



## Case Report

# A novel use of contrast-enhanced ultrasound in uterine artery embolization

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## ABSTRACT

Contrast-enhanced ultrasound (CEUS) is a cost-effective, quick, and non-invasive imaging modality that has yet to be incorporated in uterine artery embolization (UAE). We present two cases that demonstrate the utility of CEUS in UAE for the identification of uterine-ovarian collaterals which otherwise can result in ineffective fibroid treatment and non-target embolization.

**Keywords:** Contrast-enhanced ultrasound, Uterine artery embolization, Fibroids

## INTRODUCTION

Leiomyomata or uterine fibroids are the most common tumor affecting women with a prevalence of more than 80% in African-American women and nearly 70% in Caucasian women by age 50.<sup>[1]</sup> Uterine artery embolization (UAE) is a valuable treatment option for patients with symptomatic fibroids and has demonstrated durable improvement in quality of life.<sup>[2,3]</sup> However, the presence of uterine-ovarian collaterals may make UAE less effective due to incomplete fibroid infarction or can result in non-target embolization of the ovaries.<sup>[4,5]</sup> If the collaterals are detected before the procedure, embolization can be performed to improve outcomes.<sup>[6]</sup> Magnetic resonance imaging (MRI) and angiography have been described to evaluate for collaterals before UAE.<sup>[5,7]</sup>

Contrast-enhanced ultrasound (CEUS) utilizes a microbubble contrast agent, Lumason® (sulfur hexafluoride lipid-type A microspheres) (Bracco Diagnostics, Inc., Monroe Township, NJ) to evaluate for tissue perfusion. It is non-invasive and the contrast agent used has a very low rate of adverse effects. It is currently approved for use in cardiac echocardiography, the evaluation of liver lesions, and for the evaluation of vesicoureteral reflux in pediatric patients. CEUS use for the evaluation of the ovaries and in particular ovarian tumors has been described in the literature.<sup>[8]</sup>

We suggest a low cost, non-invasive, and quick method for the detection of uterine-ovarian collaterals using CEUS during UAE.

## Technique

We describe a technique using intraprocedural CEUS during UAE. Before the procedure, fleet enemas can be considered to minimize colonic gas to allow better visualization of the uterus and ovaries during ultrasound. During the patient preparation and draping, the lower abdomen

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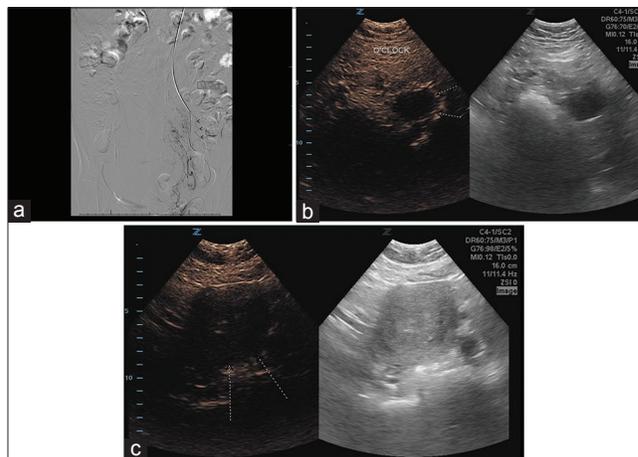
and pelvis of the patient must be prepped with chlorhexidine in addition to the groin access site, and the operative drape must expose these areas. A contrast-enhanced capable ultrasound machine must be present within the procedural suite and prepped with a sterile probe cover.

The UAE procedure is begun in a standard fashion. After selective catheterization of the contralateral uterine artery, digital subtraction angiography is performed; in our institution, we use a 2.8 French Progreat® microcatheter (Terumo Medical Corporation, Somerset, NJ). We typically dilute our Omnipaque 300 1:1 with normal saline. If branches suspicious for uterine-ovarian collaterals are seen on the angiogram or there is evidence of collaterals on the pre-operative MRI, CEUS is performed at this stage for confirmation. One cubic centimeter (cc) of Lumason® is gently hand injected directly into the microcatheter and immediate transabdominal ultrasound is performed of the ovary of interest. At our institution, we typically use a 3–6 MHz curvilinear probe. To locate the ovary, we hold the probe in transverse position slightly off midline on the side of interest and angle the probe laterally scanning up and down until the ovary is identified. Enhancement of the ovary prompts prophylactic collateral coil embolization. Failure of the ovary to enhance indicates that embolization of the contralateral uterine artery can be performed confidently in a safe manner. The same procedure is performed on the ipsilateral side before embolization. At the completion of the procedure, CEUS can be performed again to evaluate for persistent enhancement of the fibroids. If enhancement is detected, further embolization can be considered. This use for CEUS before and following UAE was previously described by Marret *et al.*<sup>[9]</sup>

### Case 1

A 46-year-old female with uterine fibroids resulting in menorrhagia, intramenstrual bleeding, severe anemia, and fatigue presented for UAE. During selective angiography of the left uterine artery, a small branch was seen traveling superolaterally, which was concerning for a utero-ovarian collateral [Figure 1a]. Thus, 1 cc Lumason® was injected directly into the microcatheter and ultrasonography was performed of the uterus and left ovary. Avid contrast uptake was seen in the uterus. However, the left ovary did not enhance, providing reassurance that there was no ovarian supply from the uterine artery [Figure 1b]. Embolization of bilateral uterine arteries was performed using 500–700  $\mu$  Embospheres® (Merit Medical, South Jordan, UT) to angiographic stasis. Post-procedure CEUS showed the absence of uterine fibroid enhancement, indicating successful embolization [Figure 1c].

At 3-month follow-up, the patient reported having normal menstruation with improvement in her anemia and no signs of premature ovarian failure. Follow-up MRI demonstrated



**Figure 1:** A 46-year-old female presenting with uterine fibroids. (a) The left uterine artery angiography demonstrates a branch traveling superolaterally concerning for a utero-ovarian collateral (black arrows). (b) Contrast-enhanced ultrasound (CEUS) of the left ovary following injection of Lumason® (Bracco Diagnostics, Inc., Monroe Township, NJ) demonstrates no enhancement (black arrows), confirming that there is no ovarian supply from the left uterine artery and that uterine artery embolization could be performed safely. (c) CEUS of the uterus following injection of Lumason® post-embolization demonstrates no enhancement (black arrows), indicating successful embolization.

marked decrease in the patient's uterine fibroids and a normal appearance of the ovaries.

### Case 2

A 42-year-old female with adenomyosis and irregular vaginal bleeding presented for UAE. During selective angiography of the left uterine artery, a vessel was seen traveling laterally which was suspicious for a utero-ovarian collateral. Thus, 1 cc of Lumason® was injected directly into the left uterine artery. Ultrasonography did not demonstrate enhancement of the left ovary. Embolization was performed bilaterally using 500–700  $\mu$  Embospheres® to angiographic stasis.

At 6-month follow-up, the patient had significant improvement in her symptoms with cessation of her intermenstrual bleeding and no signs of premature ovarian failure. Follow-up MRI showed decrease in thickness of her endometrium and size of her uterus with no significant abnormalities in her ovaries.

## DISCUSSION

CEUS can be an invaluable tool to add to the interventional radiologists' arsenal. Lumason® lacks the adverse effects associated with iodine and gadolinium and can easily be injected selectively during procedures to evaluate for perfusion. Ultrasound machines are already integrated

in every interventional radiology suite, so the additional preparation required to use CEUS is minimal.

Collaterals can be dangerous in any embolization procedure. In addition to premature ovarian failure, non-target embolization in UAE resulting in labial necrosis and buttock claudication has also been reported.<sup>[10]</sup> The use of intraprocedural CEUS can also be translated to different applications including prostate artery embolization and during the treatment of hepatic tumors.

## CONCLUSION

CEUS is a promising technique to facilitate effective UAE while minimizing non-target embolization.

### Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

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