THE USE OF OMT IN THE PREVENTION OF POSTOPERATIVE ADHESIONS

Anna Lobzova, DO, PGY-3; Hugh Ettlinger, DO, FAAO;

NMM/OMM Department, St. Barnabas Hospital, Bronx, NY

Introduction

Adhesion formation is a common sequelae of an abdominal surgery resulting in many complications including small bowel obstruction (SBO) and chronic abdominal/pelvic pain. The amount and duration of inflammation after peritoneal injury and inflammatory exudate clearance play an important role in adhesion formation. While the surgical approach and medications can influence the degree of injury and inflammation, peritoneal exudate clearance is largely dependent on mechanical factors, and therefore can be facilitated with appropriate Osteopathic Manipulative treatment (OMT).

History of Present Illness

57 year-old female with past history as below, including total laparoscopic hysterectomy (TAH) 3 days ago, presented with diffuse abdominal pain, nausea and vomiting. Admitted with SBO, she underwent exploratory laparotomy (ex-lap), lysis of adhesions (LOA) of sigmoid colon and small loops to the cuff of the cervix, untwisting of the small bowel around the omentum, reduction and repair of the incarcerated ventral hernia at the trochar site. She was seen by the osteopathic manipulative medicine (OMM) service on postoperative day (POD) two. She reported moderate abdominal soreness, bowel movement (BM), mild shortness of breath, cough, denied nausea and vomiting.

Past medical/surgical history PMH/PSH: asthma, TAH, tubal ligation, C-Section, open appendectomy

Social: 40 pack-years cigarette smoking

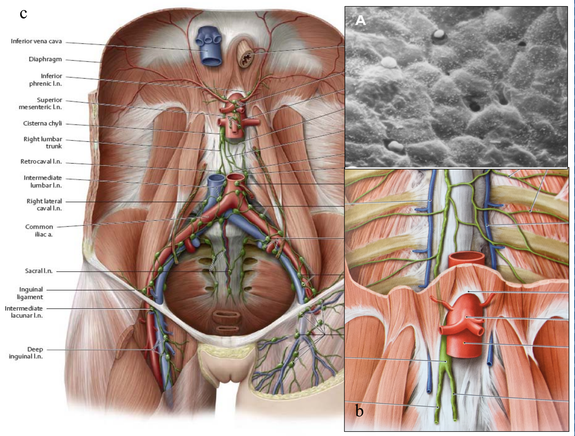
Physical Exam

Significant for mild increase in work of breathing, bilateral expiratory wheezing; mildly distended abdomen, soft, tender to palpation around midline vertical surgical incision; staples in place, clean, dry, intact, no erythema, warmth or drainage, bowel sounds present in all four quadrants.

Osteopathic Structural Exam(OSE)

right(R), left(L)

Head	OA ESrRl
Cervical	C2 FRSr with boggy changes, cervicothoracic junction FRSR
Thoracic	T3T4 FRSr, T5-L3 bilateral warm boggy tissue changes, thoracolumbar (TL) area with significant decrease in respiratory motion
Lumbar	L1, L2 ERSr, L5 ERSr, R psoas muscle hypertonicity
Sacrum/ Pelvis	R SI inferior pole restriction to lateral traction, R anterior innominate, R pelvic diaphragm inhaled
UE/LE	L clavicle posterior and superior, L mild supraclavicular congestion, R hip ER
Ribs	L1st rib depressed, R ribs 5-9 exhaled, L ribs 5-9 inhaled, 12th rib inhaled R
Abdomen	diaphragm inhaled bilaterally with severe decrease in excursion, R more than L, mesenteric drag mid lower abdomen from RUQ.



a: Scanning electron microscopy of a bat diaphragm, peritoneal surface with stomata and free orifice, occupied by erythrocyte. antimicrobe.org; b,c :Atlas of Anatomy. Thieme Med Pub, 2008

Assessment and Plan

57 year-old female with SBO 3 days after TAH, now status post ex-lap with LOA, reduction and repair of incarcerated ventral hernia post-op day 2 with mild incisional pain, return of bowel function and moderately labored breathing. OSE is significant for acute segmental facilitation at the TL and cervical spine, severely reduced excursion of the lower thorax, diaphragm; respiratory/circulatory pattern, limiting abdominal and central lymph drainage. Gentle OMT performed to all areas using balanced ligamentous tension, myofascial release to reduce facilitation, improve excursion of spine/thorax, promote respiratory/ circulatory function, lymph drainage and palliate pain.

Treatment Course

POD3	• Mild abdominal pain, small BM, mild tachypnea • OSE: unchanged from POD2. OMT.
POD4	• Intubated for acute respiratory failure secondary to pneumonia. No OMT
POD6	• Mild abdominal pain, BM, tolerating weaning • OSE: severe restriction in diaphragm, lower ribs and L thoracic outlet, warm changes RT2-T4, improved mesenteric drag. OMT • Extubated in the evening
POD7	• Decreased pain; BM, improved breathing, saturating well, productive cough • OSE: decreased warmth T-spine, improved motion at TL region, lower ribs and thoracic diaphragm excursion; improved motion L clavicle, increase in L supraclavicular congestion. OMT
POD 8- 10	• Denies pain; BM, breathing/saturating well • OSE: resolution of acute reflex in upper thoracic and TL regions, improved excursion of lower rib cage and diaphragm, decreased restriction at the thoracic inlet and posterior abdominal wall. OMT. • Discharged on POD#10

Discussion

Damage to the peritoneum triggers an inflammatory response, hypoxia, and coagulation cascade resulting in fibrin and extracellular matrix deposit. Fibrinous adhesions form in first 3 hours of injury and breakdown within 72 hours. **Persistent adhesions is a pathological outcome of healing. The amount, duration of inflammation and exudate clearance play an important role in adhesion formation**.[1,2,4,5]

OMT can aid in timely and adequate **peritoneal cellular exudate clearance**. It can restore a proper drainage from abdominal/pelvic cavity by facilitating lymph formation, and removal of major mechanical obstructions on the way of its flow at the key areas, such as diaphragm and thoracic inlet. [6,7]

Peritoneal fluid and solutes are mainly drained through **specialized diaphragm lymphatic system: open stomata and lymphatic lacunae**, plexus of terminal lymphatics **between muscles of the diaphragm.** Their function depends on excursion and tone of the diaphragm.[7,8] These lacunae drain into parasternal/ mediastinal lymph nodes and subsequently into the right lymphatic and thoracic ducts.[9,10]

The diaphragm is one of the key places of **central lymphatic flow. Cisterna chyli** that collects lymph from all abdominal viscera, and traverses the diaphragm at the aortic aperture is easily compressed against the aorta with increased tension in the crura.[6]

Part of peritoneal fluid and solutes are drained through **lymphatics in mesenteric roots.** The mesenteric drag often observed after abdominal surgery can also potentially interfere with drainage if left untreated. Mobilization of viscera and mesenteries was shown to lower the severity of adhesions.[11]

Lymph formation, movement of fluid from interstitia to end capillaries, as well as its propulsion majorly depends on **mechanic forces**. In the abdominal viscera, such forces are **gut peristalsis** and respiration.[7] Therefore, addressing viscerosomatic facilitation from abdominal/ pelvic viscera can indirectly promote lymph drainage.[6]

Negative thoracic pressure is **an important driving force** of lymph movement into end capillaries and into/ through central lymphatics.[12] Inadequate pressure gradient can be a result of limited rib cage compliance and excursion secondary to acute viscerosomatic reflex, tension in the posterior abdominal wall and crura.

Finally, there is growing evidence that the process of fibrosis is also influenced by **local mechanical forces through mechanotransduction** (conversion of mechanical forces to biochemical signals). Mechanical strain influences cellular pathways resulting in increased fibrosis.[13,14] Mechanical stress off-load at the surgical site within muscular-skeletal frame and fascial planes with OMT may contribute to the prevention of excessive fibrosis.

Further study is needed to assess the benefits of OMT in the prevention of postoperative adhesions.

References:

1.Monk BJ, Berman ML, Montz. Adhesions after extensive gynecologic surgery: clinical significance, etiology, and prevention. Am J Obstet Gynecol. 1994 May;170(5 Pt 1):1396-403.

2. Sulaiman H, Dawson L, Laurent GJ, et al. Role of plasminogen activators in peritoneal adhesion formation. *Biochem Soc Trans* 2002;30:126-31

3. Fortin CN, Saed GM, Diamond MP. Predisposing factors to post-operative adhesion development. Hum Reprod Update. 2015 Jul-Aug;21(4):536-51 Epub 2015 May 1.

4Arung W, Meurisse M, Detry O. Pathophysiology and prevention of postoperative peritoneal adhesions. World Journal of Gastroenterology : WJG. 2011;17(41):4545-4553.

5.Molinas CR, Binda MM, Manavella GD, Koninckx PR. Adhesion formation after laparoscopic surgery: what do we know about the role of the peritoneal environment? *Facts, Views & Vision in ObGyn.* 2010;2(3):149-160.

6.Ettlinger H. Treatment of the Acutly Ill Hospitalized Patient In: Ward R.C. Ed. Foundations of Osteopathic Medicine, 2d Ed.: Lippincott Williams & Wilkins; 2002. Pp1115-1142

7.Ettlinger H., Willard F.H. Anatomy and Physiology of the Lympatic System In: Chila, A, Ed. Foundations of Osteopathic Medicine, 3rd Ed. Baltimore, MD: Lippincott Williams & Wilkins; 2011. pp.191- 204

8. D. Negrini, M. Del Fabbro, C. Gonano, S. Mukenge, G. Miserocchi. Distribution of diaphragmatic lymphatic lacunae Journal of Applied Physiology Mar 1992, 72 (3) 1166-1172

9. Abu-Hijleh MF, Habbal OA, Moqattash ST. The role of the diaphragm in lymphatic absorption from the peritoneal cavity. *Journal of Anatomy*. 1995;186(Pt 3):453-467.

10. Yuan Z, Rodela H, Hay JB, Oreopoulos D, Johnston MG. Lymph flow and lymphatic drainage of inflammatory cells from the peritoneal cavity in a casein-peritonitis model in sheep. Lymphology. 1994 Sep;27(3):114-28.

11. Bove GM, Chapelle SL.Visceral mobilization can lyse and prevent peritoneal adhesions in a rat model. J Bodyw Mov Ther. 2012;16(1):76-82.

12. Schad H, Flowaczny H, Brechtelsbauer H, Bierkenfeld G. The significance of respiration for thoracic duct flow in relation to other driving forces of lymph flow. Pflugers Arch. 1978 Dec 28;378(2):121-5.

13. Duscher D, Maan ZN, Wong VW, et al. Mechanotransduction and fibrosis. Journal of biomechanics. 2014;47(9):1997-2005.

14. Bochaton-Piallat M-L, Gabbiani G, Hinz B. The myofibroblast in wound healing and fibrosis: answered and unanswered questions. F1000Research. 2016;5:F1000 Faculty Rev-752.

IRB APPROVED 2017.10