

NEW TECHNOLOGY Update

Controlling soft-tissue attachments

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The SurgiWrap® MAST Bioresorbable Sheet is a valuable new addition to the armamentarium of gynecologic surgeons. Introduced in the United States in 2001, this polymeric sheet has many uses in both open and laparoscopic procedures, providing temporary wound support and reinforcing weakened soft tissues (**FIGURES 1 THROUGH 4**). Most important, this bioresorbable sheet creates a physical barrier between opposing tissues, which controls and minimizes the formation of soft-tissue attachments (STAs).

STAs, the fibrous bands that can form between a device and viscera or other tissues after gynecologic surgery, are often caused by ischemia, abrasion, desiccation, heat, electrocautery, or suturing. Forming within 1 to 2 months of surgery,¹ STAs may complicate future operations by increasing the risk of visceral perforation, extending operating time, and increasing postoperative pain.²⁻⁶ They can lead to infertility, pelvic pain, and bowel obstruction.⁷⁻¹¹

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Safety and efficacy of bioresorbable sheets

Studies of the animal model

Ongoing reports demonstrate the utility of bioresorbable sheets for preventing adverse soft tissue outcomes. The preliminary results of 2 investigations in the animal model support preclinical observations, demonstrating that the use of bioresorbable sheets (MAST Biosurgery, San Diego, Calif) leads to at least a 2-fold reduction in the extent and severity of STAs when compared with untreated controls. The use of this product also maintains surgical dissection planes between the abdominal wall and adjacent soft tissues. Thus, strategic placement of the bioresorbable sheets minimizes STA development during critical visceral healing.^{12,13}

Case study series

Case reports from a number of clinicians have described the use of the bioresorbable sheet in gynecologic surgery to prevent STAs. Over 2 years, from September 2003 to September 2005, our team has placed the device in 180 patients to support the soft tissues and minimize STAs in patients who had cesarean deliveries. We have had the opportunity to reassess 11 patients during repeat cesarean deliveries (n=5), laparoscopic tubal ligations (n=2), lysis of adhesions for an ovarian cystectomy (n=1), hysterectomy (n=1), hysterectomy with left salpingo-oophorectomy (n=1), and resection of bilateral endometriomas (n=1).

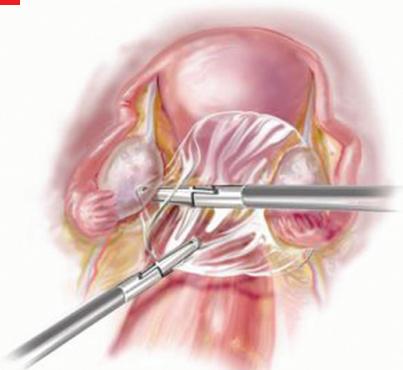
The patient who came to us for treatment of bilateral endometriomas had extensive scar tissue. In an

FIGURE 1

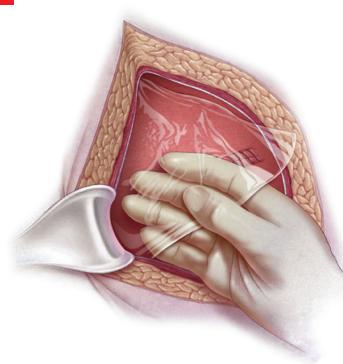
The sheet is wrapped around a blunt probe.

FIGURE 2

The thin transparent sheet is introduced through the 5-mm trocar site.

FIGURE 3

The sheet is then placed in the posterior cul-de-sac. In open procedures, the sheet is placed intraoperatively. In cesarean deliveries, it is placed after the uterine incision is closed. The bioresorbable sheet is easy to place after laparoscopic resection of endometriomas or lysis of adhesions.

FIGURE 4

The sheet's transparent, thin profile allows for simplified intraoperative placement and good visualization of underlying tissues. The MAST Bioresorbable Sheet should be used with resorbable sutures or other soft-tissue fixation devices that prevent dislocation.

attempt to prevent further STAs, we wrapped bioresorbable sheets around each ovary. When the patient required an abdominal hysterectomy at a later time, we noted that no STAs had formed between the ovaries and the posterior wall. No residual SurgiWrap was found in the pelvis, and the cul-de-sac was free of STAs. In the absence of STAs, the procedure was completed in under 1 hour.

Between September 2005 and November 2006, our team performed 135 cesarean deliveries in which we used bioresorbable sheets and reassessed 16 of these patients. Of this group, 13 had no STAs. Two women had "filmy" STAs (grade 1) that were easily removed by blunt dissection. One patient had multiple STAs.

Taking all of our case study series together, we have followed 354 patients in whom we have used SurgiWrap and conducted 37 re-looks. During the total duration of data collection, 4 adverse events were reported and documented, a rate of 1.1%.

SurgiWrap in 2 particular cases

We followed a 39-year-old woman, gravida 4, para 4. Each of her deliveries had been cesarean; after her third delivery, STAs were found between the omentum, bladder, and lower uterine segment. At that time, a bioresorbable sheet (MAST Biosurgery, San Diego, Calif) was placed over the uterus and bladder flap after the

uterine incision was closed. This was done to reinforce the soft tissues, minimize STAs, and prevent recurrence of scar tissue. The sheet was held in place using 2 interrupted sutures through the rectus muscles and the device. At her fourth cesarean delivery a year and a half later, no STAs were found.

We also reviewed a case of a 32-year-old patient, gravida 3, para 2, with a 2-year history of pelvic pain, dysmenorrhea, and menorrhagia. An endometrial biopsy at the initial visit showed a secretory endometrium. A pelvic sonogram revealed bilateral complex adnexal masses, 3 cm in diameter, which were removed by ovarian cystectomy with endometrial ablation. The examination revealed enlarged ovaries adhered to the posterior uterine wall above the cul-de-sac. The ovarian capsules were opened to reveal bilateral endometriomas, which were later confirmed by pathologic testing. After the endometriomas were removed, the extensive STAs between the ovaries and uterus were excised with blunt and sharp dissection. The removal of these STAs resulted in multiple areas of minimal bleeding in the posterior uterine wall. To reinforce the soft tissues and control the attachment of soft tissues or development of recurring scar tissue, a bioresorbable sheet (MAST Biosurgery, San Diego, Calif) was placed into the abdomen through a 10-mm umbilical trocar. The device was positioned between the ovaries and uterus to support tissues, reduce the risk of attachment of surrounding tissues, and control the wound healing process. Endometrial ablation was performed.

The patient was placed on 6 months of therapy with gonadotropin-releasing hormone; an intramuscular contraceptive was eventually added to suppress ovarian function. The patient reported continued pain. A year after the initial surgery, a total abdominal hysterectomy with bilateral salpingo-oophorectomy was performed. At the time of surgery, no STAs were observed and no residual bioresorbable material was found in the pelvic area. The cul-de-sac area also had no STAs. Because of the absence of STAs, the surgical procedure was completed in less than 1 hour.

Ongoing clinical trials

A clinical study in Spain is currently evaluating the efficacy of 2 different bioresorbable sheets to minimize STA formation during endoscopic gynecologic surgery. In this comparison of SurgiWrap (MAST Biosurgery, San Diego, Calif) with processed regenerated cellulose (PRC)

US Food and Drug Administration Clearances

October 2001: Clearance as a reconstruction sheet for the prevention of postsurgical adhesions in specific ear, nose, and throat procedures.

December 2001: Clearance for soft tissue support and for the repair of fascial defects, including vaginal prolapse repair, colon and rectal prolapse repair, and reconstruction of the pelvic floor.

September 2003: Clearance for use wherever temporary wound support is required, to reinforce soft tissues where weakness exists, or for the repair of hernia or other fascial defects that require a reinforcing or bridging material to obtain the desired surgical result. The resorbable protective sheet minimizes tissue attachment to the device in case of direct contact with the viscera.

May 2005: Clearance for use in urologic, gynecologic, and gastroenterologic anatomy; pubourethral support; bladder support; and urethral prolapse, along with indications for open and laparoscopic procedures.

The SurgiWrap MAST Bioresorbable Sheet: Characteristics

The SurgiWrap MAST Bioresorbable Sheet is a biodegradable implant made from a polylactide copolymer composed of lactic acid, similar to naturally occurring substances in the body. Thus, it does not contain any human or animal components. The polymer implant maintains its strength during the healing process, while slowly breaking down through hydrolysis. The polymer fragments are reduced to single lactic acid molecules. These molecules are metabolized by the liver into carbon dioxide and water and released from the body through the lungs.

The SurgiWrap MAST Bioresorbable Sheet can be cut with scissors to the desired shape and size. It is fully malleable and can conform to various anatomical orientations. It can be used either alone or in conjunction with soft-tissue fixation devices such as resorbable sutures, which fix the position of the SurgiWrap MAST Bioresorbable Sheet and prevent dislocation. The device retains significant strength for up to 8 weeks, maintaining support throughout the critical healing period.

TABLE 1

Patient Number	MAST Bioresorbable Sheet	PRC Sheet
8	—	—
12	—	✓
14	—	✓

PRC, processed regenerated cellulose.

Attachments observed in second-look patients who received both the MAST Bioresorbable Sheet and the PRC sheet (n=3).

TABLE 2

Patient Number	No Attachment	Filmy Bands
8	✓	—
10	—	✓
12	✓	—
14	✓	—
15	✓	—

PRC, processed regenerated cellulose.

Attachments observed in second-look patients who received the MAST Bioresorbable Sheet alone or in conjunction with the PRC sheet (n=5).

sheets, the primary effectiveness end point is the severity of attachment formation. Conducted by G.T. Lara, MD, and I.R. Ezcurra, MD, at the Hospital Virgen Del Camino, Unidad de Endoscopia Ginecología in Pamplona, the study enrolled 31 patients from November 2003 to December 2004. None of the patients had undergone previous pelvic surgery. Most of the patients in the study were scheduled for either uterine cystectomy (myomectomy) or lysis of adherent adnexal tissue. At the end of the surgical procedure, 1 or both of the products were placed in regions of the uterine surface where the incision was performed: after lysis of tuboperitoneal obliterations, the device was placed in the Douglas cavity and after lysis of attachments, it was placed next to adnexal organs.

To date, 6 patients have required adnexal surgery, allowing an opportunity for a second look at the

products placed after the first procedure. A preliminary analysis was performed based on the assessment of the pelvic cavity, independent of the regions where the products were previously placed (**TABLES 1 AND 2**). Any new attachment formation was recorded and described with a defined grading system.

Conclusions

The use of the MAST Biosurgery bioresorbable sheets to control and minimize STAs by creating a physical barrier between opposing weakened tissue represents an advancement in treatment options for gynecologic surgeons. The technical properties of the device—easily cut to meet various needs, pliable to permit use in various anatomies, and transparent to permit good visualization—make it appropriate for a variety of laparoscopic and open procedures.

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