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LAPAROSCOPY IN TRAUMA

SUMMARY

Laparoscopy in trauma offers a diagnostic and sometimes therapeutic tool that is safely applied by experienced surgeons in the appropriately selected patient with suspected, but unproven intra-abdominal injuries. Laparoscopy in trauma is contraindicated in the hemodynamically unstable patient or in the patient with a clear indication for emergency laparotomy. This technique requires advanced laparoscopic skills, surgeon expertise, and institutional resources available at all hours. Prolonged attempts at therapeutic intervention should prompt conversion to laparoscopic assisted or open procedure.

RECOMMENDATIONS

- **Level 1**
 - **None**
- **Level 2**
 - **Laparoscopy in trauma is an acceptable diagnostic tool in the hemodynamically stable trauma patient.**
 - **Contraindications to laparoscopy in trauma include: hemodynamic instability, diffuse peritonitis, evisceration, or known injury that cannot be repaired laparoscopically.**
 - **Laparoscopy is safe and accurate in penetrating abdominal injuries with documented or equivocal penetration of the fascia.**
- **Level 3**
 - **Laparoscopy is safe and accurate in blunt abdominal injuries with equivocal findings on imaging.**
 - **A standardized and systematic technique should be used when performing diagnostic laparoscopy in trauma.**
 - **Therapeutic laparoscopy in trauma is reserved for conditions amenable to simple intervention within the skill set of the provider.**
 - **Laparoscopy in trauma should only be performed at an institution with personnel who are properly equipped and trained.**

INTRODUCTION

Exploratory laparotomy in trauma is associated with a high negative laparotomy rate and significant morbidity (1-3). Laparoscopy has found many applications in general surgery. The utilization of laparoscopy in trauma as a diagnostic or therapeutic tool in the hemodynamically stable patient has been widely debated. The decreased morbidity of laparoscopy vs. laparotomy is the traditional argument for the use of a minimally invasive approach. Critics point to injuries that are missed, therapeutic limitations, and inconsistent resources and expertise with regard to laparoscopy. Current evidence supporting the use of laparoscopy in blunt and penetrating trauma is limited to a few prospective studies. Patient, facility, and methodological heterogeneity limit the level of available evidence; however the literature can be utilized to make the following recommendations.

EVIDENCE DEFINITIONS

- **Class I:** Prospective randomized controlled trial.
- **Class II:** Prospective clinical study or retrospective analysis of reliable data. Includes observational, cohort, prevalence, or case control studies.
- **Class III:** Retrospective study. Includes database or registry reviews, large series of case reports, expert opinion.
- **Technology assessment:** A technology study which does not lend itself to classification in the above-mentioned format. Devices are evaluated in terms of their accuracy, reliability, therapeutic potential, or cost effectiveness.

LEVEL OF RECOMMENDATION DEFINITIONS

- **Level 1:** Convincingly justifiable based on available scientific information alone. Usually based on Class I data or strong Class II evidence if randomized testing is inappropriate. Conversely, low quality or contradictory Class I data may be insufficient to support a Level I recommendation.
- **Level 2:** Reasonably justifiable based on available scientific evidence and strongly supported by expert opinion. Usually supported by Class II data or a preponderance of Class III evidence.
- **Level 3:** Supported by available data, but scientific evidence is lacking. Generally supported by Class III data. Useful for educational purposes and in guiding future clinical research.

LITERATURE REVIEW

Benefits of Laparoscopy in Trauma

Negative diagnostic laparotomy in trauma is associated with a high complication rate (14.5%) and prolonged length of stay (2,3). The rate of negative / non-therapeutic laparotomy in trauma is variable ranging from 1.7% to 38% (1). Negative laparotomy incidence in both blunt and penetrating trauma is widely accepted as around 20%, but this number is decreasing with increased utilization of advanced imaging and laparoscopy in trauma.

Multiple small single institution observational studies note a decreased negative laparotomy rate, decreased complications, faster return of bowel function, and decreased length of stay with the use of diagnostic laparoscopy in trauma (2,4,5). In penetrating trauma, the ability to rule out peritoneal penetration with laparoscopy allows patients to be discharged without admission for observation. Limited investigations show that therapeutic laparoscopy in trauma also results in decreased length of stay relative to therapeutic laparotomy (4).

Contraindications to Laparoscopy in Trauma

There are multiple institutional, surgeon, and patient specific contraindications to utilizing diagnostic laparoscopy in trauma. Laparoscopy is contraindicated in the hemodynamically unstable patient. Inability to tolerate pneumoperitoneum is a contraindication to laparoscopy in trauma. Patients with known injuries not amenable to therapeutic laparoscopy or clear indications for laparotomy (diffuse peritonitis, evisceration, or hemorrhagic shock) should not undergo laparoscopy. Patients with prior abdominal surgery may present a technical challenge and result in incomplete assessment of the peritoneal cavity due to adhesions. Limited institutional or surgeon laparoscopic expertise is a contraindication to laparoscopy in trauma.

Penetrating Trauma

Laparoscopy for penetrating trauma was initially met with widespread skepticism, however, as technology and surgeon skill with laparoscopic surgery has improved, acceptance in penetrating trauma has risen. Multiple limited and small studies have shown promising results with the use of laparoscopy in penetrating trauma. The majority of studies have shown laparoscopy to be an effective tool for evaluating the parietal peritoneum for violation in penetrating trauma prompting further exploration. Multiple studies found near complete exploration of the abdominal cavity to be possible to include the diaphragm and retroperitoneum (6).

With regard to therapeutic laparoscopy in penetrating trauma, the literature is replete with cases of intracorporeal suturing of bowel, bladder and diaphragmatic injuries, and obtaining hemostasis of bleeding injuries to the liver or spleen (5-9). Laparoscopy is touted by many articles for effectiveness in evaluating and offering the ability to treat diaphragmatic injuries after penetrating thoracoabdominal injuries (5,7). Friese et al. evaluated 34 hemodynamically stable patients with penetrating thoracoabdominal injuries and found laparoscopy to have a sensitivity and specificity of 87.5% and 100% respectively for evaluating for diaphragm injury (7). Given the described use in penetrating trauma, therapeutic laparoscopy in the hemodynamically stable patient should be considered contingent on surgeon skill.

Blunt Trauma

The use of laparoscopy for blunt trauma is less defined than in penetrating trauma. Some literature cites reluctance to utilize laparoscopy in blunt trauma because of the frequently encountered physiologic derangements and associated systemic injuries such as head and orthopedic insults (4). Exploration for blunt trauma victims is typically reserved for the hemodynamically unstable patient limiting the role of laparoscopy. Given advances in imaging and the trend towards non-operative management of liver and spleen injuries, the role of diagnostic laparoscopy in blunt trauma is limited to equivocal cases when abdominal injury cannot be ruled out.

The reported role of therapeutic laparoscopy in blunt trauma is limited. Nonetheless there are reports in the literature of successful treatment of bladder injuries and hemostasis of liver and spleen injuries utilizing

multiple techniques (2,6). Just as with penetrating trauma, the use of therapeutic laparoscopy should be highly selective in blunt abdominal injuries.

How is laparoscopy in trauma performed?

There are no studies comparatively proving one method over another for exploring the abdominal cavity. However, available studies recommend some variation of umbilical port placement either by the Hasson technique or Veress entry, a 30 or 45 degree laparoscope and additional port placement that allows full exploration of the abdomen to include additional ports for an assistant to help with retraction if needed. Bilateral trocar placement may offer optimal visualization allowing the camera to be passed through multiple quadrants allowing better visualization of the entire abdomen. It is also recommended to secure the patient adequately in order to allow use of operating room table positioning to aid in exposure. In early applications of laparoscopy in trauma, the literature reports missed injury rates of 41-77%. Kawahara et al. have described a technique for a systematic approach to laparoscopic exploration which has a sensitivity and specificity of 97.6% and 100% respectively for identifying intra-abdominal injury (8). Their strategy begins with open Hasson insertion of a 10mm trocar in the supraumbilical position followed by pneumoperitoneum to 15 mmHg. Using a 30 degree laparoscope, two additional 10 mm ports are placed under direct vision bilaterally at the pararectus lines just superior to umbilical port. First, the diaphragm and parietal peritoneum are inspected for penetration. Next, the abdominal cavity is searched for gross contamination by blood, enteric contents, or urine. Starting at the ligament of Treitz, the small bowel is then run in 10 cm increments, flipping it over along the way to observe both sides down to the ileocecal valve. The colon is inspected from the cecum through the rectum. The inframesocolic space is inspected and the esophagus to duodenum are then inspected to complete inspection of the supramesocolic space. Lastly, the gallbladder, liver, Morison's pouch and spleen are carefully examined. If therapeutic maneuvers are performed for a diaphragmatic injury, a subxiphoid trocar is placed.

Limitations of Laparoscopy in Trauma

The possibility of inadequate visualization and missing an injury is the primary concern expressed by critics of laparoscopy in trauma. Improved surgeon expertise and the use of a systematic technique for diagnostic laparoscopy in trauma have improved the reported rates of missed injury in both penetrating and blunt abdominal trauma(6). A recent study of 138 patients who underwent laparoscopy for trauma reported no missed injuries (4).

Specific injury patterns such as posterior penetrating or flank wounds may limit effective laparoscopic evaluation. Injuries to the duodenum or pancreas may be missed with laparoscopy. The presence of hematoma or frank bleeding may obscure laparoscopic evaluation resulting in missed injuries.

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