



Diagnostic laparoscopy in abdominal trauma patients

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Abstract: Abdominal trauma might be blunt or penetrating type. In some situations, radiological imaging methods might be insufficient for diagnosis, where diagnostic laparoscopy (DL) might be necessary. DL enables us to make a direct visualization of intra abdominal organs, to see any injury if present and decide if laparotomy is necessary or not. DL can be performed under either general or local anesthesia. Its advantages are minimal invasiveness, easiness-to-use, direct visualization of organs and primary laparoscopic repair chance if possible. Two-dimensional view and difficulty in visualizing of all surfaces of organs are among its disadvantages. Intra abdominal irrigation and analysis of the irrigation fluid also give indirect clues. At the end of DL, intra abdominal drain placement and follow up of drainage content can be done.

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Introduction

Trauma is an important and emergent surgical entity which we may see frequently in daily routine. It might be seen in forms of work or home accident, fall-down from height, traffic accident etc. Single organ trauma like falling on one hand or multiple organ traumas which are generally more common or whole-body trauma may be seen. A single trauma to abdomen because of a fist blow may be seen. A good history taking is important in trauma patients to understand the characteristic of trauma. The information of the traumatized part of abdomen and type of the trauma, blunt or penetrating, guides us to make a diagnosis. It is important to decide if intra abdominal organ injury is present or not and if surgery is necessary or not in case of intra-abdominal organ injury. Misdiagnosis might lead to unnecessary surgery. Every unnecessary surgical operation might result in increased mortality and morbidity risk. Radiological modalities to understand if any intra abdominal organ injury is present or not, are available. But these modalities might not be present in every hospital, not

be available at that time period or need a preparation period where we do not have time and need immediate diagnosis. Under these circumstances, surgeon has to make an urgent decision. Again, in spite of using radiological imaging, a certain diagnosis cannot be made, still surgeon has to decide and make the diagnosis certain. Diagnostic laparoscopy (DL) is an alternative method in such situations (1-3).

Patient selection and workup

DL can be used for diagnosis in blunt or penetrating intra abdominal trauma. It is an invasive method which is valuable in diagnosis where non-invasive methods are insufficient or cannot be used. Ideally, it is performed in operation room under general anesthesia but, also can be performed at bedside and under local anesthesia. It can be used to see if any solid or hollow organ or mesentery injury is present in blunt injury cases. A strong abdominal trauma might not result in solid organ injury but mesenteric tear and bleeding because of being crushed between blow and vertebral body. This

may be seen as an intra abdominal fluid collection on CT, but, lacerated area might not be seen. DL is both diagnostic and treatment method, by using which hemostasis and primary repair can be provided, in such situations. Also, possible associated intestinal wall crushing or laceration can be assessed. When the degree of injury or severity of active bleeding of solid organ due to blunt abdominal trauma cannot be assessed well, DL can be preferred. If injury is mild or/and hemorrhage is not active, thus, follow up and medical treatment are the preference, DL can be repeated during follow up period. If hollow organ injury is suspected in blunt abdominal trauma, DL can also be preferred. Penetrating trauma might be either stab or gunshot injuries. Stab injuries might be with knife, rapier etc. Gunshot injuries might be with single or multiple bullets, and lead. Stab wounds generally have a straight wound trace but, in some situations, because of multiple to-and-fro movements of the knife, multiple traces in a single stab wound might be present which should be reminded. Gunshot wounds might have either a straight or strange traces because bullet might change direction within the body. For lead wounds, it might be difficult to assess traces as so many lead penetrations are present. DL can be used to see presence of any intra abdominal penetration, if so, any organ injury and, in presence of organ injury, to decide whether laparotomy is necessary or not. The trace and intra abdominal access of a penetrating trauma might be understood by exploring the wound under local or intravenous sedation anesthesia. But, sometimes, wound exploration may be difficult and has a high complication risk. For example, penetrating injuries of inguinal region can be explored but, here, there are tissues, femoral arterial and venous structures within the inguinal canal. If wound trace of this area goes towards upward, i.e., intra abdominally, DL can be performed to see intra abdominal penetration, intactness of peritoneum, presence of preperitoneal or retroperitoneal hematoma, and, if present, size of hematoma (4-10).

Pre-operative preparation

As DL is an invasive procedure, it necessitates a pre-operative preparation. Intravenous access should be provided, vital parameters should be monitored. Hemogram, biochemical parameters, PT, INR and blood group should be ordered pre-operatively. Either general or local anesthesia under which DL is performed, the patient should be consulted by and it should be talked about the procedure to the anesthesiologist. However, if there isn't

enough time to complete blood test and the surgeon feels DL to perform immediately, he/she should consult the patient with the anesthetist and, during the procedure, while inserting trocar into intra abdominal cavity, the surgeon should be very careful to prevent bleeding and to provide hemostasis.

Equipment preference card

Laparoscopic equipment is necessary for DL which is composed of monitor, light source, insufflator, camera system, and the equipment should have mobile trolley system. Laparoscopic surgical tools such as sterile Veress needle, trocars, dissectors, endoclensh and retractors are also necessary for intra abdominal access and exploration.

Procedure

DL can be performed in operating room (OR) or at bedside under either general or local anesthesia. Ideally, it should be performed in OR and under general anesthesia to explore intra abdominal cavity properly. We explain DL performed in OR first: as conversion is possible following DL, preparation should be as if laparotomy is performed. The patient is placed on operation table, abdominal hair is shaved, abdominal skin is scrubbed with 10% povidone iodine solution and patient is covered with sterile covers. Abdominal fascia is accessed by making an infra umbilical 1-1.5 cm skin incision. The edges of incision, thus fascia, are hanged up with two forceps. If the patient is obese one and this maneuver is insufficient to suspend the fascia, then fascia is grabbed with Kocher's forceps on both side of medial line and hanged up. If there is no history of previous abdominal operation or umbilical hernia, the Veress needle is inserted into abdominal cavity and physiologic saline sterile water is administered through its lumen which flows into the abdominal cavity because of negative pressure gradient if you access properly. Then, CO₂ pneumoperitoneum of 10 to 12 mmHg of pressure is formed through Veress needle. Normally, when insufflation is begun, intra abdominal pressure gets increased slowly beginning from the level of 3 to 5 mmHg as long as gas inflow keeps go on. If a pressure of 10 to 12 mmHg or more is seen at the beginning of insufflation, Veress needle might not be in intra abdominal cavity but in preperitoneal area. So, the surgeon must care that abdominal insufflation occurs properly. Then, 10 mm trocar is inserted into abdominal cavity by using the same

fascia hanging maneuver. Videoscope is entered through the trocar and intra abdominal exploration begins. In cases with previous intra abdominal operation or umbilical hernia, trocar can be placed by using open technique. On exploration, intra abdominal blood because of major organ injuries like liver and splenic lacerations, free fluid mixed with intestinal content because of intestinal injury, clear fluid due to urine of perforated urinary bladder might be observed. The degree of bleeding may be assessed on direct observation. The surgeon may decide conversion to laparotomy observing major organ or actively bleeding major arterial injury. Laparoscopic hemostasis can be tried in minor bleeding. If any active bleeding or pathology cannot be detected or a negligible amount of blood is present in intra abdominal cavity, then, blood is aspirated and its origin is searched. If intestinal content is present, intestinal injury and perforation is the case and its repair either laparoscopically or by laparotomy depends on experience on laparoscopy and preference of the surgeon. If presence of intra abdominal urine is suspected, sterile physiological sterile saline water or diluted methylene blue can be administered into the urinary bladder through a urinary catheter and intra abdominal fluid can be observed per operatively. Reverse Trendelenburg position is useful for better visualization of urinary bladder. If urinary bladder injury is still unclear, then an urologist should consult the patient per operatively. If there is no pathological finding at first, then laparoscopic systemic exploration is begun. Abdominal wall and diaphragm are carefully explored. As the abdomen is insufflated, peritoneum is stretched and a tear or laceration of it can be seen more easily. All the free surfaces of liver is tried to be explored and, if needed, second and/or third trocars are placed; inferior surface of the liver is explored by the help of a liver retractor. It is searched if there is any fluid or not between liver and diaphragm or liver and abdominal wall. Splenic surfaces and parasplenic area are also searched for any injury, blood and fluid collection. Anterior surface of stomach and duodenum are explored by retracting the liver. Right and left paracolic gutters are explored. Beginning from caecum, entire colon must be explored. Small intestine and pelvic organs should also be explored. Omentum is retracted upward over colon and small intestine is grabbed with atraumatic bowel forceps and all surfaces of small intestine are explored. Ridiculous care should be taken not to make an iatrogenic injury during exploration. The exploration can be made easier by deviating of operation table to the right side, left side, Trendelenburg or reverse Trendelenburg positions,

as needed. If the surgeon considers it necessary, intra abdominal cavity can be irrigated; the irrigation fluid is centrifuged and evaluated under microscope. Detecting intestinal content on this examination is a clue of small bowel perforation. Abdominal cavity is commonly irrigated with physiological saline solution; dextrose-containing solutions are not used as they are good mediums for microorganism proliferation. Physiological saline solution of 1 liter can be administered, aspirated and analyzed. Complete irrigation of all compartments can be achieved by changing position of operation table. Also, localized irrigation of certain compartments can be done by placing a Nelaton catheter in that anatomical region, irrigating with a certain amount of saline solution (for example 100 mL) and taking of sample fluid for analysis. For example, a Nelaton catheter is placed by liver through a trocar and irrigation and suction is done. These local irrigations give information about that anatomic region, not others. The surgeon can locally irrigate other areas if necessary. Completing DL, the surgeon might place a Nelaton catheter through one of the trocar port and use it for drainage content follow up. In situations where general anesthesia can't be used, DL can be performed under local anesthesia. Still, the patient should be consulted by an anesthesiologist pre-operatively. Anesthesiologist can help the surgeon by administering intravenous sedating drugs. The patient should be monitored during this procedure, too. Following local anesthesia, infra umbilical skin incision is made and fascia is reached. We prefer open trocar entry technique in our practice. A 15 mm median incision on fascia and peritoneum is made and trocar is entered into abdominal cavity. A minimum insufflation should be done as a usual insufflation might result in severe abdominal pain due to peritoneal stretching. Unfortunately, minimum pneumoperitoneum use need restricts optimum visualization of intra abdominal cavity and brings the risk of skipping some important pathological findings. Intra abdominal access under local anesthesia might be easy in slim patients but obese patient might not tolerate the procedure. After DL, a Nelaton catheter can be placed into abdominal cavity through trocar port and watched for any pathological drainage (4,7,9,11).

Role of team members

DL is of a team-work. The procedure needs help of anesthesiologist and an experienced nurse on laparoscopy who helps the surgeon during performing it. As a second or third trocar placement, hence more hand tool use, might

be needed during DL, thus, the nurse should be able to use the videoscope. Entire laparoscopic equipment should also be ready to use during the procedure.

Pre and post-operative management

Antibiotic prophylaxis and parenteral fluid replacement should be done pre-operatively. If there isn't any pathology on DL or any complication in early post-operative period, oral fluid intake can be started in early post-operative period, provided that gastro intestinal functions are returned and general condition of the patient is well. Post-operative analgesics provide patient comfort.

If a drain tube has been placed into abdominal cavity, drainage content can be watched. If surgeon desires, intra abdominal cavity irrigation might be repeated through drain tube with physiological saline and this irrigation fluid may be analyzed in laboratory.

Tips, tricks and pitfalls

Recently, DL is needed less than that of yesterday. Innovations and development in radiological methods have an important role on this decrease. But, still, when radiological imaging cannot ascertain the diagnosis or is unavailable, DL is needed. DL performed at optimum conditions satisfies the surgeon and give direction to the treatment. Its disadvantage is its 2 dimensional view. Another one is its limits to view all surfaces of the intra abdominal organs. Though it hasn't got a 100% of diagnostic value, its minimal invasiveness is an advantage. Direct visualization of the organs and drain placement chance if needed are its other advantages.

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Footnote

Conflicts of Interest: Both authors have completed the ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/ales.2016.09.06>). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are

appropriately investigated and resolved.

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