Savi Scout Localization for Extrapelvic Endometriosis Resection

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Patient: Female, 33-year-old
Final Diagnosis: Abdominal wall endometriosis
Symptoms: Abdominal pain
Clinical Procedure: —
Specialty: Radiology

Objective: Unusual clinical course

Background: Endometriosis is a common cause of chronic pelvic pain among women globally. Pharmacological therapy for endometriosis includes non-steroidal anti-inflammatory drugs (NSAIDs) and hormonal contraceptives, while surgical therapy often involves either laparoscopic excision and ablation of endometriosis implants or open surgery. Surgical therapy is one of the mainstays of treatment especially for extrapelvic endometriomas. However, little guidance exists for the treatment of non-palpable or intermittently palpable lesions of this nature.

Case Report: A 33-year-old woman with a previous cesarean section presented with complaints of intermittent discomfort in the area between her umbilicus and the surgical incision, for the previous 7 years, that worsened during her menstrual cycle. A 3×3-cm area of fullness was only intermittently palpable during various clinic visits, but was visualizable on computed tomography and magnetic resonance imaging. Given the lesion’s varying palpability, a Savi Scout radar localization device was placed into the lesion pre-operatively to aid with surgical resection. The mass was excised, pathologic examination revealed endometrial tissue, and the patient had an uncomplicated postoperative course with resolution of her symptoms.

Conclusions: Surgical removal of extrapelvic endometrioma lesions can be made difficult by varying levels of palpability or localizability due to a patient’s menstrual cycle. The Savi Scout, most commonly used in breast mass localization, is a useful tool in guiding surgical excision of non-palpable or intermittently palpable extrapelvic endometrioma lesions.

Keywords: Endometriosis • General Surgery • Radar

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Background

Endometriosis is the presence of endometrial-like tissue outside the uterus, and is estimated to affect up to 10% of reproductive-aged women globally [1]. It is often associated with symptoms of debilitating chronic pelvic pain and infertility [2]. First-line pharmacological therapy includes non-steroidal anti-inflammatory drugs (NSAIDs) and continuous hormonal contraceptives for mild to moderate pelvic pain, as well as gonadotropin releasing hormone (GnRH) agonists for severe symptoms [3]. For pelvic pain from endometriomas that is refractory to medical management, treatment is often surgical excision or ablation of the endometrial tissue. Imaging followed by direct visualization with laparoscopy is currently the criterion standard to confirm the diagnosis of endometriosis [4]. Perioperative and postoperative complications from surgery are often attributed to distortion of anatomy by endometrial tissue or incomplete resection [5,6]. The prevalence of extra pelvic endometriosis is unclear; however, abdominal wall endometriosis represents a major subset of these cases [7].

Additionally, the pathogenesis of endometriosis has been noted to be multifactorial, with genetic, epigenetic, and molecular factors playing pivotal roles [8]. Specifically, the homeobox genes and the wingless pathway have been implicated in endometriosis pathogenesis, along with aberrant DNA methylation and steroidogenic pathways. The interplay of these various factors likely contributes to variations in clinical presentation and treatment responses amongst individuals with endometriosis. While no exact mechanism has been delineated for the pathogenesis of abdominal wall endometriomas, the abdominal wall is the most frequent site of extra pelvic endometriosis [9]. Common clinical symptoms of these endometriomas include a palpable mass and atypical focal abdominal pain that is prone to misdiagnosis, making imaging an important tool in adequate diagnosis and characterization [10].

In this case report, we present a novel approach to resecting an extra pelvic endometrioma in the abdominal wall utilizing radar localization methods typically employed in breast-conserving surgeries. This innovative approach demonstrates the potential for leveraging advances in imaging technology to improve surgical outcomes.

Case Report

A 33-year-old woman with a past medical history of migraines and a past surgical history of a cesarean section at age 26 presented to the outpatient General Surgery clinic with complaints of left lower quadrant abdominal pain. She was not menstruating during this initial clinic visit. The patient reported that shortly after her cesarean section, she felt a significant “tearing” pain in the left abdominal wall between her umbilicus and her incision after a bout of sneezing. She did not seek medical care for these symptoms, but for the next 7 years she reported intermittent discomfort in the area, made worse with exertion and improved with rest and direct pressure. She also noted that the discomfort tended to increase during her menstrual cycle. Infertility was also a problem since the birth of her first child. She was unsuccessful in trying to conceive naturally but did not undergo any medical therapy to assist with conception. Prior CT imaging 5 years earlier demonstrated a left ovarian simple cyst, but no hernia, abdominal wall defects, or masses at this area of tenderness. On physical exam, she had a 3×3-cm palpable area of fullness in the left rectus muscle that was tender to palpation.

A repeat CT scan was performed to further characterize the lesion (it was unclear if the scan was performed during menstruation) and this scan demonstrated a 2.1-cm poorly defined mass within the left rectus muscle that was suspicious for endometrioma or desmoid tumor that had not been seen on imaging 5 years earlier (Figure 1). Magnetic resonance imaging (MRI; unclear if performed during menstruation) also demonstrated a 4×2×2-cm mass lesion in the medial aspect of the left rectus muscle abutting the linea alba below the umbilicus, extending through the anterior rectus sheath into the subcutaneous fat, without extension through the transversalis fascia, with magnetic resonance characteristics suspicious for an endometrioma (Figure 1).

Given the location near the cesarean section scar, worsening of symptoms with menstrual cycle, and supportive imaging, endometrioma was deemed likely. Due to the severity of her symptoms, the patient agreed to surgical resection of the mass. Given the fluctuation in size of the mass leading to variability of detection by palpation in various clinic visits, the decision was made to place a Savi Scout radar localization device into the mass prior to surgery to aid with detection.

The Savi Scout device placement was localized to the rectus lesion under ultrasound guidance by interventional radiology (unclear if device was placed during menstruation). A Savi Scout needle was inserted into the mass and the device was deployed in the usual manner (Figure 2). Subsequent ultrasound and CT demonstrated that the Savi Scout was located within the superficial ½ of the lesion (Figure 2). At surgery, the lesion was localized utilizing the Savi Scout by identifying the point of highest uptake signal. The lesion could then be partially palatted deep to that point. An incision was made over the central portion of the lesion. The mass involved the rectus muscle and anterior rectus sheath and was dissected using electrocautery, sparing the rectus muscle. The fascia was then closed with #1 Prolene. Surgical pathology of the mass demonstrated endometriosis, negative for atypia or malignancy (Figure 3).
The patient had an uncomplicated postoperative course. There were a total of 3 postoperative evaluations at 2, 4, and 16 weeks after excision of the mass. At the 4-week follow-up, the patient noted resolution of abdominal pain with her menstrual cycles and began to have improved pain with movements requiring rectus muscle activation. At the 16-week follow-up, she had complete resolution of abdominal pain including resolution of pain upon rectus muscle activation.

Discussion

Abdominal wall endometriosis is a known complication of cesarean section, with the risk noted to be about 1.8% [11]. In addition, 57 to 70% of abdominal wall endometriosis cases develop secondary to cesarean section [12,13]. Many of the remaining cases occur secondary to laparoscopic procedures or represent primary abdominal wall endometriosis. One study of 83 patients with abdominal wall endometriosis determined 72.3% to have cyclical pain as a primary presenting symptom, with 79.5% having had a previous abdominal surgical history [13]. In 32.5% of these patients, there was a palpable nodule on clinical exam. In cases with non-palpable lesions, preoperative ultrasound was used to demarcate the nodule prior to surgery.

Various methods have been utilized for the preoperative localization of non-palpable masses. In 1979, Ferris Hall and Howard Frank created a guidewire to aid in mass localization, capable of being placed into breast tissue prior to surgery [14]. The wire had a hook on the end to keep the wire in place and guide the surgeon to the lesion with increased certainty. While this technique provided an improvement over prior methods, the guidewire also had limitations: the wire and attached needle could only be advanced in and not retracted, repositioning once in place was not possible, and the chance of wire migration was high. The separate surgical resection was recommended to occur on the same day, given the risk of infection as well as migration if the patient was discharged. While the benefits of preoperative wire localization are most commonly associated with breast-conserving therapy, its use has also
been documented in localization of lung nodules, clear cell carcinoma in the abdominal wall, and intrarenal masses [15-17].

Many alterations of wire-based localizations have been made since 1979, including a spring-hook wire system by Daniel Kopans and the J-shaped wire by Marc Homer, to create a safe, effective and patient-friendly method for localization [18,19]. The Savi Scout represents an advancement that has not only increased patient comfort but also reduced complications such as lost wires and repeat surgeries [20].

**Figure 2.** Ultrasound (A) and non-contrast procedural CT (B) images show Savi Scout in position within the upper 1/3 of the mass pre-surgery.

**Figure 3.** Hematoxylin and eosin (H&E)-stained sections (A) showing clusters of endometrial glands surrounded by endometrial stroma with scattered hemosiderin-laden macrophages, consistent with endometriosis (20×); dilated endometrial gland (B) with adjacent atrophic skeletal muscle (arrow) in fibrous stroma (100×).
Approved by the Food and Drug Administration in 2014 as a non-wire method of breast cancer localization, the Savi Scout uses a nonradioactive reflector placed up to 30 days prior to surgery to mark lesions. On the day of surgery, the reflector is activated and nonradioactive radio waves are used as surgical guidance for removal of lesions. This method of localization avoids discomfort associated with other techniques (e.g. wire localization) and provides more flexibility concerning when the preoperative localization can be scheduled. Furthermore, the Savi Scout provides depth measurements to the reflector, allowing better approximations of what margins to resect. The Savi Scout represents a significant advancement in localizing nonpalpable breast lesions. Outside of breast tissue, the device has also been used to assist in the resection of pulmonary nodules, but no literature to date has described its use in endometrioma removal [21].

Additionally, there have been no studies to date that directly compare the results of CT-guided preoperative localization, ultrasound-guided wire localization, and radio-guided surgery for non-palpable abdominal wall endometriosis. However, one report in which a Kopans needle was inserted into an abdominal wall endometrioma under CT guidance preoperatively, notes the benefits of using CT localization over ultrasound guidance for deeper lesions in patients with a large body mass index as well as lesions near neurovascular and visceral structures [22]. Another report used a preoperative marking technique with a radioactive isotope (Tc99) that could later be localized with a portable gamma probe [23]. This technique offers the benefit of not having to implant a medical device into the lesion, unlike the wire or Savi Scout approach. Of note, various non-surgical techniques exist for treating abdominal wall endometriosis including cryoaoblation and high-intensity focused ultrasound. Both of these techniques have been shown to be useful in treating chronic pelvic pain as well as decreasing overall lesion size [24]. Given the image-guided nature of these treatment modalities, these techniques may also be appropriate for treating non-palpable abdominal wall endometrioma lesions. Recurrence rates following surgical excision of abdominal wall endometriomas are noted to be between 12.5 and 28.6%. However, further studies are needed that detail modes of mass localization along with their respective recurrence rates [13].

One study directly compared wire-guided localization, Savi Scout radar localization, and radioactive seed localization for breast masses. That study found no difference in operative time, positive margin rate, volume of tissue excised, or 30-day complications between the 3 groups [25]. However, wire-guided localization was found to have a significantly longer perioperative time when compared with the 2 other cohorts. While no study currently exists that compares these 3 modalities for abdominal wall endometriomas, it is possible that similar results may be found.

Conclusions

The described case of intermittently palpable extrapelvic endometriosis is one of the few examples that show a future for Savi Scout outside of breast lesions. As demonstrated, the Savi Scout is a reasonable and effective method for guiding surgical treatment in patients with these types of lesions.

Institution Where Work Was Done

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Declaration of Figures’ Authenticity

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