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Quantitative Assessment of Myometrial Microperfusion Recovery after Preserving Uterine Surgery for Fertility (PUSH) Using Contrast-Enhanced Ultrasound

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Introduction

Adenomyosis, affecting 20-40% of women, causes uterine enlargement, heavy menstrual bleeding, and pain. Severe cases often require surgery, traditionally subtotal hysterectomy, which is invasive and ends fertility. PUSH (Preserving Uterine Surgery for Fertility), which removes lesions and reconstructs uterine structure, preserves fertility and alleviates symptoms. Evaluating postoperative myometrial perfusion is crucial for assessing surgery effectiveness. This study uses intravenous contrast-enhanced ultrasound (CEUS) to evaluate microperfusion recovery post-PUSH surgery.

Methods

The study included 164 adenomyosis patients undergoing PUSH surgery between March 2022 and March 2024. Postoperatively, patients underwent transvaginal ultrasound with intravenous contrast to assess myometrial perfusion. Perfusion defect volumes and uterine volumes were calculated pre- and post-surgery using an irregular shape volume formula ($0.523 \times A \times B \times C$).

Results

Patients' average age was 39.1 ± 4.5 years, with CEUS conducted at an average of 116.5 ± 107 days post-surgery. Myometrial perfusion defect volumes averaged 9.9 ± 12.9 ml within 90 days, significantly dropping to 2.9 ± 6.0 ml at 91-180 days and 2.9 ± 4.7 ml beyond 181 days ($P < 0.01$). Perfusion defects represented 56.6% within 90 days, decreasing to 18.9% after 181 days. Preoperative uterine volume (260.6 ± 226.3 ml) reduced to 71.1 ± 39.2 ml post-surgery. Volume reductions were $66.7 \pm 15.6\%$ (within 90 days), $62.1 \pm 19.2\%$ (91-180 days), and $78.6 \pm 5.4\%$ (beyond 181 days). Differences between timeframes were not statistically significant, though volume continued decreasing notably after 181 days.

Conclusion

CEUS effectively evaluates PUSH surgery outcomes by quantifying myometrial microperfusion recovery, with significant improvement noted by 90 days post-surgery.



Figure 1. In diffuse adenomyosis, the PUSH procedure resects the diseased myometrium.

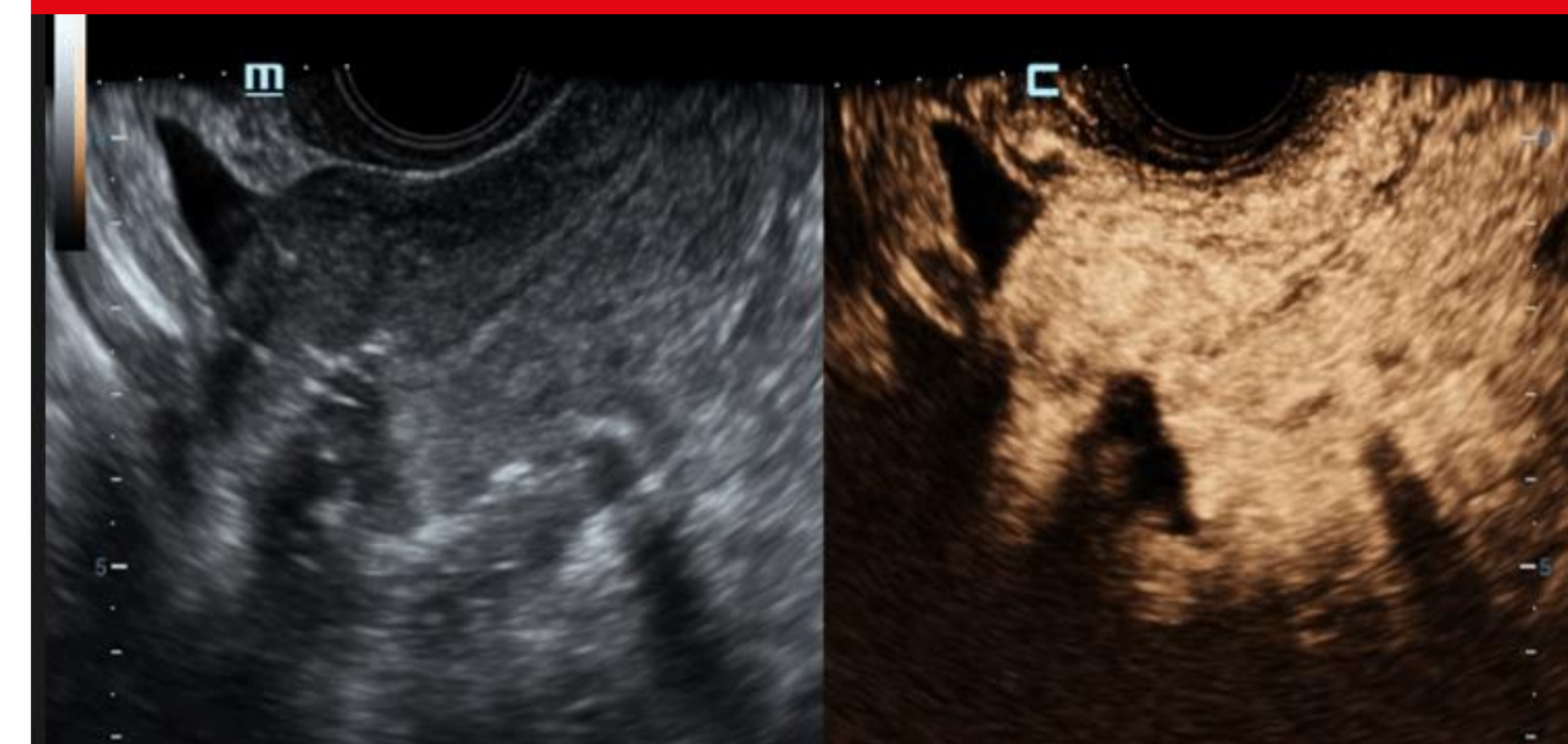


Figure 2. Thirty days after PUSH, contrast-enhanced ultrasound shows a focal perfusion defect in the posterior fundal myometrium, indicating that revascularization at this site is still incomplete.



Figure 3. One hundred ninety-seven days after PUSH, contrast-enhanced ultrasound demonstrates that the previously non-perfused myometrium has resolved and the entire myometrium now exhibits complete perfusion.