

Laparoscopic exploration and lavage in penetrating abdominal stab wounds: a preliminary report

Penetran abdominal bıçak yaralarında laparoskopik eksplorasyon ve lavaj: Öncü çalışma

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BACKGROUND

To determine the role of a combined laparoscopic exploration and lavage (LELA) in abdominal stab wounds (ASW). We hypothesized that peritoneal penetration (PP) is not an indication for exploratory laparotomy (EL) if LELA is negative.

METHODS

A prospective study (Jan 2002-Dec 2003) was carried at our Level I Trauma Center. Patients with anterior fascia penetration in wound exploration and with systolic blood pressure greater than 90 mmHg were included. Patients with back and flank injuries, evisceration and presentation after six hours were excluded. LELA was considered positive if red blood cell count was >5000 and white blood cell count was >150 in a lavage without the presence of bile, gross blood, food fibers or stool.

RESULTS

Eighty-nine patients with anterior ASW (AASW) were included. Twenty-eight patients underwent laparoscopy to rule out PP. Seventeen patients had PP and 8 demonstrated injuries that required immediate exploratory laparotomy. The remaining 9 underwent LELA. Four patients had positive LELA that demonstrated injuries (sigmoid, right colon, and small bowel [n: 2]). Five patients had a negative LELA and avoided an unnecessary EL.

CONCLUSION

LELA in AASW shows a promising role to rule out mainly hollow viscus injuries. This technique could decrease the number of non-therapeutic laparotomies, length of stay and hospital costs without increasing the incidence of missed abdominal injuries.

Key Words: Diagnostic peritoneal lavage; laparoscopy; stab wounds.

AMAÇ

Abdominal bıçak yaralanmalarında (ABY) laparoskopik eksplorasyon ve lavajın (LELA) birarada uygulanım rolü değerlendirildi. LELA'nın negatif çıkması durumunda periton penetrasyonunun (PP) tanısal laparotomi (TL) için bir endikasyon olmadığı varsayıldı.

GEREÇ VE YÖNTEM

Ocak 2002 ile Aralık 2003 tarihleri arasında birinci düzey travma merkezimizde ileriye dönük bir çalışma yürütüldü. Yapılan yara incelemesinde ön fasya penetrasyonu olan ve sistolik kan basıncı ≥ 90 mmHg bulunan hastalar çalışmaya dahil edildi. Sırt ve böğür yaralanması bulunan, eviscerasyon olan ve altı saatten sonra başvuran hastalar çalışma dışında bırakıldı. Lavajda safra, aşikar kanama, gıda lifi veya dışkı bulunmaksızın eritrosit değerinin >5000 ve lökosit değerinin >150 olması durumunda, LELA pozitif olarak kabul edildi.

BULGULAR

Çalışmaya 89 anterior ABY olgusu dahil edildi. PP'yi ekarte etmek üzere, 28 hastaya laparoskopi uygulandı. Laparoskopi, hastaların 17'sinde PP ve 8'inde acil TL uygulanmasını gerektiren yaralanma bulunduğunu ortaya koydu; geriye kalan 9 hastada LELA gerçekleştirildi; 4 hastada yaralanma bulunduğunu ortaya koyan pozitif LELA (sigmoid, sağ kolon, 2 tane ince bağırsak) sonucuna sahip oldu. Beş hastada, negatif bir LELA saptandı ve gereksiz bir TL önlendi.

SONUÇ

Anterior ABY'de uygulanan LELA, esas olarak içi boş organ yaralanmalarını ekarte etmeye yönelik umut vericidir. Bu teknik, gözden kaçırılan abdominal yaralanmaların sayısını artırmaksızın, tedavi amaçlı olmayan laparotomilerin sayısını, hastanede kalma süresini ve hastane giderlerini azaltabilir.

Anahtar Sözcükler: Tanısal periton lavajı; laparoskopi; bıçak yaraları.

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One of the most important goals when managing penetrating abdominal trauma is the avoidance of non-therapeutic exploratory laparotomies without allowing missed significant injuries. Management of patients with stab wounds to the anterior abdominal wall has varied, ranging from exploratory laparotomy to clinical observation. The use of laparoscopy to evaluate this type of injury has been advocated to rule out peritoneal penetration. However, this approach has not eliminated or significantly decreased the number of non-therapeutic laparotomies. Moreover, diagnostic peritoneal lavage (DPL), as a minimally invasive procedure, has been utilized by many trauma centers in an attempt to detect intraabdominal injury.

The use of a laparoscopic exploration and lavage (LELA) is presented as a unique technique that could identify hollow viscus injury and decrease the number of non-therapeutic laparotomies in patients with anterior abdominal wall stab wounds (AASW).

MATERIALS AND METHODS

Over the two-year period from January 1, 2002 through December 31, 2003, 89 patients with AASW were evaluated at St. Barnabas Hospital, an urban, Level I trauma center in the Bronx, New York. Patients with anterior fascia penetration in wound exploration and with a systolic blood pressure greater than 90 mmHg were included. Patients with back and flank injuries, evisceration and presentation after six hours of injury were excluded. Anatomic landmarks that defined AASW wounds were the costal margins superiorly, inguinal ligaments and pubis inferiorly and anterior axillary line laterally. Patients with AASW underwent a local wound exploration in the emergency department and if anterior fascia penetration was present or was unequivocal, a diagnostic laparoscopy was performed to evaluate for peritoneal penetration. Peritoneal penetration was an indication for LELA. Once penetration had been confirmed, a lavage via the laparoscope was performed and the fluid was sent for laboratory analysis that consisted of red blood cell (RBC) count, white blood cell (WBC)

count, bile and vegetable matter. While awaiting the lavage results, a laparoscopic exploration was performed, which consisted of evaluating the small bowel from the ligament of Treitz to the ileocolic region. In addition, evaluation of the colon was performed by mobilizing the lateral peritoneal attachments. LELA was considered positive if the RBC count was greater than 5000/mm³ and the WBC count was greater than 150/mm³ in a lavage without the presence of bile, gross blood, food fibers or stool. Patients with a positive lavage and exploration underwent a laparotomy. Secondly, in patients with a positive or borderline lavage but a negative exploration, hand-assisted surgery was planned to visualize the small bowel outside the peritoneal cavity.

The presence of gross blood in upper quadrant stab wounds was not considered a positive LELA because of possible injuries to solid organs that did not require therapeutic intervention. Bile, food fibers and stool were the indications for an exploratory laparotomy or hand-assisted surgery.

RESULTS

Eighty-nine patients sustained stab wounds to the anterior abdominal wall during the two-year study period. Twenty-eight patients (31.4%) with anterior fascia penetration on local wound exploration underwent diagnostic laparoscopy to investigate for presence of peritoneal penetration. Seventeen patients (60.7%) demonstrated peritoneal penetration and eight (47%) sustained injuries that required immediate exploratory laparotomies. The remaining nine patients (52%) underwent LELA (Table 1).

Four patients had a positive LELA that demonstrated injuries to the sigmoid, right colon and small bowel (1 to the ileum and 1 to the jejunum). The average RBC and WBC counts in this group were 15551 and 468 cells/mm³, respectively. Five patients had a negative LELA by lavage and exploration and were discharged home within 12 hours after admission. The average age in this group was 19.4 and the RBC and WBC counts were 10.4 and 7.66, respectively (Table 2).

Table 1. Diagnostic procedures in 89 abdominal stab wound patients

Total (n)	DL	PP	PP/EL	LELA	LELA pos	LELA neg
89	28	17	8	9	4	5
	31.4%	60.7%	47%	52%	44.4%	55.6%

DL: Diagnostic laparoscopy; PP: Peritoneal penetration; PP/EL: Peritoneal penetration, exploratory laparotomy; LELA: Laparoscopic exploration and lavage.

Table 2. LELA results

	LELA neg	LELA pos
Age	19.4 ± 4.3	26.1 ± 3.3
RBC	10.4 ± 7.60	15551 ± 6253
WBC	7.66 ± 2.79	468 ± 224.74

LELA: Laparoscopic exploration and lavage; RBC: Red blood cells;
WBC: White blood cells.

Patients with a positive LELA had a positive lavage and the injuries were clearly visualized on exploration. These bowel injuries were repaired via a formal exploratory laparotomy using a double-layer technique. There were no complications reported after the procedure and all patients were discharged home. All patients were followed up as outpatients in our trauma clinic, where the surgical clips were removed and they were questioned about their postoperative course.

DISCUSSION

Although much has been written about the management of penetrating abdominal trauma, controversy remains over the optimal management. The treatment of patients after penetrating abdominal trauma depends on many factors. Some are institution-specific, whereas others depend on the type and location of the injury. Stab wounds to the anterior abdominal wall are reported to have a lower incidence of injuries requiring repair and the incidence of non-therapeutic laparotomy was greater. This has led to the development of multiple regimens that include some variations of wound explorations and DPL or observation, computed tomography, sonography and laparoscopy.^[1-5]

For stab wounds to the anterior abdominal wall, many studies recommend a combination of local wound exploration, and if penetration of the anterior fascia is found, either a DPL is performed or the patient is admitted for observation. Local exploration in cooperative patients has the benefit of eliminating more than one-third of patients with superficial injuries who can then be discharged.^[6] Observation has the advantages of being less invasive and has a lower non-therapeutic laparotomy rate than DPL, which can be misleading in stab wounds to the upper quadrants where solid organ injury could be present.^[7] In addition, the use of awake laparoscopy has been described in selected groups of patients, facilitating an expedited patient discharge.^[8] Finally, basic laparoscopy for penetrating abdominal

injuries in a defined set of conditions is safe and accurate and decreases the number of non-therapeutic explorations.^[9]

Diagnostic peritoneal lavage was introduced for the evaluation of stab wounds in order to expedite management beyond observation and to minimize the rate of missed injury. A problem has been establishing RBC and WBC counts that are appropriate in penetrating injuries and minimizing the number of missed injuries. Gonzalez et al.^[10] found that patients with RBC counts between 10,000 and 100,000 were as likely to undergo therapeutic laparotomy as those with counts greater than 100,000. However, their study demonstrated that eight patients with RBC counts greater than 1000 who were admitted for observation developed positive physical findings that required exploratory laparotomy; four of them had a delayed laparotomy. This study demonstrated that three of four patients with WBC count greater than 500 had therapeutic laparotomies.

Laparoscopy has been described as an adjunct to these techniques and its use has been described in different settings. Its use to evaluate occult diaphragmatic injuries in left lower chest penetrating trauma is well established.^[11] Zantut et al.,^[10] in a multicenter study with over 500 patients, avoided non-therapeutic exploration in 54.3% of cases. This study found a role for laparoscopy in patients with abdominal penetrating trauma who were hemodynamically stable. In a subgroup of highly selected patients, therapeutic laparoscopy was performed successfully.

The use of laparoscopy and DPL in penetrating abdominal trauma has been described in one previous study. DeMaria et al.^[11] studied the complementary roles of laparoscopic abdominal exploration and DPL in stab wounds to the abdomen. They avoided non-therapeutic exploration in 55% of 31 patients and found that the DPL was positive in 11 of 12 patients who were found to have injuries that required surgical intervention.

The development of LELA was based on our need to have a procedure that could safely rule out hollow viscus injuries and at the same time decrease the length of stay of patients that are usually admitted for 24- or 36-hour observation periods. The decision to use counts of 5000/mm³ RBC and 150/mm³ WBC was based on the reasoning that these numbers could be decreased compared to other studies since an exploratory laparoscopy was being performed on each patient and both the sensitivity and specificity

would be increased because the procedure would provide an extra layer of safety for the patient. In addition, the RBC count is sometimes misleading, especially in upper quadrant stab wounds, where a hepatic or splenic injury could be present, but routine exploration in these patients would yield non-therapeutic results.

Patients with AASW underwent a local wound exploration in the emergency department and if anterior fascia penetration was present or was unequivocal, a diagnostic laparoscopy was performed to evaluate for peritoneal penetration. Peritoneal penetration was an indication for LELA. Once penetration had been confirmed, a lavage via the laparoscope was performed and the fluid was sent to the laboratory. While awaiting the lavage results, a laparoscopic exploration was performed and this consisted of evaluating the small bowel from the ligament of Treitz to the ileocolic region. In addition, if necessary, evaluation of the colon was performed by mobilizing the lateral peritoneal attachments. Once the results of the lavage were known, the decision to perform a hand-assisted procedure or exploratory laparotomy was reached. The use of this approach simplifies the management of these patients because the surgeon has three alternatives: First, patients with a positive lavage and exploration undergo a laparotomy; second, patients with a positive or borderline lavage but a negative exploration undergo hand-assisted surgery to visualize the small bowel outside the peritoneal cavity; and third, patients with a positive exploration and a negative or borderline lavage undergo a laparotomy.

In summary, even though our series consisted of a small number of patients, LELA shows a promising role for ruling out hollow viscus injury in patients with AASWs. A multicenter study should be considered to explore this technique, which could

decrease the number of non-therapeutic laparotomies, length of stay and hospital costs without increasing the incidence of morbidity due to missed abdominal injuries.

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