Surgical adhesion

Dr. M. Rasekhi
The most common cause of long-term complication of abdominal surgery
The formation of peritoneal adhesions following surgery is a common problem that can have significant implications both to the individual and to the healthcare system.
ADHESIONOLYSIS SURGERY

USA

MORE THAN 400/000 DAILY

EXCEEDING $ 1.3 BILLION ANNUM
Postoperative adhesions have been reported in 60-90% of women who underwent extensive open gynaecological surgery.
After laparotomy 68% - 82%
Midline incisions 59%
Pfannenstiel incisions 27%
Laparascopy < laparatomy
Although often asymptomatic, adhesions can be associated with significant morbidity.
ADHESION RELATED MORBIDITY

2 MAIN CATEGORIES

- PHYSICAL
- TREATMENT RELATED
complications during subsequent surgery

- difficult surgical access
- increased risk of injury to bowel and genitourinary tract
- blood loss
- increased duration of surgery
TREATMENT RELATED MORBIDITY

DIFFICULT POSTOPERATIVE INTERVENTIONS

1) INTRAPERITONEAL CHEMOTHERAPY
2) RADIATION COMPLICATIONS
3) INJURY AT REOPERATION
PHYSICAL MORBIDITY

- SMALL BOWEL OBSTRUCTION
- INFERTILITY
- DYSPAREUNIA
- CHRONIC PELVIC PAIN
- CHRONIC ABDOMINAL PAIN
SMALL BOWEL OBSTRUCTION

54%-74% THE CAUSE IS ADHESION
SBO

I. COLORECTAL SURGERY (IN 2 YEARS) = 17%

II. ABDOMINAL HYSTERECTOMY
   - NO RADIOTHERAPY = 5%
   - POST OP RADIOTHERAPY = 20%
   - PRE OP RADIOTHERAPY = 22%
1. chronic pelvic pain
2. deep dyspareunia
3. Chronic abdominal pain
CHRONIC PELVIC PAIN

- 10% GYNECOLOGIC VISITS
- 50% LAPAROSCOPIC INVESTIGATIONS

RESTRICTION OF THE FREE MOVEMENT OF THE PELVIC ORGANS
infertility

15-20% of infertility in women is secondary to adhesions
INFERTILITY

PELVIC ADHESIONS RESTRICT THE FREE MOVEMENT OF PELVIC ORGANS
Pathophysiology
Adhesion formation is triggered by injury to the peritoneal mesothelium, which initiates a peritoneal repair response.
The two main factors associated with surgical injury that escalate the organisation of fibrin into adhesions

1. inflammation
2. tissue ischaemia
inflammation

the injury to tissue triggers the release of cytokines, growth factors, cell adhesion molecules and histamine, mediators of the local inflammatory response that promote fibrin deposition
FOLLOWING TISSUE TRAUMA

INFLAMMATION BRINGS MACROPHAGES, FIBROBLASTS, A FIBRIN MATRIX TO THE SURFACE OF WOUND.
Tissue ischaemia

Tissue damage associated with ischaemia also promotes the formation of peritoneal adhesions as a maladaptive response. The response is an attempt to revascularise areas of relative ischaemia following surgical procedures such as ligation, fulguration or crushing, which disrupt tissue vasculature.
DAY 3 AFTER SURGERY

MACROPHAGES = FOUNDATION OF THE ADHESION

FIBRIN MATRIX ADVANCEMENT = PROLIFERATION OF FIBROBLASTS AND VASCULARIZATION
D A Y  5

The advancing adhesions are increasingly vascular and organized in structure.
ADHESION FORMATION

- BEGINS IMMEDIATELY AFTER SURGERY

- NO NEW ADHESION FORMATION AFTER DAY 7
I. Adhesions can develop within the first few hours after surgery

II. Fine balance between pathways that promote fibrin deposition and others that cause degradation (fibrinolysis).
Factors that favour the deposition of fibrin over its degradation will lead to the formation of fibrinous bridges between adjacent peritoneal surfaces.
Fig. 1. Schematic representation of adhesion formation and peritoneal surface healing following tissue insult. (reproduced from Hatipoglu A, Turkyilmaz Z, Mert S. The effects of melatonin on postoperative intraabdominal adhesion formation. Yonsei Med J. 2007 Aug 31; 48(4): 659-664.)
The treatment of adhesive disease is very difficult and most patients who undergo surgery for adhesiolysis develop adhesions to a similar degree. The best strategy is to avoid, as much as possible
OPTIMAL PREVENTION

THE CRITICAL 7-DAY PERIOD OF PERITONEAL HEALING
Strategies to prevent adhesions

1. injury minimisation via meticulous surgical technique and reduced tissue trauma
2. placing a physical barrier between peritoneal surfaces
3. use of pharmacological agents to modulate the cellular response to tissue injury
<table>
<thead>
<tr>
<th>Predisposing Factors for Adhesions</th>
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<tbody>
<tr>
<td>Ischemia</td>
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<tr>
<td>Drying of serosal surfaces</td>
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<tr>
<td>Excessive suturing</td>
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<td>Omental patches</td>
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<tr>
<td>Infection</td>
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<td>Traction of peritoneum</td>
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<td>Blood clots retained in peritoneal cavity</td>
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<tr>
<td>Prolonged operations</td>
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<tr>
<td>Adnexal trauma</td>
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<tr>
<td>Cornstarch powder and lint from surgical gloves, masks, laparotomy pads, etc</td>
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Table 2. Predisposing factors for adhesion formation.
MINIMIZING TISSUE TRAUMA
GOOD HEMOSTASIS
MINIMIZING ISCHEMIA AND DESICCATION
PREVENTION OF INFECTION
PREVENTION OF FOREIGN BODY RETENTION
surgical technique / careful tissue handling

- gentle handling of tissue and meticulous haemostasis, reduces adhesion formation
- laparoscopic techniques involve smaller incisions and reduced exposure to foreign materials leading to reduced injury
- extent of the surgery
- individual patient characteristics
- Copious irrigation is recommended to minimise contamination
contamination of the peritoneal cavity with materials such as sutures, talcum powder, starch, faeces or bacteria may induce further inflammation, which inhibits fibrinolysis and increases the likelihood of adhesion formation. Hence the importance of measures that reduce contamination
REVIEW OF THE LITERATURE DOSE NOT SUPPORT THE GLOSURE OF PERITONEUM TO PREVENT ADHESIONS
Anti adhesion adjuvants

I. Disrupt the inflammatory cascade or fibrin forming process

II. Provide a mechanical barrier preventing apposition of tissues
Pharmacological agents
NSAIDS, Steroids

BLOCKING PRODUCTION OF THROMBOXANES

Decrease the inflammatory response
Corticosteroid

1. there is no evidence to support their use to prevent adhesions based on their anti-inflammatory properties
2. the potential for an increased risk of infection in the perioperative setting
Side effect

- Infection
- Delayed wound healing
rt-PA
Recombinant human tissue plasminogen activator

Plasminogen → plasmin

↓

fibrin degradation

↓

reduction in adhesions
Lack of adequate study
FIBRINOLYTIC AGENTS

NORMAL PERITONEUM HAS FIBRINOLYTIC ACTIVITY WHICH PREVENT ADHESIONS
Need more study

- Postoperative bleeding
- Altered wound healing
- Little known about proper dosage and length of treatment
HEPARIN

ADD HEPARIN TO THE CRYSTALLOID SOLUTION FOR IRRIGATION PREVENT BLOOD CLOTTING AND FIBRIN DEPOSITION

CLINICAL TRIALS

NO BENEFIT
IRRIGATION WITH CRYSTALLOID SOLUTIONS

HYDROFLOTATION ALLOW TISSUES TO FLOAT APART FROM ONE ANOTHER 200 TO 500 CC LACTATED RINGER INSTILLED AT THE END OF SURGERY

NO DECREASE IN ADHESION FORMATION
REABSORPTION FROM THE PERITONEAL CAVITY
BE EVACUATED
IN 12 HOURS 35-60 cc/hr SO THAT 500cc WOULD ADHESION FORMATION EXTEND 5-7 DAYS
32% solution of dextran 70

PREVENT ADHESION FORMATION

NO LONGER

UTILIZED
SIDE EFFECTS

HIGH OSMOTIC GRADIANT

FLUID OVERLOAD, ASCITES, LEG AND VULVULAR EDEMA, PLEURAL EFFUSIONS, COAGULOPATHIES, DIC, HYPOTENSION, ANAPHYLACTIC SHOCK
SURGICAL ADHESION BARRIERS
Adhesion barriers

Physical barriers aim to reduce the formation of fibrinous attachments between injured peritoneal surfaces by keeping them apart, particularly for the first 72 hours.
Adhesion formation usually occurs within this 3-5-day window, which has clinical implications for the efficacy of anti-adhesion agents that must also be active over this period.
Medical implant

Reduce abnormal internal scarring by separating internal tissues and organs while they heal.

Once tissue surfaces heal, the barrier dissolves and absorbed.
MECHANICAL BARRIERS

1. INTRAPERITONEAL SOLUTIONS

2. MRMBRANE FORM
1904

The first membrane
MORE THAN 20 MEMBRANES AND LIQUIDS

4 BARRIERS APPROVED IN EUROPE AND USA
IDEAL ADHESION BARRIER

1. EFFECTIVE TISSUE SEPERATING
2. LONG HALF TIME (7 DAYS PERITONEAL HEALING )
3. WITHOUT INFLAMMATORY TISSUE RESPONSE
4. REMAIN ACTIVE IN THE PRESENCE OF BLOOD
5. DOSE NOT COMPROMISE WOUND HEALING
6. DOSE NOT PROMOTE BACTERIAL GROWTH
HYALURONIC ACID

Glucuronic acid

N-Acetylglucosamine
PROCARYOTES - MUCOID CAPSULE

EUCARYOTES - CULTURE
HUMAN

- SKIN
- SYNOVIAL JOINT FLUID
- VITEROUS OF EYE
- VERTEBRA
- UMBLICAL CORD

- MAIN COMPONENT OF EXTRACELLULAR FLUID
REGULATION OF WATER, IONS, CELL SUBSTRATE INTERACTION

MIGRATION, PROLIFERATION, ANGIOGENESIS
- ANIMAL SOURCE = BOVINE EYES, ROOSTER COMB
- MICROBIAL SOURCE = STREPTOCOCCI A, C
SPRAY GEL

POLYETHYLENE GLYCOL

2 LIQUID PRECURSOR REACT AFTER SPRAYED HYDROGEL

COAT TISSUES
METHYLENE BLUE IN ONE OF THE PRECURSORS

AREA COVERED AND THICKNESS OF HYDROGEL LAYER TO BE SEEN DURING LAPAROSCOPY
ACP GEL
HYSTROSCOPY
EASILY APPLIED
NO SIDE EFFECTS
HYDROLYSATION AND CLEARED

KIDNEY

7-8 DAYS
ADEPT

ICODEXTERIN = WATER SOLUBLE GLUCOSE POLYMER FROM CORNSTARCH

4% SOLUTION

INTRA ABDOMINAL COLLOIDAL OSMOTIC ACTIVITY FOR 3-4 DAYS
Side effects

1. INFECTIVE EVENTS
2. ANASTOMOTIC WOUND HEALING EVENTS
3. LABIAL SWELLING
4. SEVERE DIC
High Viscosity
Anti-Adhesion
Guardix-sol. 1.5g
ONE SOLUTION FOR ALL
Genewel
a Dongwha Company
MEMBRANE FORM BARRIERS

PREVENT ADHESIONS ONLY IN THE AREA OF APPLICATION
INTERCEED

OXIDISED REGENERATED CELLOLOSE
KNITTED FABRIC SOLID SHEET

INJURED PERITONEUM → SWELLS → GEL

GLYCOSIDASES (PERITONEAL MACROPHAGES)
MONOSACCHARIDS
METABOLISM = 4 DAYS - 2 WEEKS

SIDE EFFECT = ONLY POSTOPERATIVE FEVER
Extend the benefits of your meticulous surgical technique with the proven performance of GYNECARE INTERCEED®.
CONTRAINDICATION

- INFECTION OF PELVIC OR ABDOMINAL CAVITY
- PRESENCE OF BLOOD
- PRESENCE OF EXCESS PERITONEAL FLUID
CORE-TEX

- POLYTETRAFLUROETHYLENE MEMBRANE
- NONABSORBABLE - NON REACTIVE
- PERICARDIUM AND PERITONEUM
- MORE EFFECTIVE THAN INTERCEED
- LAPARATOMY AND LAPAROSCOPY
- PROPERTIES DO NOT WORSEN WHEN WET
- NONABSORBABLE AND NEED FOR SUBSEQUENT REMOVAL (LAPAROSCOPY 11 DAYS AFTER MYOMECTOMY)
SEPROAFILM

HYALURONATE
CARBOXYMETHYLCELLULOSE
- SOLID - THIN TRANSLUCENT MEMBRANE
- 1-2 DAYS VISCOS GEL
- 7 DAYS REABSORPTION FROM PERITONEAL CAVITY
- 28 DAYS METABOLISM (KIDNEYS)
It is technically possible to apply Sepraﬁlm or Interceed laparoscopically. Neither product is approved for this use in the USA.
REDUCE ADHESION BOTH IN GYNECOLOGICAL AND COLORECTAL SURGERIES
Seprafilm should not be wrapped directly around a fresh intestine anastomotic suture or staple line.

Such use can cause leak, sepsis and peritonitis.
NEW BOWEL ANASTEMOSIS

ANASTEMOSIS LEAKAGE - ABCESS - FISTULA
Case reports

- 69 y man - febrile on 12 day - laparotomy - foreign body
  Granulomatous reaction - steroid, antibiotic

- 71 y woman - fever - 21 day - laparotomy - dense, glue like mass involving small intestine, transverse colon,
  Peritonitis foreign body reaction - death

- 3 patients - fever - 4-7 day - raised neutrophiles - cloudy ascite - washing

- 3 patients - CT scan - abcess - laparotomy - sterile
  Collection - foreign body reaction
Much work and further research is still required to develop new products that can more effectively reduce the formation of surgical adhesions.
Thank you for your attention