

**Why are adhesions a problem?**

Adhesions can cause significant complications such as small bowel obstruction, infertility, chronic pelvic pain, and difficulty in postoperative treatment, including complexity during subsequent surgical procedure<sup>1</sup>. The adhesions can build onto organs within the abdominal cavity, called pelvic adhesive disease. If scar tissue envelops the uterus and ovaries, this can cause infertility and an increased risk of ectopic pregnancy.

- **Pain** - Adhesive disease has been estimated to account for up to 50% of all cases of pelvic pain.<sup>1</sup>
- **Menstrual irregularities**
- **Small Bowel Obstruction** - Adhesions have been implicated as the cause of 54% to 74% of all cases of SBO<sup>1</sup>
- **Infertility** - Intra-abdominal adhesive disease is associated with up to 15% to 20% of all cases of infertility<sup>1</sup>
- **Difficult/Longer repeat C-sections** - Patients with prior surgery required a mean of 21 minutes to open their abdomens whereas patients without prior surgery required a mean of 6 minutes<sup>2</sup>.
- **Economic Burden** - More than 400,000 surgical procedures are performed daily in the United States for lysis of adhesions, with the economic impact exceeding \$1.3 billion per annum<sup>2</sup>. A minute in the OR costs the hospital up to \$133<sup>3</sup>. C-section patients who suffer from adhesions can cost the hospital over **\$2,700 per delivery**.
- **Ectopic pregnancy** - Women who delivered by CD were 67% more likely to have an ectopic pregnancy in their next pregnancy compared with women who delivered by spontaneous vaginal delivery<sup>4</sup>.

**What obstetric procedures are commonly associated with adhesions?**

**Myomectomy** is the removal of fibroids (benign tumors), without removing the uterus. Myomectomy is the preferred fibroid removal treatment for women who want to become pregnant. Even with laparoscopic procedures, adhesions can form along the anterior and posterior uterine wall.<sup>5</sup> *Learn more: <https://www.drseckin.com/myomectomy>*

**Hysterectomy** is the surgical removal of the uterus. Sometimes the surgery also removes the ovaries and fallopian tubes. A woman may have a hysterectomy for many different reasons such as uterine fibroids and endometriosis. A surgeon may only remove part of the uterus (subtotal) or all of it (total). *Each year approximately 600,000 hysterectomies are performed in the United States.<sup>7</sup> One third of American women will have had a hysterectomy by the age of 60<sup>7</sup>. It is the 2<sup>nd</sup> most common gynecologic surgery. 5 times more common than myomectomies in the treatment of fibroids.<sup>6</sup>* Even after the uterus is removed, adhesions can form upon the surrounding reproductive and pelvic organs, ranging from the ovaries to the bowels and bladder.

*Learn more: <https://www.drseckin.com/hysterectomy>*

**Endometriosis** is a chronic disorder in which the tissue that normally lines the uterus grows outside of the uterus. This disorder is one of the most common reasons women develop adhesions. *In both laparotomy and laparoscopy, about 20% to 30% of women will have their endometriosis return within 5 years.<sup>11</sup>*

**Caesarean section** - also known as C-section, is the use of surgery to deliver babies. *In the US over 30% of babies are born by cesarean section<sup>9</sup>.* The baby is taken out through incisions in the mother’s abdomen. Once the birth has taken place, the incision layers of the abdominal wall are closed via sutures. The trauma caused to this area produces internal scar tissue called adhesions. *100 of 217 women (46%) who underwent a first cesarean delivery had pelvic adhesive disease.<sup>10</sup>*

**What is currently used to prevent adhesions?**

Currently there is no treatment for adhesions; some complications from adhesions may require adhesiolysis (the removal of existing adhesions), which may result in additional adhesions. Surgical technique alone is not enough to prevent adhesions. Adhesion barriers may be placed during surgery to reduce the incidence and severity of adhesions before they form - the most common being Gynecare Interceed® and Seprafilm®

**Interceed** – a clear, thin fabric, composed of oxidized, regenerated cellulose designed as an absorbable adhesion barrier. Interceed efficacy is reduced in the presence of blood<sup>8</sup>

**Seprafilm** – bioresorbable, translucent adhesion barrier composed of two anionic polysaccharides, sodium hyaluronate and Carboxymethylcellulose. It is rather difficult to use in laparoscopy as the sheets are firm and non-compliant.<sup>8</sup>

*Interceed and Seprafilm are synthetic barriers that don’t offer any bioactive benefit.*

**Why amniotic tissue?**

The amniotic membrane graft is used as a protective, therapeutic barrier to prevent the formation of adhesions. The purpose of this barrier is to reduce the incidence, extent and severity of postoperative adhesions. The tissue acts as mechanical

	Amniotic Membrane Barrier Membrane	Seprafilm Adhesion Barrier	Interceed Adhesion Barrier
Resorption time	>3weeks	7 days	2-4weeks
Membrane type	Biologic	Synthetic	Synthetic
Visibility	✓		✓
Superior thickness	✓		
Preferable handling characteristics	✓		
Efficacious in presence of blood	✓	✓	
Suturability	✓		
Indicated in laparoscopy and laparotomy	✓	✓	
Hyaluronic acid	✓	✓	
Interleukins	✓		
TIMPs	✓		
TGFβ-1	✓		
HBD-1	✓		
Lactoferrin	✓		
Remains a solid barrier	✓		
Foldability/maneuverability	✓	✓	

barrier to prevent adhesions from forming but is also full of hundreds of proteins and growth factors that enhance healing and tissue repair.

### What clinical evidence is there?

Ogaya-Pinies G et al. "Postoperative Adhesion Development Following Cesarean and Open Intra-Abdominal Gynecological Operations: A Review" *J Robot Surg.* 2018 Jun;12(2):235-243.

- **Summary:** A review discussing the pathophysiology of adhesion development, the impact of physiological changes associated with pregnancy on markers of adhesion development, and the clinical implications of adhesion development following cesarean delivery. It concludes the following:
  - Patients with prior surgery required a mean of 21 minutes to open their abdomens whereas patients without prior surgery required a mean of 6 minutes<sup>2</sup>.
  - Adhesions have been shown to cause small bowel obstruction and bowel injury, and urinary tract injury in intra- abdominal pelvic surgery .
  - It has been shown that adhesions may contribute to infertility in about 40% of infertile couples and represent the sole infertility factor in up to 15% of cases.
  - Adhesiolysis (surgical removal of adhesions) for the treatment of pelvic pain has **not** been shown to be effective in achieving pain control.

### Beneficial Properties of AM

- Reduction of inflammation and pain
- Barrier that lasts at least 3 weeks in the body
- Acceleration of angiogenesis and cell proliferation
- Modulation of scar formation
- Antimicrobial effect
- Wound protection
- Immunologically privileged

Tulandi T, Agdi M, Zarei A, et al. Adhesion development and morbidity after repeat cesarean delivery. *Am J Obstet Gynecol* 2009;201:56.e1-6.

- **Summary:** A review of 1,283 charts of women who underwent repeat cesarean deliveries and 203 other women who underwent primary cesarean deliveries with the primary outcome measures being incidence and extent of adhesions, incision-to-delivery interval, and operating time.
- **Findings:**
  - *Adhesions* - No adhesions were found in primary cesarean deliveries. Compared with those women with a second cesarean deliveries (24.4%), significantly more women had adhesions after 3 cesarean deliveries (42.8%).
  - *Conclusion* - Increased adhesion development and a longer time to delivery were found with each subsequent CS.

Morales KJ, Gordon MC, Bates GW Jr. Post cesarean delivery adhesions associated with delayed delivery of infant. *Am J Obstet Gynecol* 2007;196:461.

- **Summary:** A high percentage of cesarean deliveries result in adhesive disease (is defined as a condition in which scar tissue binds adjacent organs to one another), which delays repeat cesarean delivery of the fetus.
  - 100 of 217 women (46%) who underwent a first cesarean delivery had pelvic adhesive disease
  - 48 of 64 women (75%) who underwent a third cesarean delivery had pelvic adhesive disease
  - 5 of 6 women (83%) who underwent a fourth cesarean delivery had formed pelvic adhesive disease

Dulemba J, Mirzakhani P, Istwan NB (2016) Evaluation of Dehydrated Human Amnion/Chorion Membrane as an Adhesion Barrier in Women Undergoing Robotic Laparoscopy. *Gynecol Obstet (Sunnyvale)* 6:405. doi:10.4172/2161-0932.1000405

- **Summary:** 16 patients underwent robotic laparoscopy for pelvic pain due to endometriosis and adhesions. All patients had resection of endometriosis and adhesiolysis with application of dHACM. Patients were scheduled for a second surgery to inspect for reformation of adhesions, and to lyse any additional adhesions found.
- **Results:** 15 of 16 patients receiving dHACM had a second procedure 1-2 weeks later. In 14 of the 15 cases, no new adhesions were observed in areas where dHACM was placed. No adverse events or major complications had been recorded in the medical record.

### How to Apply

- **Application:** The amniotic membrane is applied on areas where adhesions are most likely to form: on the pelvic side walls, cul de sac, areas of raw/denuded peritoneum, and areas of previous lysed adhesions. The amniotic membrane is also applied before closure. It can be wrapped directly around a fresh anastomotic suture or staple line.
- **Recommended graft size:** 2x12 cm or 4x6 cm  
Graft can be cut to preferred size and placed with or without suture.

<sup>1</sup> González-Quintero, Víctor Hugo, and Francisco E Cruz-Pachano. "Preventing Adhesions in Obstetric and Gynecologic Surgical Procedures." *Reviews in Obstetrics and Gynecology* 2.1 (2009): 38–45. Print.

<sup>2</sup> Ogaya-Pinies G et al. "Postoperative Adhesion Development Following Cesarean and Open Intra-Abdominal Gynecological Operations: A Review" *J Robot Surg.* 2018 Jun;12(2):235-243.

<sup>3</sup> *J Robot Surg.* 2018 Jun;12(2):235-243

<sup>4</sup> Awonuga, Awoniyi O. et al. "Postoperative Adhesion Development Following Cesarean and Open Intra-Abdominal Gynecological Operations: A Review." *Reproductive Sciences* 18.12 (2011): 1166–1185. *PMC.* Web. 11 Oct. 2018.

<sup>5</sup> <https://www.drseckin.com/pelvic-adhesion-surgery>

<sup>6</sup> <https://www.drseckin.com/myomectomy>

<sup>7</sup> <https://www.brighamandwomens.org/obgyn/minimally-invasive-gynecologic-surgery/hysterectomy-options>

<sup>8</sup> Pal, Bhaskar. "Adhesion Prevention in Myomectomy." *Journal of Gynecological Endoscopy and Surgery* 2.1 (2011): 21–24. *PMC.* Web. 11 Oct. 2018.

<sup>9</sup> <http://www.pregnancy-info.net/treating-c-section-adhesion.html>

<sup>10</sup> Morales KJ, Gordon MC, Bates GW Jr. Post cesarean delivery adhesions associated with delayed delivery of infant. *Am J Obstet Gynecol* 2007;196:461.

<sup>11</sup> <https://www.webmd.com/women/endometriosis/surgery-for-endometriosis#1>