

## **Contrast-enhanced ultrasound (CEUS) in the evaluation and characterization of complex renal cysts**

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# Learning objectives

The objective is to describe contrast-enhanced ultrasound (CEUS) in the evaluation and characterization of complex renal cysts.

## Background

Renal cysts are very common abnormalities and with the rise in use of cross-sectional abdominal imaging there has been an increase in the diagnosis of complex renal cysts.

Complex cysts do not meet the strict criteria for simple cysts (anechoic, sharply defined, imperceptible back wall, round or ovoid and enhances sound transmission) and include the presence of septations, calcifications, perceptible wall and mural nodularity.

Contrast enhanced ultrasound (CEUS) is a very promising imaging modality for the study of complex renal cysts. It combines the advantages of ultrasound to the administration of a microbubble contrast agent, which is both safe and not nephrotoxic.

This technique will allow to distinguish cyst that require immediate surgical intervention from those who only require follow-up.

CEUS may be used as an alternative to CT contrast in complex cysts follow-up, reducing exposure to ionizing radiation and nephrotoxic contrast-especially useful in patients with concomitant chronic kidney disease.

## Findings and procedure details

Contrast enhanced ultrasound (CEUS) can adequately characterize complex cystic lesions due to the greater definition of fine septa and small nodules, when comparing to CT.

This characterization allows the use of an adapted Bosniak classification (Figure 1), which has been the center of the complex evaluation of renal cyst for more than twenty years, and defining the lesions according to their complexity and greater probability of malignancy.

**Fig. 1:** Bosniak classification using CEUS.

**References:** - Coimbra/PT

**Fig. 2:** Complex kidney cyst detected on US, with thick internal septa. CEUS allowed prompt assessment of the cyst, showing no internal enhancement.

**References:** - Coimbra/PT

**Fig. 3:** Complex kidney cyst detected on US, with thick internal septa. CEUS allowed prompt assessment of the cyst, showing no internal enhancement - Bosniak I. Probable hemorrhagic cyst.

**References:** - Coimbra/PT

**Fig. 4:** Kidney transplantation. Large complex cyst detected in the renal graft. CEUS allowed a safe assessment of this patient, showing no internal enhancement - Bosniak I. Probable hemorrhagic cyst.

**References:** - Coimbra/PT

**Fig. 5:** Complex renal cyst with septum in its interior. After contrast administration, a slightly thickened and vascularized septum (arrow) is observed. Suggests need for follow-up.

**References:** - Coimbra/PT

**Fig. 6:** A complex renal cyst with irregular borders, which sketches multiple septa, some calcified in its interior. After administration of contrast, some septa have a prominence (arrows), the largest of which is 4 mm thick. Partial nephrectomy was performed.

**References:** - Coimbra/PT

**Fig. 7:** Complex cyst in the middle of the right kidney, classified as Bosniak IIb by contrast-enhanced CT. CEUS showed clear solid component - Bosniak IV, not apparent at CT. There is also a large inferior cyst with thin internal septa - Bosniak II.

**References:** - Coimbra/PT

**Fig. 8:** Renal cyst initially described as Bosniak II / IIF by CT scans. The internal septa become much more evident in the CEUS, as well as its internal enhancement, so the classification was changed to Bosniak IV.

**References:** - Coimbra/PT

**Fig. 9:** Comparison of contrast uptake in a renal cyst - CEUS vs RM. In this case, the enhancement of the septum is more marked in the CEUS.

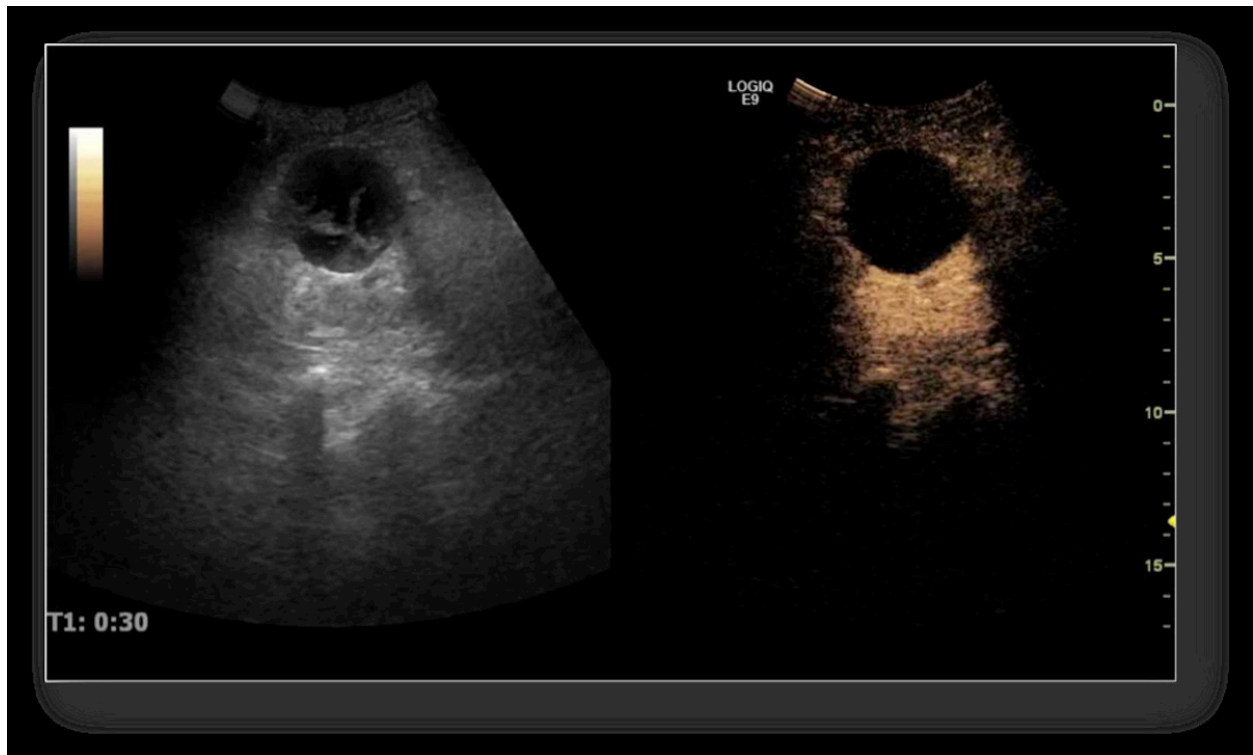
**References:** - Coimbra/PT

**Images for this section:**

Bosniak classification using CEUS	
I	Simple cyst
II	Few hairline thin septa Fine or slightly thickened calcifications Minimal just perceived enhancement of the septa
IIF	Multiple hairline thin septa Smooth minimal thickening of wall or septa Thick or nodular calcifications Minimal just perceived enhancement of the septa
III	Thickened wall or septa with measurable enhancement No solid enhancing lesions
IV	Soft tissue enhancing mass

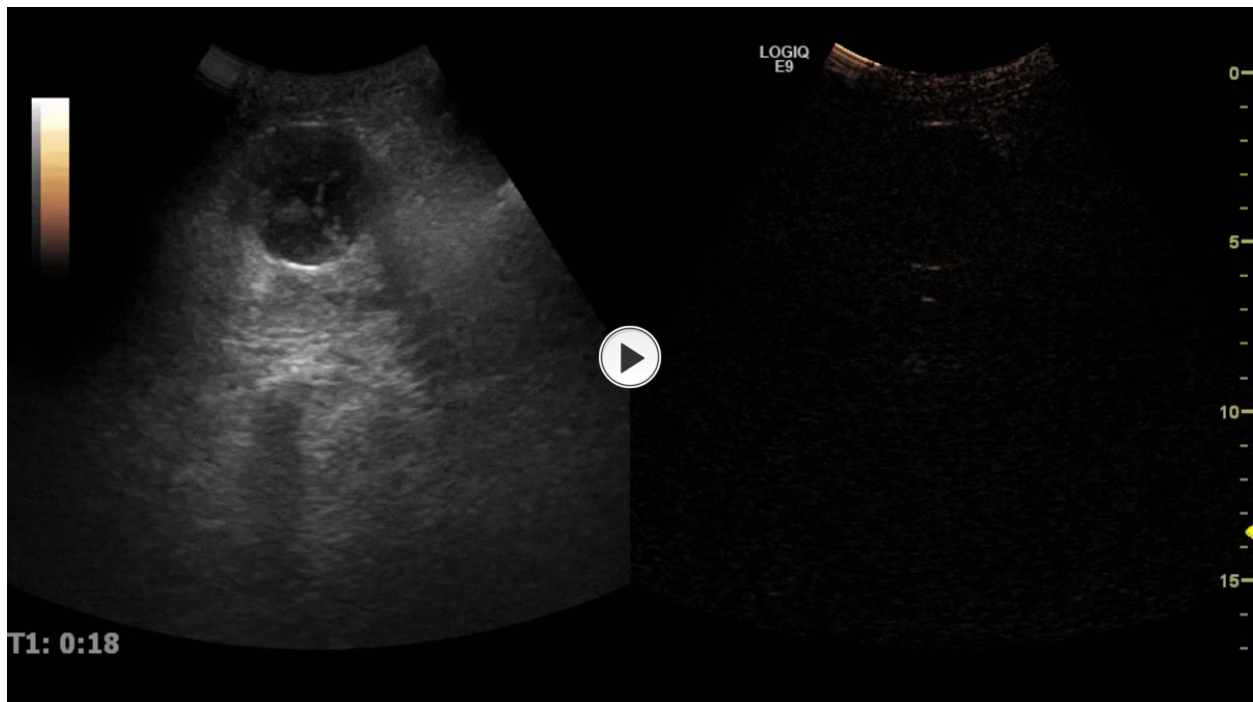
**Fig. 1:** Bosniak classification using CEUS.

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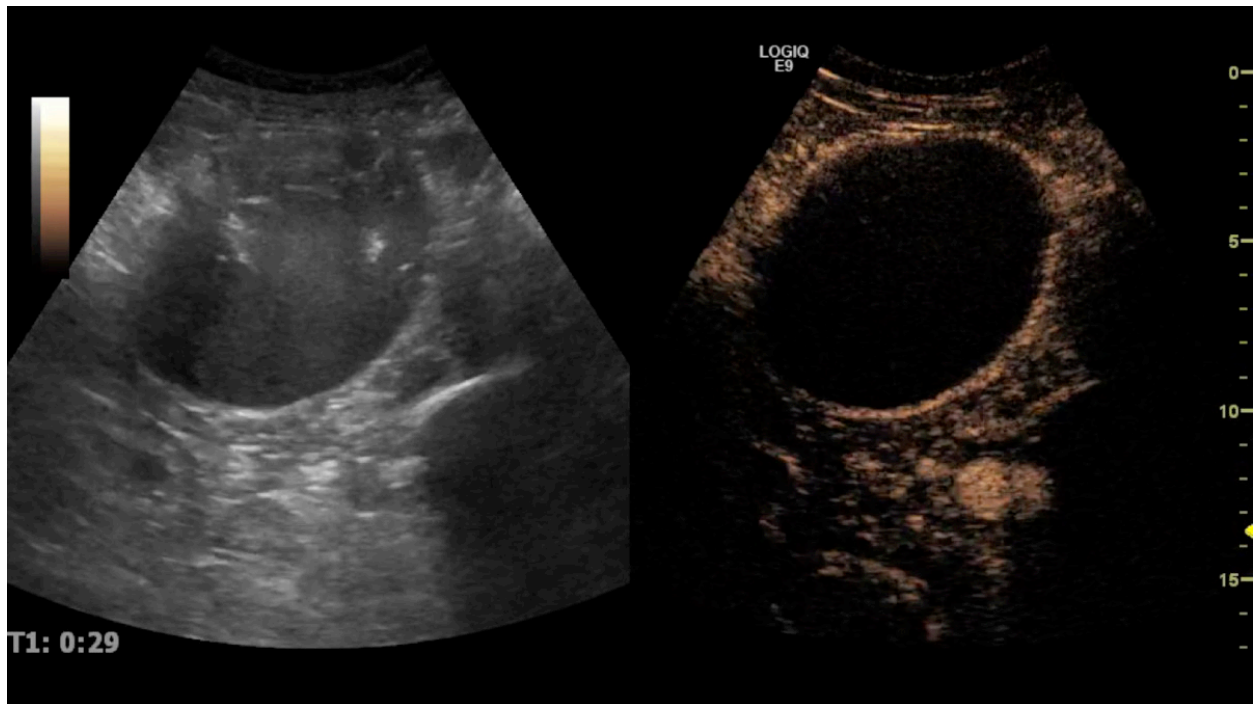
**Fig. 2:** Complex kidney cyst detected on US, with thick internal septa. CEUS allowed prompt assessment of the cyst, showing no internal enhancement.

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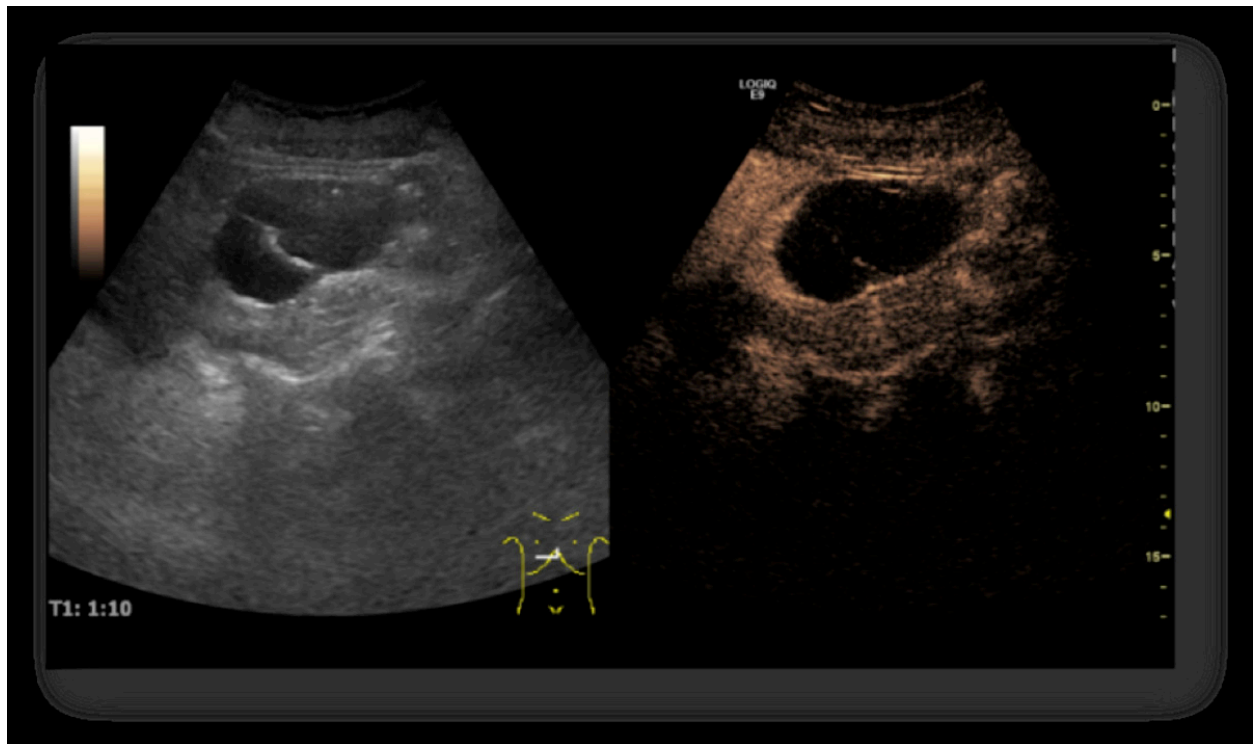
**Fig. 3:** Complex kidney cyst detected on US, with thick internal septa. CEUS allowed prompt assessment of the cyst, showing no internal enhancement - Bosniak I. Probable hemorrhagic cyst.

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**Fig. 4:** Kidney transplantation. Large complex cyst detected in the renal graft. CEUS allowed a safe assessment of this patient, showing no internal enhancement - Bosniak I. Probable hemorrhagic cyst.

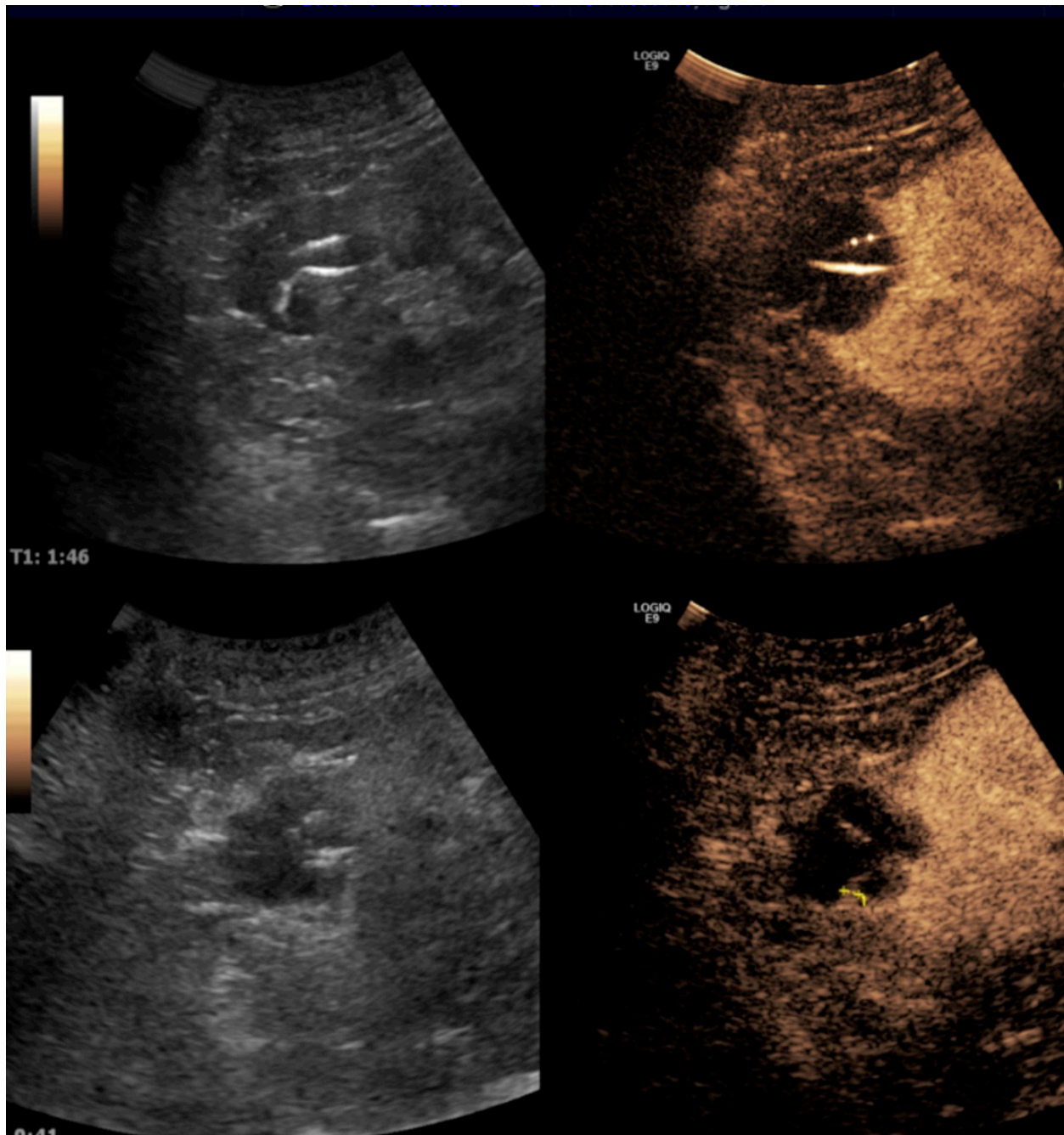
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**Fig. 5:** Complex renal cyst with septum in its interior. After contrast administration, a slightly thickened and vascularized septum (arrow) is observed. Suggests need for follow-up.

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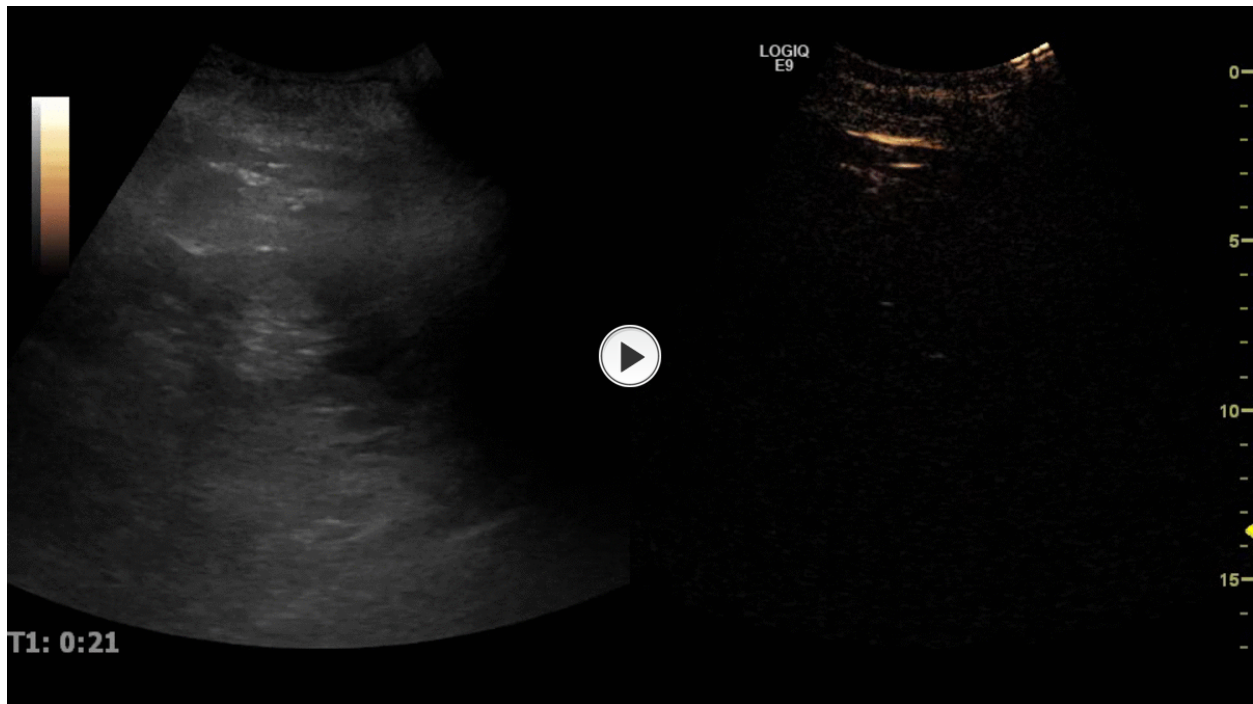




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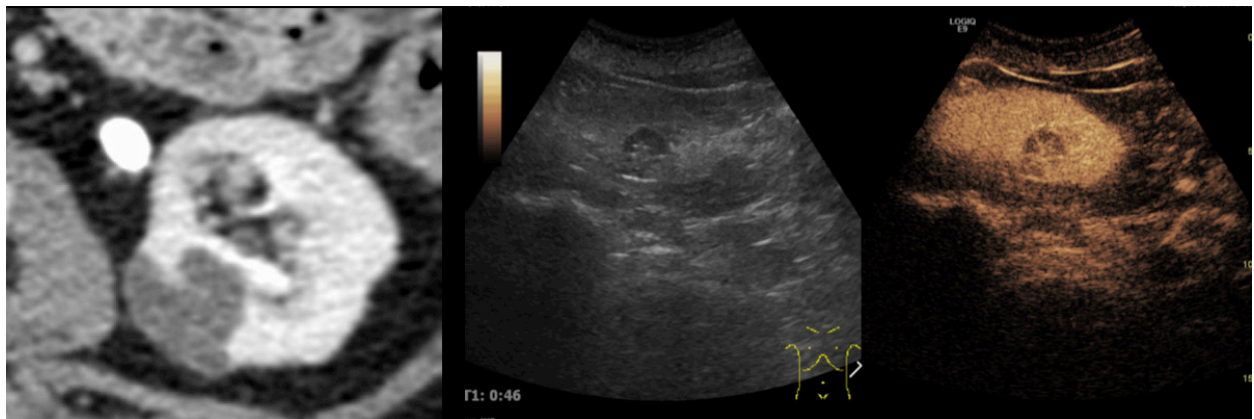
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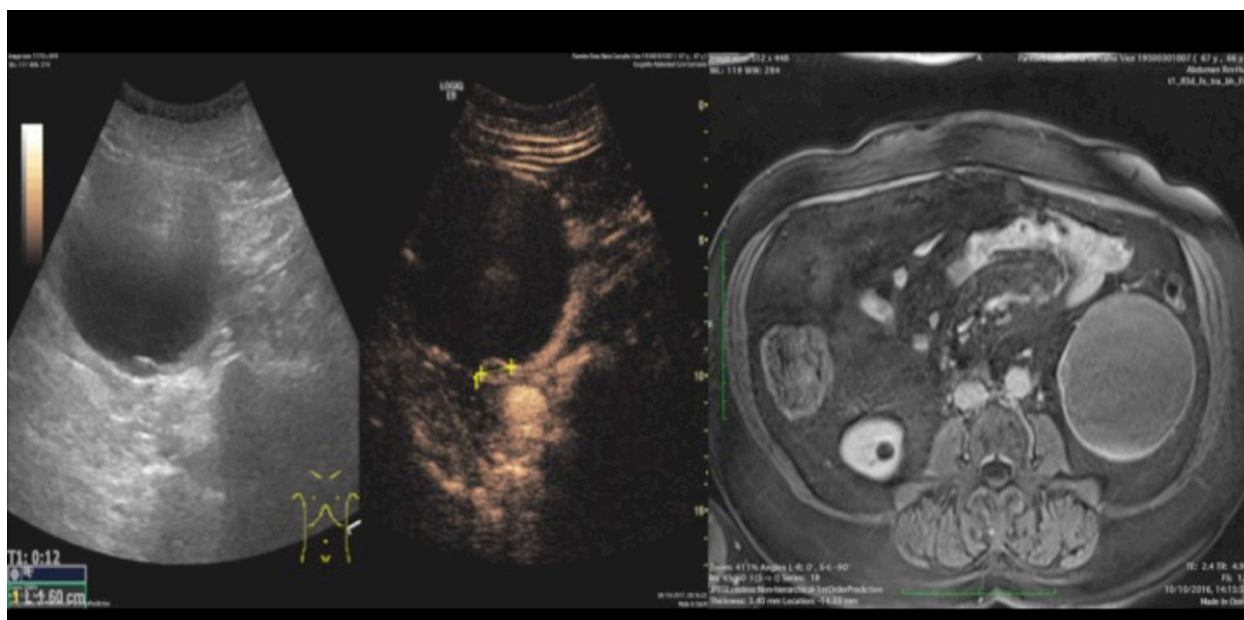
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**Fig. 9:** Comparison of contrast uptake in a renal cyst - CEUS vs RM. In this case, the enhancement of the septum is more marked in the CEUS.

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## Conclusion

Complex renal cysts are a major clinical problem, since it is often difficult to rule out malignancy.

Contrast-enhanced ultrasound (CEUS) is a new relatively inexpensive technique used in the diagnosis and characterization of complex renal cysts. With absence of nephrotoxicity and ionizing radiation, this technique allows the evaluation of this type of injury quickly and in real time. Therefore, CEUS has unique advantages over traditional imaging modalities.

## Personal information

## References

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