Evidence-based assignment of diagnostic peritoneal lavage (DPL) sensitivity in penetrating abdominal trauma

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Abstract

Background: There are a large number of patients with penetrating abdominal trauma who have normal vital signs and negative abdominal examination when referred to trauma centers. A great deal of controversy exists between authorities about screening these patients for emergency explorative laparotomy. Many references have reported more than 90% sensitivity for DPL as a diagnostic method to determine whether intraabdominal injuries were present and emergent laparotomy is indicated or not. This study is for reassignment of this sensitivity according to our own evidence.

Methods: All of the patients with abdominal stab wounds and normal vital signs plus negative abdominal examination who were referred to Shohada-e-Tajrish hospital between March 2004 to December 2005, underwent local wound exploration and those confirmed to have peritoneal penetration, underwent emergency laparotomy. In the operating room and prior to surgery, under general anesthesia, DPL was performed. Then DPL results were compared with laparotomy findings and DPL sensitivity was assigned.

Results: Of the total number of 34 patients, 8 had a positive DPL and positive laparotomy; 2 had a positive DPL and negative laparotomy; 8 had negative DPL and positive laparotomy, and 16 patients had negative DPL and negative laparotomy.

Conclusion: According to our study, DPL sensitivity is much less than mentioned in trauma texts (approximately 50%). So, it is not a valuable tool to discriminate between operative and conservative approaches in penetrating abdominal trauma. We suggest more sensitive modalities. Laparotomy is the most sensitive approach but at the price of a high negative laparotomy rate.

Keywords: penetrating abdominal trauma, diagnostic peritoneal lavage, laparotomy, stab wound.
emergent laparotomy is life saving in penetrat-
ing abdominal trauma. Exsanguination, sepsis
and multiorgan failure (MOF) are the principal
preventable causes of death in cases of delayed
laparotomy. Intraabdominal injuries often-but
not always-manifest as vital sign instability or
signs of peritoneal irritation [6].

In hemodynamically stable patients who
have normal abdominal examination, the sur-
geon has an opportunity for further evaluations
to minimize negative laparotomies [8].

Stab wounds almost always are caused by
knives. In 1/3 of cases, the stab does not pene-
trate the peritoneal cavity and just in half of
peritoneal penetrations, surgical intervention is
inevitable [1].

Initial evaluation in penetrating abdominal
trauma after primary resuscitation includes an
exact history taking and precise physical exam-
ination.

Important points in history comprise: injury
time, trauma mechanism and site, amount of
bleeding at the scene, time of the last food in-
take, past medical and drug history, history of
simultaneous blunt or penetrating trauma, etc [12].

Critical points in physical examination in-
clude: vital sign evaluation, presence or ab-
sence of evisceration or peritoneal irritation
signs, thoracic examination, digital rectal ex-
amination and NG tube and Foley catheter in-
sertion [17].

Localized abdominal tenderness at the trau-
ma site can be due to abdominal wall injury,
while distant rebound tenderness is an evidence
of intraabdominal visceral injury [9].

Patients with abdominal gunshot or gunshot
injury; and stab wound cases with initial vital
sign instability, evisceration, signs of general-
ized peritoneal irritation and presence of blood
or bloody fluid on rectal exam, NG tube or Fo-
ley catheter (all equal peritonitis), should un-
dergo emergency laparotomy without any fur-
ther diagnostic procedures [1].

Patients with abdominal stab wound who
have normal vital signs and physical examina-
tion at the beginning, undergo wound explo-
ration at the emergency department [1-4,7].
Under local anesthesia, the stab wound is ex-
plored. If the anterior rectus sheath is not pene-
trated, the patient is discharged after wound clo-
sure [1-4,7]. But if it has been penetrated, there
are two available options: Exploratory laparo-
tomy [4], and diagnostic peritoneal lavage [2-
4,11].

In abdominal stab wounds, at least 50% of
peritoneal penetrations are not accompanied by
intraabdominal injury [1]. Therefore, to mini-
mize negative laparotomy, some authors prefer
DPL to distinguish intraabdominal injury [2,3].

In the open technique of DPL, under local
anesthesia, a 3-5cm midline incision is made
just below the umbilical ring and the peri-
toneum is opened under direct vision.

Then, a catheter (eg. Nelaton urinary catheter)
is inserted in the pelvic cavity and aspiration is
performed. If at least 10cc of blood is with-
drawn, DPL is considered grossly positive and
discontinued. Otherwise, 1 liter of N/S or
Ringers solution is instilled intraperitoneally
and at least 600cc is drawn back and sent for
laboratory analysis. In any of the following
conditions, the DPL result is considered posi-
tive [2-5,13-15]:

RBC count >10000/dl in lower thoracic trau-
ma (from nipples to costal margins).

RBC count >100000/dl in anterior abdomi-
nal trauma (between costal margins, posterior
axillary lines and groin).

Amylase >20 IU/dl and alkaline phosphatase
>3 IU/dl [16].

Grossly visible food, bile, stool and urine.

In the presence of positive DPL results, the
patient is prepared for emergency laparotomy
[2-4,18]. Otherwise, the patient is discharged
after IV antibiotic therapy.

Methods
In this study, any patient with lower thoracic
or anterior abdominal stab wound who was re-
ferred to Shohada-e-Tajrish Hospital from March 2004 to December 2005, whose initial vital signs and physical examination was normal, underwent local wound exploration. All cases of peritoneal penetration were selected for emergency laparotomy; but in the operating room under general anesthesia, a DPL was performed before laparotomy.

DPL results were compared with laparotomy findings.

In most references, more than 95% sensitivity is mentioned for DPL in distinguishing intraabdominal injury [2-4].

34 patients were studied with initial normal vital signs and negative abdominal examination plus absence of bloody contents in rectal exam, NG tube and Foley catheter.

The patient average age was 28.1 years.

2 cases (5.8%) were stabbed in the lower thoracic area, and the rest were injured in the anterior abdominal region.

On the average, every patient had received 1.5 knife stabs but just 2 patients had more than one abdominal stab wound (meaning that the second one clashed the extremities).

The average time from trauma occurring to hospital arrival was 120 minutes.

**Results**

Of the total 34 patients, in 10 cases (29.4%), DPL was positive and in 16 cases (47.07%), intraabdominal injury was found during laparotomy.

DPL positive + laparotomy positive = 8 cases
DPL positive + laparotomy negative = 2 cases
DPL negative + laparotomy positive = 8 cases
DPL negative + laparotomy negative = 16 cases
DPL sensitivity = \( \frac{a}{a+c} = 50\% \).
DPL specificity = \( \frac{d}{b+d} = 88.8\% \).

Table 1. Results of DPL & laparotomy in the total 34 patients.

<table>
<thead>
<tr>
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<th>Laparotomy positive</th>
<th>Laparotomy negative</th>
<th>Total DPL</th>
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<tbody>
<tr>
<td>DPL positive</td>
<td>8(a)</td>
<td>2(b)</td>
<td>10</td>
</tr>
<tr>
<td>DPL negative</td>
<td>8(c)</td>
<td>16(d)</td>
<td>24</td>
</tr>
<tr>
<td>Total laparotomy</td>
<td>16</td>
<td>18</td>
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DPL positive predictive value = \( \frac{a}{a+b} = 80\% \).
DPL negative predictive value = \( \frac{d}{c+d} = 66.6\% \).

Among 34 patients with peritoneal penetration by stab, intraabdominal injury was found in just 16 (47.7%). Of these 16 patients, in 8 cases (50%), the DPL result was negative. This means that a negative DPL can not rule out intraabdominal injuries.

12 out of these 16 cases, had single organ injury. In all 4 cases with dual organ injury, the diaphragm was one of the damaged organs and in 3 of these 4, DPL was negative.

No kidney and urinary tract, pancreas and gall bladder injury were found.

5 cases of splenic injury were found but splenectomy was not indicated in any of them.

3 cases of small intestinal injury were found and DPL was negative in all of them.

In 1 case, a severe colon perforation was found in whom DPL was also negative (!).

Overall, 20% of patients with positive DPL result could be managed conservatively (as compared with 53% of negative laparotomy rate when DPL was not done); If laparotomy was performed only when DPL was positive, at the price of decreasing negative laparotomy rates, 8 cases with intraabdominal injury (50% of the injuries) would have been missed, which is not acceptable at all.

**Conclusion**

DPL negative result (with aforementioned criteria) can not rule out intraabdominal injury.

DPL sensitivity (with aforementioned criteria) is much less than the reported figures in surgical textbooks (50% versus 95%).

The most important portion of DPL fluid analysis is RBC count (in none of 16 cases with
intraabdominal injury was an RBC count < 1000/dl found).

We can increase DPL sensitivity by decreasing RBC count threshold to consider DPL result as positive; but at the price of a high negative laparotomy rate.

To determine a more precise RBC count threshold that can minimize the negative laparotomy rate, further studies with higher patient numbers are recommended.

References