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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<sup>1,2,3</sup>.
- 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.

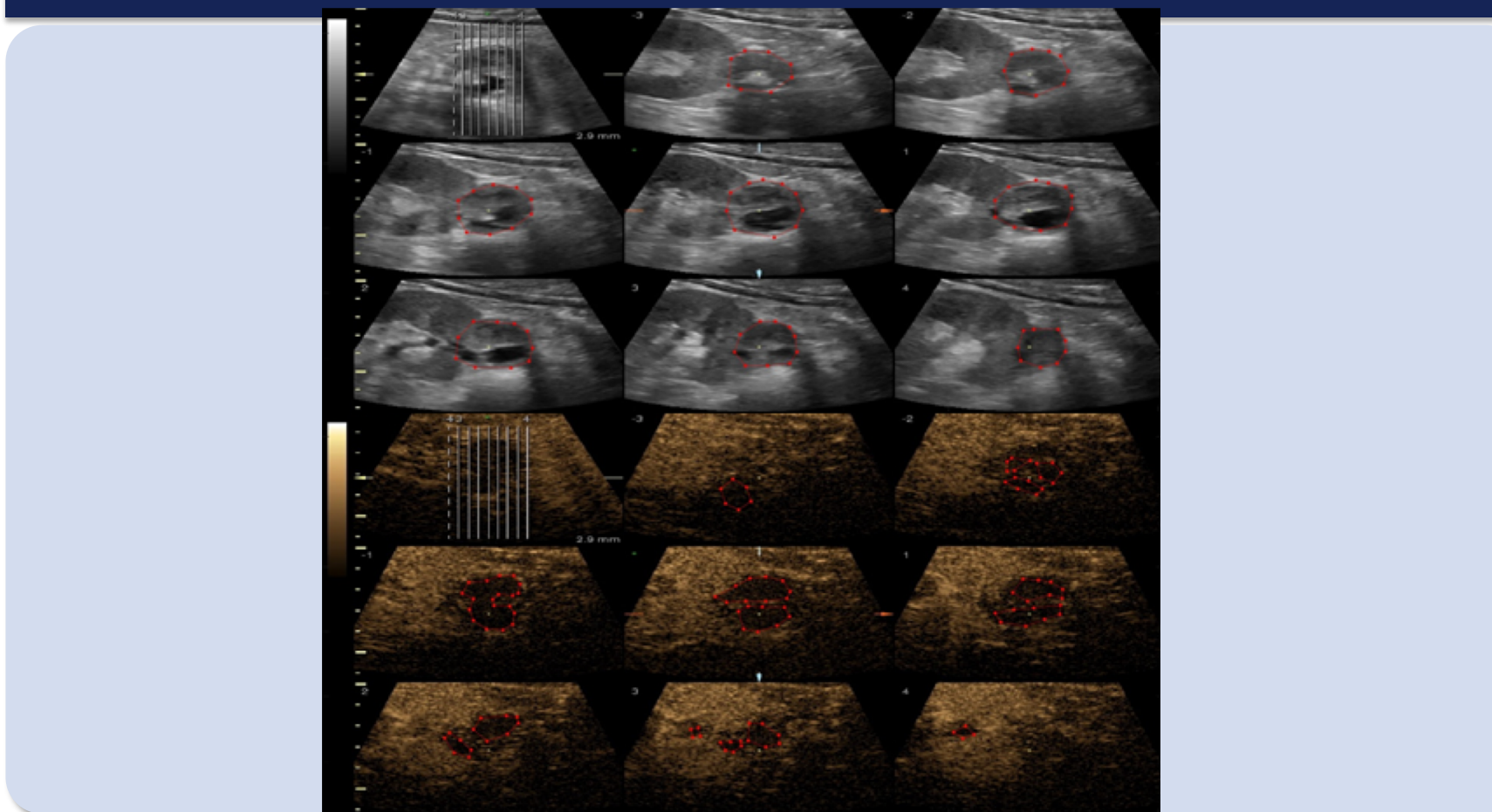
## 2. Objective

- 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 =  $1 - (\text{Non-enhancing area/lesion area})$ .
- FV% and Bosniak classification were compared to the final surgical pathology report and radiologist evaluation

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



## 4. Patient Demographics

- 20 patients included for final analysis
- Mean age  $58.9 \pm 15.0$  years
- Mean pre-operative lesion size was  $4.1 \pm 1.7$  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)

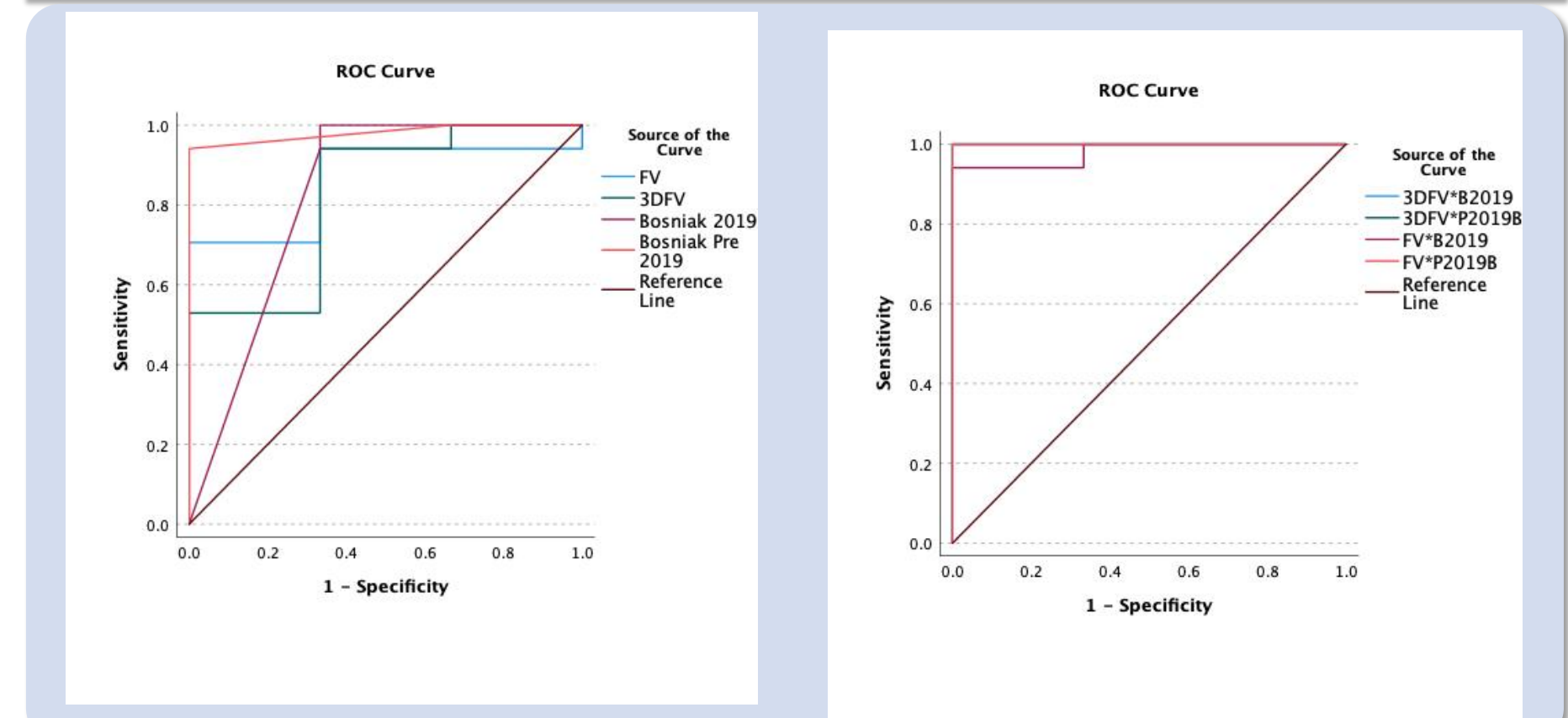
**Table 1. CEUS Measurements, Pathologist Estimations and Final Surgical Pathology**

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

1. Winters BR, Gore JL, Holt SK, Harper JD, Lin DW, Wright JL. Cystic renal cell carcinoma carries an excellent prognosis regardless of tumor size. *Urol Oncol.* 2015;33(12):505.e9-505.13. doi: S1078-1439(15)00360-9 [pii].
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