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Vaginal Pessary for Uterine Repositioning During High-Intensity Focused Ultrasound Ablation of Uterine Leiomyomas

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Abstract

In order to ensure safe magnetic resonance-guided high-intensity focused ultrasound ablation of uterine leiomyomas, ultrasound beam path should be free of intervening scar and bowel. Pre-treatment magnetic resonance imaging of a 9cm long and 7.7cm wide leiomyomatous uterus in a 39-year-old woman with menorrhagia and abdominopelvic pain initially demonstrated a focused ultrasound treatment path without bowel between the uterus and abdominal wall. On the day of ablation, however, multiple loops of bowel were observed in the ultrasound beam path by magnetic resonance imaging. Uterine repositioning was accomplished with a 76 mm donut vaginal pessary which anteverted the fundus and successfully displaced bowel. A vaginal pessary may aid in repositioning an axial or retroverted uterus to enable ablation of uterine leiomyomas.

Keywords

vaginal pessary; focused ultrasound; magnetic resonance imaging; leiomyoma

Introduction

Uterine leiomyomas are a common gynecologic problem associated with menorrhagia and pelvic pain. Leiomyomas are present in 30–80% of women of reproductive age [1]. Treatment options for symptomatic leiomyomas include pharmacologic, surgical and interventional radiology therapies. Pharmacologic treatment such as combined oral contraceptives do not remove the leiomyomas and symptoms may return when treatment is stopped [2]. Although hysterectomy is the standard treatment for symptomatic leiomyomas,

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less invasive alternatives have become available. In the 1980s, operative endoscopy and improved morcellation techniques enabled laparoscopic and hysteroscopic myomectomies, allowing patients to benefit by minimizing recovery time and health care cost[3]. However, only one third of female patients deliver vaginally after myomectomy[4].

Uterine fibroid embolization (UFE), while eliminating the need for general anesthesia, can nonselectively minimize the blood supply to the uterus, which may not be suitable for women who are seeking pregnancy[5]. In 2004, the U.S. Food and Drug Administration approved the first device which combined magnetic resonance imaging (MRI) and ultrasonography as a noninvasive therapy for uterine leiomyomas[6]. This technique is called magnetic resonance-guided high-intensity focused ultrasound (MR-HIFU) because magnetic resonance imaging is used to monitor the path and location of a tightly focused, high-intensity ultrasound beam during treatment of leiomyomas, resulting in coagulative necrosis and subsequent leiomyoma involution[7]. Although a recent study reported UFE has significantly lower rate of re-intervention than MR-HIFU[8], MR-HIFU has many advantages such as avoidance of ionizing radiation, faster recovery time, minimal reported adverse effects, improvement in quality of life and conversion of inpatient hospital admissions to outpatient procedure, which is very attractive economically[9]. Additionally, similar to UFE, MR-HIFU is potentially favorable for patients planning pregnancy[10].

In order to perform high-intensity focused ultrasound ablation of uterine leiomyomas, the path of the ultrasound beam must be free of intervening significant scar and any bowel. Women with symptomatic leiomyomas with an axial or retroverted 8 to 12-week sized uterus may not be able to undergo this treatment if bowel is located anterior to the uterus. The use of a vaginal pessary is described to reposition the uterus, displace bowel loops anterior to uterus and facilitate a safe pathway for MR-HIFU ablation of uterine leiomyomas.

Case report

Women between ages 18 and 50 were recruited at the Clinical Center, National Institutes of Health, for a prospective study approved by the NICHD IRB (NCT00837161). A 39-year-old woman had regular, but heavy menses, uterine leiomyomas, and worsening abdominopelvic pain. On bimanual examination, she had an irregularly shaped 10-week sized axial uterus and experienced mild tenderness to palpation of the uterine fundus. Transvaginal ultrasonography confirmed an enlarged axial uterus measuring 6.5 cm in the anteroposterior fundus, 9 cm in the craniocaudad dimension and 7.7 cm in transverse uterine width with a hypoechoic fundal leiomyoma measuring $2.8 \times 3.4 \times 2.6$ cm. Pre-treatment MRI initially demonstrated an accessible treatment path with no bowel between the uterus and abdominal wall. On the day of magnetic resonance-guided high-intensity focused ultrasound treatment as part of a clinical trial to undergo leiomyoma ablation followed by hysterectomy (clinical trials.gov identifier: NCT00837161), multiple loops of small bowel were observed between the abdominal wall and uterus on MRI, in the ultrasound beam path (Figure 1). The position of the intervening bowel was determined to be unsafe for focused ultrasonography. Several maneuvers failed to reposition the uterus or the

bowel: patient ambulation, abdominal massage in the supine position, and sterile saline instilled into the bladder via a Foley catheter left in situ.

Uterine repositioning was eventually accomplished with a 76 mm donut rubber vaginal pessary (Figure 2) which anteverted the fundus and successfully displaced bowel. No adverse events were observed during MR-HIFU treatment (Figure 3).

Discussion

MR-HIFU is a promising, noninvasive modality that might decrease the need for invasive procedures in the treatment of uterine leiomyomas. It effectively limits leiomyoma growth by targeting only the leiomyoma and not affecting the major blood supply of the uterus. Although still under investigation, this strategy has the potential to preserve fertility and uterine function in women of childbearing age[10]. According to Office for National Statistics, there is a delay in childbearing age which can be associated with the postponement of marriage and partnership formation to later years [11], underscoring the importance of fertility sparing interventions for treatment of uterine leiomyomas. Recent studies showed that women undergoing MR-HIFU have a significant reduction in leiomyoma size with rapid clinical improvement, minimal complications, and fewer side effects compared with hysterectomy[12]. Study of long-term outcomes after MR-HIFU showed significant decrease in treated leiomyoma volume, with the mean volume decrease 32 % after three years, also decreasing with time.[13] Our patient did not experience any adverse effects during high-intensity focused ultrasound treatment.

Limitations in the use of high-intensity focused ultrasound include large submucosal leiomyomas and inaccessible leiomyoma location because of significant abdominal scarring, intervening bowel, or close proximity to the spine. Zhang et al described successful high-intensity focused ultrasound treatment for ablating uterine leiomyomas without bowel injury in 21 patients with bowel initially placed anterior to the uterus[14]. They used a degassed water balloon to compress and displace bowel, or moved the bowel out of pelvis by filling the bladder with saline.

Vaginal pessaries are used to support and reposition a prolapsed or malpositioned uterus[15,16] especially a retroverted uterus. Another option might have been to place a manipulator within the uterine cavity to reposition the uterus, a technique used during laparoscopic surgery[17]. However, uterine manipulator placement and manipulation during MR-HIFU is difficult. Its placement requires a speculum and visualization of the cervix; and manipulation would be challenging when the patient is lying prone on the treatment table. Additionally, because heat is generated during high-intensity focused ultrasound, a uterine manipulator within the endometrial cavity may absorb and conduct heat to adjacent areas, potentially resulting in thermal damage to the endometrium or subjacent myometrium. Moreover, the components of certain types of uterine manipulators may be metallic and/or ferromagnetic, prohibiting use in the MR environment entirely.

In our case, we successfully anteverted an axial uterus and moved bowel loops away from the ultrasound beam path with the use of a vaginal pessary, maintaining the uterus in a safe position for MR-HIFU. At study hysterectomy within 30 days of treatment, the area of

necrosis corresponded to that seen on imaging[18]. Without that maneuver, MR-HIFU potentially could not be performed due to lack of a safe path to the targeted leiomyoma. Vaginal pessary placement may help in repositioning an axial or retroverted uterus to enable safe ablation of uterine leiomyomas and avoid bowel damage.

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Established facts

1. Magnetic resonance-guided high-intensity focused ultrasound ablation of uterine leiomyomas is a successful non-surgical approach to treating symptomatic leiomyomas that preserves the uterus.
2. Magnetic resonance-guided high-intensity focused ultrasound ablation of uterine leiomyomas is possible only if the path of the ultrasound beam to the uterus is free of intervening scar and bowel.

Novel insights

1. A vaginal pessary may aid in repositioning an axial or retroverted uterus for safe ablation of uterine leiomyomas, thereby avoiding intestinal injury.

Figure 1. Sagittal T1 weighted survey prior to vaginal pessary placement with multiple bowel loops between the abdominal wall (black arrow) and uterus (white arrow) in the path of the ultrasound beam.

Figure 2. Sagittal T2 weighted images following vaginal pessary placement (white arrow). Pessary anteverts uterus (black arrow), displaces anterior bowel loops and facilitates safe HIFU.

Figure 3. Sagittal T1 weighted image post contrast shows area of necrosis (black arrow) achieved (immediately post HIFU) with pessary in place (white arrow).