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Oxidized Regenerated Cellulose Resembling Vaginal Cuff Abscess

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ABSTRACT

Introduction: Application of oxidized regenerated cellulose is commonly performed in laparoscopy to achieve hemostasis during surgery. The appearance of an abscess resembles oxidized regenerated cellulose, causing imaging studies to be difficult to interpret.

Case Description: We describe the cases of 3 patients who underwent oxidized regenerated cellulose placement during laparoscopic gynecologic surgery. They subsequently presented with signs and symptoms resembling an abscess. Computed tomographic imaging can be challenging to interpret in such cases; radiologic findings can be used to differentiate between the characteristics of oxidized regenerated cellulose and those of abscess formation on the vaginal cuff.

Discussion: Oxidized regenerated cellulose has an appearance that often mimics postsurgical abscess formation. There are distinct characteristics that distinguish both findings. It is essential that patients' records accurately describe the presence and location of regenerated oxidized cellulose when placed intraoperatively, and this information must be relayed to the interpreting radiologist to facilitate medical diagnosis and guide clinical management.

Key Words: oxidized regenerated cellulose, hemostatic agent, vaginal cuff abscess, laparoxopy, pelvic abscess

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INTRODUCTION

Topical hemostatic agents are increasingly used in laparoscopic surgery to control intraoperative bleeding. Surgicel SNoW (structured nonwoven material) is composed of oxidized regenerated cellulose (ORC) belonging to the Surgicel family of absorbable hemostats (Ethicon, Somerville, New Jersey). These thrombogenic agents are effective in maintaining hemostasis.[1] The knit mesh facilitates platelet adhesion and aggregation, further improving surgical visibility during surgery. The fabric material also allows easy passage of the hemostatic agent through a laparoscopic port.[2]

Like other ORC products, Surgicel SNoW is a plant-based nonwoven fabric with interlocking fibers designed to facilitate rapid hemostasis. It is an advanced product that has been reported to cause minimal tissue reaction. Clinical data on Surgicel absorbable hemostats claim broad-spectrum bactericidal activity against gram-positive and gram-negative organisms including methicillin-resistant *Staphylococcus aureus*, vancomycin-resistant *Enterococcus*, penicillin-resistant *Streptococcus pneumoniae*, and methicillin-resistant *Staphylococcus epidermidis*.[3]

Computed tomography (CT) imaging can be challenging to interpret because oxidized cellulose appears similar to a pelvic abscess. We present 3 case reports of patients who had placement of Surgicel SNoW during surgery. All 3 women presented within 2 weeks after surgery with signs and symptoms concerning for pelvic abscess. We describe distinguishing characteristics on imaging studies to differentiate abscess formation from ORC. This information facilitates proper interpretation of CT scans and prevents the inaccurate diagnosis of abscess formation.

CASE REPORTS

Case 1

A 50-year-old patient with menorrhagia and failed endometrial ablation underwent a laparoscopic hysterectomy. She had extensive pelvic and abdominal adhesions and endometriosis. Laparoscopic placement of Surgicel SNoW at the vaginal cuff was performed at case completion. The

patient's immediate postoperative course was uncomplicated, and she was discharged home the next day.

The patient presented to the emergency department on postoperative day 6 with complaints of sudden onset of right-sided abdominal and pelvic pain. She was afebrile, and her vital signs were all normal. Abdominal examination showed normal postoperative tenderness. A complete blood count, basic metabolic profile (BMP), and urinalysis were performed, and the findings were all within normal limits. Chest radiographs and blood and urine cultures also yielded negative findings. CT scan of the pelvis with intravenous contrast showed expected postsurgical findings with an air-containing collection along the superior margin of the vaginal cuff. There was a localized, punctate, irregular collection of gas without an air-fluid level (**Figure 1**). Mild, diffuse fat stranding in the pelvis was noted, most likely from postoperative changes. No focal fluid collection was identified to suggest an abscess. The interpreting radiologist reviewed the operative note with the gynecologist who performed the surgery and reported that this imaging finding was characteristic of ORC. The patient was discharged from the emergency department and scheduled for follow-up as an outpatient. The rest of her postoperative course was uneventful.

Case 2

A 45-year-old woman underwent robotic-assisted laparoscopic hysterectomy, left salpingo-oophorectomy, right salpingectomy, cystoscopy, and coincidental appendectomy for endometriosis. Intraoperatively, the patient was found to have a 14-week-size uterus and extensive endometriosis. Surgicel SNoW was placed as a single sheet over the vaginal cuff. The patient tolerated the procedure well and was discharged the following day.

Ten days later, the patient presented to the emergency department with worsening abdominal pain, tachycardia, and brownish vaginal discharge. A complete blood count showed leukocytosis. BMP and urinalysis showed normal findings. A CT scan with intravenous contrast showed pelvic fat stranding with a rim-enhancing 7.6 × 5.1–cm fluid collection and small foci of air, characteristic of an abscess (**Figure 2**). The patient was admitted to the hospital overnight and treated with intravenous antibiotics. She remained afebrile for the entire hospital course. Leukocytosis decreased from a white blood cell count of 16.4×10^9/L on admission to 9.4×10^9/L. The fluid collection drained spontaneously, and the patient was discharged the following day.

Case 3

A 43-year-old patient underwent a total laparoscopic hysterectomy, left oophorectomy, and bilateral salpingectomy for pelvic pain and endometriosis. Intraoperatively, she was found to have endometriosis with severe pelvic adhesive disease. Surgicel SNoW was placed at the vaginal cuff. The surgery was uncomplicated. The patient was discharged home in excellent condition after an overnight hospital stay.

Four days after surgery, the patient presented to the emergency department with malaise and reported having a fever at home. She denied any vaginal bleeding or discharge. She was afebrile on admission and had appropriate postoperative tenderness on left lower-quadrant abdominal palpation. The initial white blood cell count was 16.52×10^3/NL and remained elevated at 14.63×10^3/NL when repeated 24 hours later. BMP and urinalysis showed normal findings. A CT scan with intravenous contrast showed a large area of

Figure 1. CT shows a localized collection of gas (arrow) that is punctate and irregular with no air-fluid levels, characteristic of ORC.

Figure 2. CT shows a rim-enhancing fluid collection (arrow) containing a small air bubble, characteristic of an abscess.

Figure 3. CT shows a rim-enhancing and irregular fluid collection (arrow), characteristic of an abscess.

inflammatory fat stranding on the left side of the pelvis and a 6.6 × 3.7–cm irregular fluid collection with a thin enhancing rim along the lateral margin (**Figure 3**). A sagittal reformatted image showed the fluid collection with small bubbles of air anteriorly, characteristic of an abscess (**Figure 4**). The patient was treated with oral antibiotics, clindamycin, and metronidazole with close outpatient follow-up.

DISCUSSION

Topical hemostatic agents are becoming commonly used in gynecologic surgery, especially in the setting of laparoscopic procedures. Although the mechanism of action is not fully understood, oxidized cellulose forms a gelatinous mass when saturated with blood. It acts as a matrix for fibrin deposition, promoting platelet plug formation and aiding surgical hemostasis. It also causes local vasoconstriction, further controlling intraoperative bleeding.[4]

In addition to Surgicel SNoW, other ORC products include Surgicel Original, Surgicel Nu-Knit, and Surgicel Fibrillar. Surgicel Original is composed of a loosely knit ORC providing a matrix for platelet adhesion. Surgicel Nu-Knit is a densely woven knit of ORC providing a matrix for platelet adhesion and aggregation useful during heavy bleeding. Surgicel Fibrillar is a soft layered ORC with a mechanism of action similar to Surgicel Nu-Knit.[3] These absorbable hemostats are primarily used to control bleeding during surgery when conventional methods for hemostasis fail.

The ORC material gradually reabsorbs and is bounded by granulation tissue at 14 days, surrounded by very dense suppuration at 21 days, further enclosed with fibroblastic tissue at 30 days, and then completely invisible at 45 days.[5] Therefore patients with oxidized cellulose placed during surgery may present postoperatively with the hemostatic material still present.

Figure 4. CT sagittal view shows a rim-enhancing fluid collection (black arrow) with small bubbles of air anteriorly (white arrow), characteristic of an abscess.

Radiologic examinations of our 3 patients showed the imaging difference between the bioabsorbable hemostat and an abscess. The first patient did not have an abscess, as depicted with radiologic images showing features of a confined, punctate, irregular collection of gas without an air-fluid level. The second and third patients did have pelvic abscesses, characterized through imaging as rim-enhancing fluid collections with scattered air bubbles. These findings are consistent with those previously described in the literature as being distinguishing characteristics of oxidized cellulose versus an abscess.

During the degradation process, ORC can trap air, resulting in multiple imaging patterns, which can be misinterpreted as an abscess. Most of the case reports describing oxidized cellulose imitating a postsurgical abscess[6–8] and granuloma formation mimicking local tumor recurrence[9–11] have been published in the general and urologic surgery literature. Only 1 recent case report in the gynecologic literature described ORC mimicking a pelvic abscess.[12]

A CT scan is typically ordered to evaluate for any postoperative abscesses. Oxidized cellulose appears as a collec-

tion of gas at the surgical site, thus imitating the appearance of an abscess on CT scan.[6] Imaging features of ORC that help differentiate it from an abscess include a unifocal collection of gas with a linear or punctate pattern, without an air-fluid level.[8] The unusual pattern of the air collection is likely caused by air trapped within the spaces of the hemostatic gauze material. In comparison, a postoperative abscess typically shows air-fluid levels and scattered air bubbles on CT scan.[8] Imaging features of either ORC or an abscess are nonspecific and could present a diagnostic dilemma. Magnetic resonance or sonographic imaging has been suggested as an alternative diagnostic modality to differentiate between abscess formation and the presence of retained oxidized cellulose.[13,14]

CONCLUSION

Awareness of Surgicel SNoW placement and its effects on surrounding tissues enables clinicians to accurately interpret radiologic findings. With increasing placement of absorbable hemostatic agents in laparoscopic gynecologic surgery, it is important to discern the presence of oxidized cellulose versus an abscess. Knowledge of imaging characteristics in addition to the patient's clinical symptoms will help differentiate between these 2 conflicting diagnoses.

Although literature from Ethicon states that Surgicel SNoW absorbs in 7 to 14 days,[3] histopathologic analysis in animal research has proved otherwise. Alpaslan et al[5] reported that ORC material slowly resorbed and could still be detected in a few specimens at 30 days. It was not until day 45 that the Surgicel material was completely undetectable. Melamed et al[14] reported that oxidized cellulose (Surgicel) appeared like a complex echogenic pelvic mass mimicking an abscess up to 35 days after surgery. The concern is not one of absolute absorption of Surgicel but of the characteristics and duration of the postsurgical changes observed at the site of the retained topical hemostatic material.

It is essential to notify the interpreting radiologist when a local hemostatic agent is used in surgical practice. Proper communication between the gynecologic surgeon and the radiologist is crucial when ORC is placed intraoperatively on the vaginal cuff. There is valid concern about the risk of vaginal cuff infection after a laparoscopic hysterectomy because the vagina is a nonsterile field despite preoperative vaginal preparation. It must be taken into consideration that oxidized cellulose could be the cause of the fluid and gas collection seen on CT scan instead of a postoperative vaginal abscess. A more accurate diagnosis is essential to properly manage patients' postoperative complaints, thereby preventing unnecessary reoperations or further medical and/or surgical interventions.

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