

Oncology

Can contrast enhanced ultrasound differentiate benign cystic nephroma from malignant multicystic renal lesions? A case report

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ABSTRACT

Multicystic renal lesions pose a diagnostic dilemma and standard imaging may not be able to differentiate between benign or malignant lesions. Adult cystic nephroma and multicystic renal cell carcinoma are two such cystic renal lesions.

We describe the appearance of cystic nephroma using contrast enhanced ultrasound. We hypothesize how quantitative parameters using time intensity curves appear to be able to distinguish between cystic nephroma and other malignant lesions such as multicystic renal cell carcinoma.

This differentiation is of importance as it may obviate the need for tissue sampling and allow the clinician to recommend conservative management rather than nephrectomy.

Introduction

Multicystic renal lesions pose a diagnostic dilemma. In the absence of sinister features such as enhancing solid nodule or invasion of adjacent structures it may not be possible to distinguish between a benign or malignant lesion radiologically and often the patient will have to undergo nephrectomy.

Adult cystic nephroma (ACN) is an uncommon entity that can present as a multicystic renal mass mimicking the appearances of multicystic renal cell carcinoma (MCRCC), which has been reported to occur in up to 5% of cases of RCC.¹ Recent studies using contrast-enhanced ultrasound (CEUS) have shown promise in the characterisation of RCC however the data on adult cystic nephroma is sparse.

We describe a patient presenting with asymptomatic cystic renal mass who underwent CEUS as part of their imaging work up. Subsequent nephrectomy and histopathological confirmation of adult cystic nephroma was made. We describe our findings on CEUS and the pattern of the time intensity curve.

Case report

Patient A was found to have an incidental 3 cm cystic mass on

ultrasound. CT confirmed a multilocular cystic lesion in the right kidney and CEUS was performed. Time intensity curve was subsequently evaluated using standard machine protocols (GE Logiq E9) (see Fig. 1). The region of interest (ROI) cursor was placed over normal cortical parenchyma in the same kidney as the lesion and at a similar depth to the septation of the multicystic lesion. 2.4 cc of Sonovue sulphur hexafluoride (Bracco) microbubbles were instilled intravenously followed by a 10 cc bolus of 0.9% normal saline, with the timer starting upon injection. Histopathological confirmation of adult cystic nephroma was made.

Discussion

Cystic nephroma and differentials

Cystic nephroma in adults occurs between the 4th to 6th decades with a female predominance. Imaging appearances are that of a multicystic unilateral lesion with the diagnostic criteria originally being described by Powell et al., in 1951.¹

The most clinically relevant differential to consider is the cystic variant of renal cell carcinoma (multicystic RCC). Others include RCC with cystic or necrotic changes, benign multilocular cysts and renal abscesses.

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Abbreviations

(ACN)	Adult cystic nephroma
(CT)	Computed Tomography
(CEUS)	Contrast enhanced ultrasound
(DCE)	Dynamic contrast enhancement
(H&E)	Haematoxylin and Eosin
(MRI)	Magnetic Resonance Imaging
(MCRCC)	Multicystic renal cell carcinoma
(ROI)	Region of interest
(RCC)	Renal Cell Carcinoma
(USS)	Ultrasound

Analysis of the time intensity curve in contrast enhanced ultrasound

Our case report shows that ACN can have similar appearances on CT and gray-scale ultrasound imaging. However differences can be appreciated when time intensity curves are analysed.

With regards to enhancement intensity curve analysis in CEUS the following characteristics are used in the literature:

- Time to peak enhancement.
- Level of peak intensity.
- Time to initial enhancement

When comparing ‘time to peak enhancement’ we demonstrate a similar time to peak at 20 seconds for both the ROI over the normal parenchyma and the septation.

There are two striking differences however. We observed a ‘reduced peak intensity’ in the septation ROI as compared to normal parenchyma and we also note that the ‘time to initial enhancement’ is slower (see Fig. 2).

Analysis of enhancement characteristics versus malignant MCRCC

We found in our case of cystic nephroma that the time to peak enhancement was similar between the septation and normal parenchyma but the peak intensity and time to initial enhancement was less and slower, respectively, in the septation.

Aoki et al. studied 20 patients with clear cell RCC and found “time to peak” of tumour was shorter than that of normal parenchyma in 100% of cases for both solid and cystic lesions.²

This difference could be hypothesized on the grounds that in the cystic nephroma the septation of the lesion contains compressed tubules and fibrous tissue as described in the 1989 Joshi and Beckwith diagnostic criteria.¹ Contrast reaching the septation of the lesion would experience delayed and slower transit due to densely packed stroma and flattened cells as seen on histopathology and H&E staining (see Fig. 1).

Describing cystic nephroma with CEUS

ACN have been investigated in previous studies using CEUS.

Shahzad et al. studied several renal lesions of which two were eventually diagnosed as cystic nephroma on histology.³ They found both had ‘malignant enhancement’ on contrast ultrasound but did not describe quantitatively and it is uncertain if time intensity curves are similar to our case.

Similar findings by Quaia et al. in which they found two cystic nephromas were misclassified as malignant on CEUS due to enhancement in the septa.⁴ Likewise no time intensity curve pattern was available.

Role of MRI

It is known that MRI can upstage the Bosniak classification of complex renal cysts due to its high spatial resolution by demonstrating thickened irregular enhancing septae and small enhancing solid areas, that are not detected by CT or unenhanced standard B-mode USS.

Wang et al. examined the use of dynamic contrast enhanced (DCE)

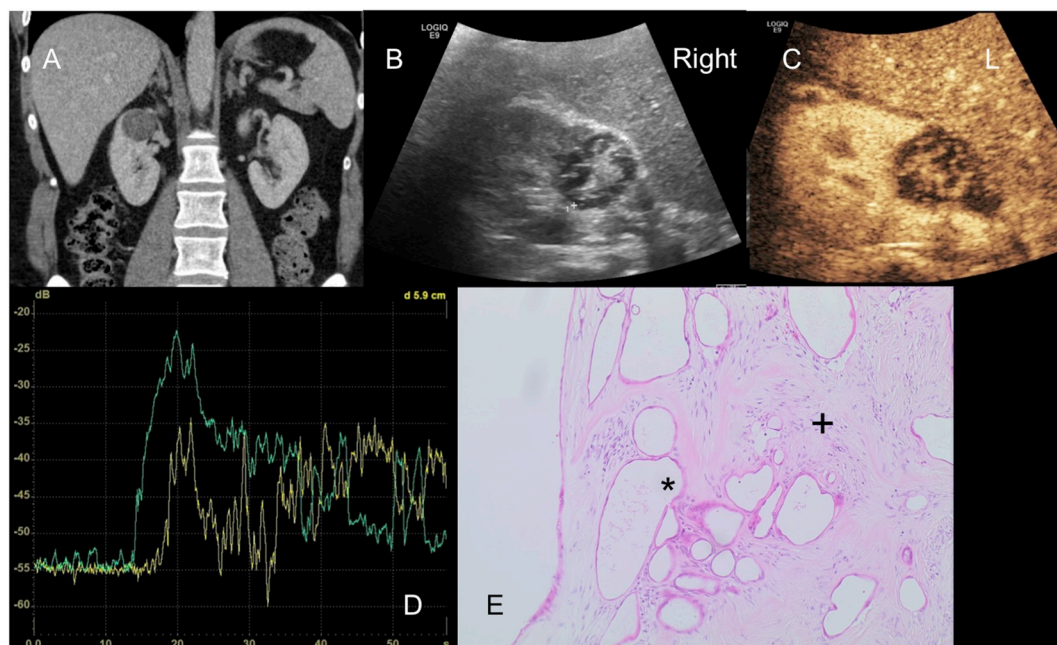


Fig. 1. Coronal Contrast Enhanced CT showing a right upper pole cortical cystic lesion with septations. There was no capsular breach or venous involvement (not shown). **(B):** B-mode ultrasound showing the right kidney upper pole multi-septated cystic lesion. **(C):** Contrast enhanced ultrasound showing the multi-septated cystic lesion with bubble contrast flow through the septa as well as the background parenchyma. Liver (L) is seen in the top right corner of the image. **(D):** Time intensity curve for the lesion. **(E):** H&E staining shows multiple cystic spaces lined by flattened epithelium (*). The surrounding stroma is closely packed resembling ovarian stroma-like appearances (+). Overall histopathology is in keeping with multicystic nephroma.

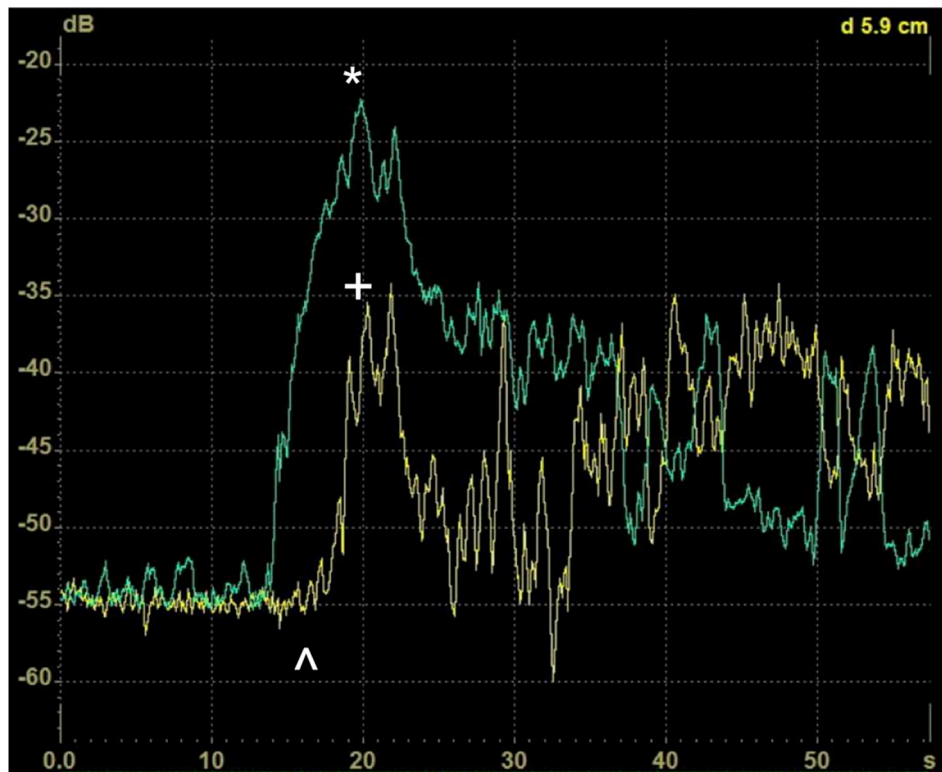


Fig. 2. Yellow line correlates with ROI over the septation and Green line correlates with ROI over the parenchyma. ROI curve shows contrast enhancement reaches its peak at the same time of 20 seconds (*). The intensity of contrast enhancement over the septation is less (+) than the parenchyma and time to initial contrast enhancement is slower (^).

MRI pharmacokinetics in differentiating benign and malignant solid renal masses and found no significant difference between benign and malignant renal masses.⁵ DCE kinetic measurements were statistically different however between the various subtypes of RCC and in distinguishing fat poor angiomyolipoma from non clear cell RCC.

The use of either CEUS or DCE-MRI to investigate the enhancement patterns in complex multi-septated cystic lesions like MCRCC and ACN, such as in our case, to our knowledge has not been previously examined.

Conclusion

We describe a case of ACN, examined with CEUS and diagnosed histopathologically.

Our findings demonstrate quantitative differences in the time intensity curve when placing the ROI over thickened septations and the normal renal cortex. This information may be helpful in order to discriminate a benign from malignant complex renal cyst.

We propose that benign cystic lesions have a reduced peak intensity enhancement and a slower time to initial contrast enhancement, when compared to malignant lesions.

This has crucial management implications for the patient as a more conservative approach could be considered for benign lesions.

We found that time to peak intensity was not a discriminator when placing the ROI over thickened septations. However we acknowledge that time to peak may be able to differentiate when comparing a solid nodule with normal parenchyma as described in previous studies.

To our knowledge we are the first to describe in the literature the CEUS pattern with time intensity curve in ACN.

Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.eucr.2019.101079>.

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References

- Joshi VJ, Beckwith JB. Multilocular cyst of the kidney (cystic nephroma) and cystic partially differentiated nephroblastoma. *Terminol Criteria Diag Cancer*. 1989;64:466–479. [https://doi.org/10.1002/1097-0142\(19890715\)64:2<466::AID-CNCR2820640221>3.0.CO;2-V](https://doi.org/10.1002/1097-0142(19890715)64:2<466::AID-CNCR2820640221>3.0.CO;2-V).
- Aoki S, Hattori R, Yamamoto T, et al. Contrast enhanced ultrasound using a time intensity curve for the diagnosis of renal cell carcinoma. *BJUI*. 2010;108:349–354. <https://doi.org/10.1111/j.1464-410X.2010.09799.x>.
- Shazad K, Simms MS, Byass O. Evaluation of contrast enhanced ultrasound for investigation of complex cystic renal masses. *British J Med Surg Urology*. 2011;4:253–258. <https://doi.org/10.1016/j.bjmsu.2011.03.001>.
- Quaia E, Bertolotto M, Cioffi V, et al. Comparison of contrast enhanced sonography with unenhanced sonography and contrast enhanced CT in the diagnosis of malignancy in complex cystic renal masses. *Am J Rev*. 2008;191:1239–1249. <https://doi.org/10.2214/AJR.07.3546>.
- Wang H, Su Z, Xu X, et al. Dynamic contrast enhanced MRI in renal tumors: Common subtype differentiation using pharmacokinetics. *Nature*. 2017;7:3117. <https://doi.org/10.1038/s41598-017-03376-7>.