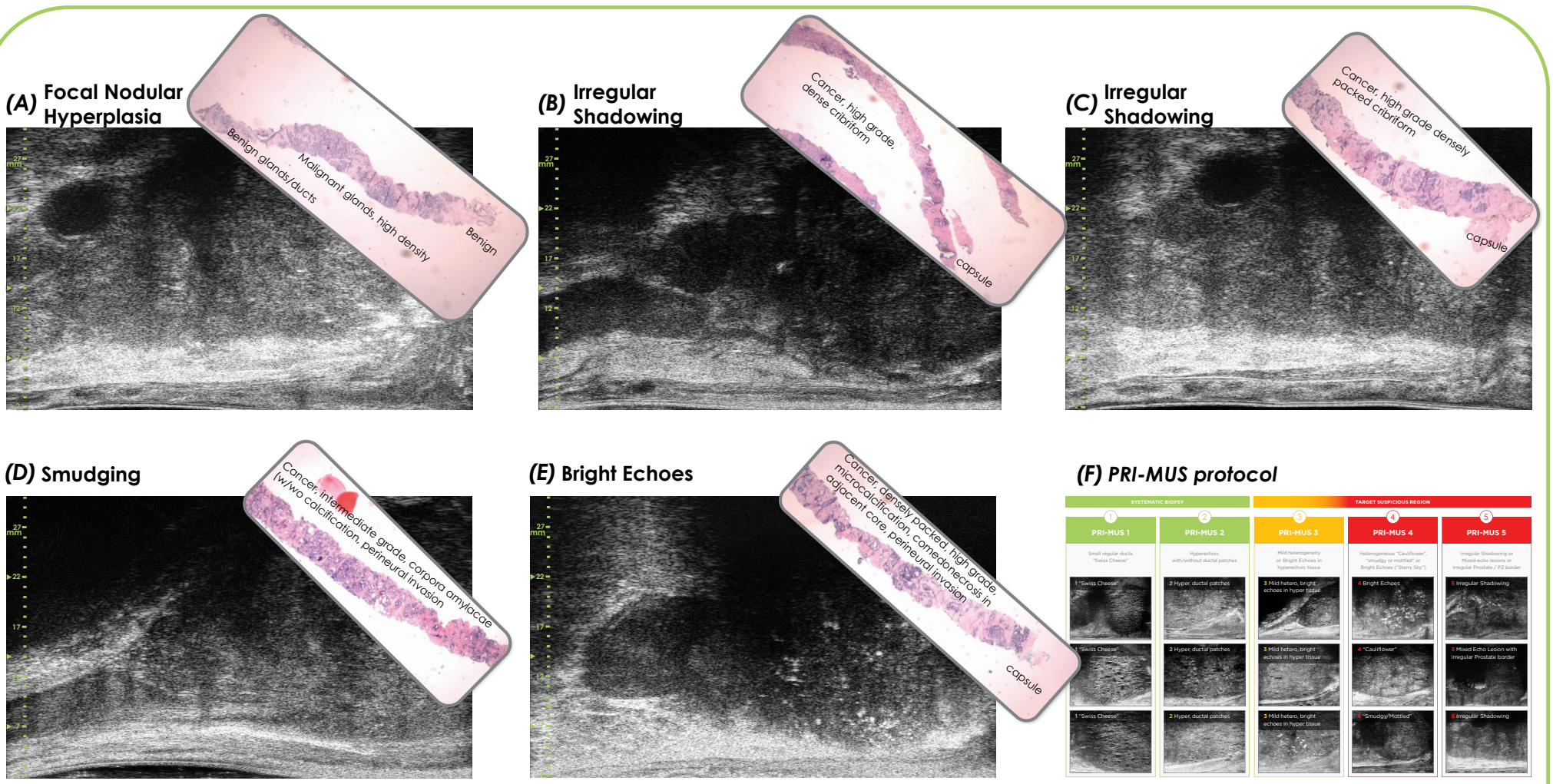

***Figure 1:* Different prostatic tissue features that were characterized with the ExactVu micro-ultrasound system.**
A total of 20 prostatic samples were collected and correlated.
(A) is an example of Focal Nodular Hyperplasia. ***(B)*** is an example of Irregular Shadowing. ***(C)*** is an example of Finger-like/Irregular Shadowing.
(D) shows the "Smudging" feature. ***(E)*** is an example of Bright Echoes. ***(F)*** shows the **PRI-MUS** protocol for scoring the zones of the prostate.

Results:

A Strong correlation was found for all of the features investigated (*Figure 2*).

- The **PRI-MUS 4** Echogenic "Cauliflower" feature was correlated to densely packed cancer
- The **PRI-MUS 4** "Bright Echoes" feature was associated with comedonecrosis (*Figure 1e*)
- The **PRI-MUS 4** "Smudgy texture" feature contained corpora amylacea mixed with dense or intermediate grade cancer (*Figure 1d*)
- The **PRI-MUS 5** "Finger-like shadowing" feature samples all contained dense cribriform cancer (*Figure 1c*)

Total Results	Swiss Cheese (PRI-MUS 1)	Cauliflower (PRI-MUS 4)	Finger-like Shadowing (PRI-MUS 5)	Bright Echoes (PRI-MUS 4)	Smudgy Texture (PRI-MUS 4)	Corpora Amylacea (PRI-MUS 4)
20	2/2	4/5	3/3	3/4	3/3	3/3

Figure 2: Correlation results of Pathology and PRI-MUS Characteristics (as visualized with Micro-Ultrasound)

Conclusions:

- **The strong correlation between pathology and micro-ultrasound imaging suggests a biophysical basis for the sonographic changes observed in the prostate**
- This correlation will perhaps allow for the tracking of cancer progression as well as estimation of the grade of disease using micro-ultrasound
- Future work involving multiple pathology and imaging readers will be used to determine the strength of this correlation and potentially to improve the PRI-MUS risk identification system

References

1. Ghai, S. et al., "*Assessing Cancer Risk in Novel 29 MHz Micro-Ultrasound Images of the Prostate*", Journal of Urology, 2016 Aug;196(2):562-9