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# Contrast-Enhanced Ultrasonography for the Evaluation of Complex Renal Cysts

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# MP33-04 Contrast-Enhanced Ultrasonography for the Evaluation of Complex Renal Cysts

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## 1. Introduction

- Management of complex renal cysts is guided by Bosniak classification system but is lacking in its ability to risk stratify patients for intervention.
- Population-based studies have shown that cystic renal cell carcinoma (RCC) has better survival outcomes than solid counterpart and is overtreated[1,2,3].
- Appropriate identification of candidates for intervention is an unmet need in patients with cystic renal masses.
- Contrast-enhanced ultrasound (CEUS) is emerging as a tool for characterizing renal lesions and better risk stratifying complex renal cysts.

## 2. Objective

- We conducted an IRB-approved prospective pilot study evaluating the use of CEUS to calculate tumor fractional vascularity (FV) as a metric to better risk stratify patients.

## 3. Methods

- Patients undergoing partial (PNx)/radical (RN) nephrectomy for Bosniak IIF-IV cysts on pre-op imaging were recruited
- Pre-2019 (P2019B) and 2019 Bosniak (B2019) classifications were assigned by experienced GU radiologist
- CEUS was performed pre-op on day of surgery with both 2D and 3D modalities
- Custom MATLAB program used to select regions of interest for FV calculation **(Figure 1)**.
- Tumor FV% calculation = 1 – (Non-enhancing area/lesion area).
- FV% and Bosniak classification were compared to the final surgical pathology report and radiologist evaluation

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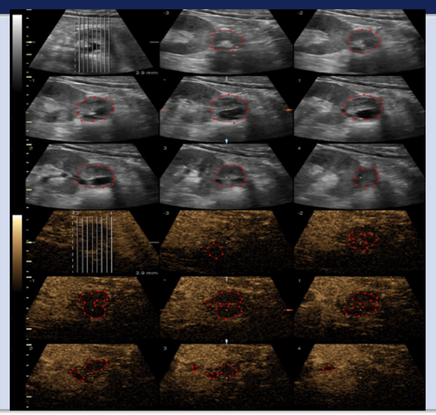
## Figure 1. 3DFV% quantification using ROI pre and post-contrast administration



## 4. Patient Demographics

- 20 patients included for final analysis
- Mean age 58.9 ± 15.0 years
- Mean pre-operative lesion size was 4.1 ± 1.7 cm (Range: 1.2-8.3 cm)
- 9 underwent RN, 11 PNx

## 5. Results

- Final pathology: 3 benign lesions, 17 malignant (See **Table 1** below)

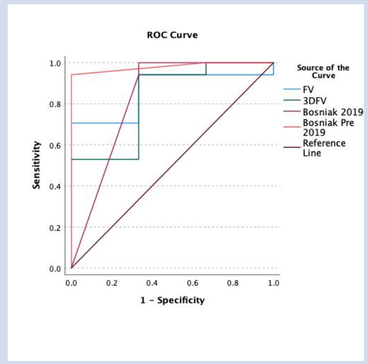
## Table 1. CEUS Measurements, Pathologist Estimations and Final Surgical Pathology

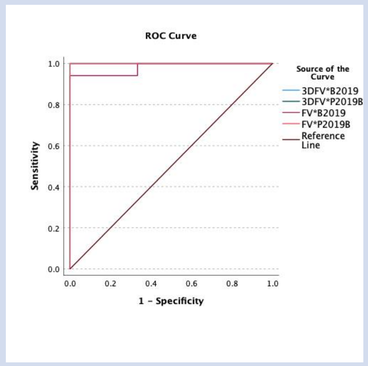
| ID | Bosniak Pre-2019 | Bosniak Post-2019 | Radiologist Estimate of Enhancing / Solid Component (%) | 2DFV% | 3DFV% | Pathologist Estimate of Cystic Component (%) | Clinical T-Stage | Pathologic T-stage | Histology | ISUP Grade |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 4 | 5% | 29.2 | 8.54 | | T1b | | Multilocular Renal Cyst | |
| 2 | 4 | 4 | 15% | 66.9 | 60.9 | 75 | T2a | T3a | CC RCC | 3 |
| 3 | 4 | 4 | 5% | 63.4 | 75.8 | 40 | T1a | T1a | CC RCC | 2 |
| 4 | 4 | 4 | 10% | 6.5 | 11.5 | 10 | T1a | T1a | CC Papillary RCC | 2 |
| 5 | 4 | 4 | 20% | 63.7 | 96.1 | 20 | T1b | T3a | CC RCC | 2 |
| 6 | 4 | 4 | 50% | 82.1 | 95.2 | 40 | T1a | T1a | CC RCC | 2 |
| 8 | 3 | 2F | 5% | 32.4 | 36 | 10 | T1a | | Multilocular Renal Cyst | |
| 9 | 4 | 4 | 15% | 73.3 | 41.8 | 40 | T1a | T1a | CC RCC | 2 |
| 10 | 2F | 2F | 75% | 67.1 | 80.9 | 10 | T1a | | Multilocular Renal Cyst | |
| 11 | 4 | 4 | 95% | 93.4 | 78.6 | | T1a | T1a | Papillary RCC | 3 |
| 12 | 4 | 4 | 18% | 72 | 88.2 | 30 | T1a | T1a | CC RCC with Cystic Features | 2 |
| 13 | 4 | 4 | 80% | 94.4 | 89.1 | 85 | T1b | T1a | CC RCC | 2 |
| 14 | 4 | 4 | 25% | 88.7 | 95.8 | 60 | T1b | T3a | CC RCC | 1 |
| 15 | 4 | 4 | 25% | 93.2 | 96.2 | 90 | T1b | T1b | CC RCC | 2 |
| 16 | 4 | 4 | 60% | 83.6 | 71.4 | | T1b | T1b | CC RCC | 2 |
| 18 | 4 | 4 | 15% | 81.9 | 91.3 | 25 | T1b | T1a | CC Papillary RCC | 2 |
| 19 | 3 | 3 | 5% | 77.7 | 87.3 | 65 | T1b | T1a | CC Papillary RCC | 2 |
| 20 | 4 | 4 | 20% | 70 | 55.1 | | T1b | T3a | CC RCC | 2 |
| 21 | 4 | 4 | 15% | 56.3 | 56.7 | | T1b | T1b | CC RCC | 4 |
| 23 | 4 | 4 | 20% | 94.4 | 95.8 | 99 | T1b | T1a | CC RCC with Rhabdoid Features | 4 |

## 5. Results (cont.)

- On ROC analysis, the AUC was 0.980, 0.824, 0.863, and 0.824 for P2019B, B2019, 2DFV%, and 3DFV% to predict malignancy, respectively
- When assessing the additive effect of combining Bosniak score and FV% to predict malignancy, three models had an AUC of 1 and the 2DFV%/B2019 had an AUC of 0.980 (p value = <0.001) (**Figure 2**)

## Figure 2. ROC Curve analyses of ability to predict malignancy both individually (left) and combined (right)




## 6. Conclusions

- FV is a novel metric in the evaluation of complex cystic renal masses that improves upon the Bosniak Classification system's ability to predict malignancy on final surgical pathology.
- It may serve as an important adjunct for risk stratification for surgical intervention.
- Further prospective evaluation is warranted.

## 7. References

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