

DETECTION OF INTRA-ABDOMINAL INJURY IN TRAUMA PATIENTS: OUR EXPERIENCE WITH DIAGNOSTIC PERITONEAL LAVAGE

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Abstract- Diagnostic peritoneal lavage (DPL) is considered by many as the most important investigation for the early detection of intraperitoneal injury. The aim of this study is to assess the accuracy of DPL as a diagnostic method in evaluating abdominal trauma. A prospectively maintained database of all DPLs performed in the past 36 months at Sina Hospital was analyzed. Information relative to the type of injury, indication for DPL, DPL and laparotomy results were analyzed in order to evaluate the accuracy, sensitivity and specificity of DPL. Over a 36-month period, 111 (13.9%) DPLs were performed for 800 patients with abdominal trauma at Sina Hospital. Fifty-five (49.5%) patients had negative and 56 (50.5%) patients had positive DPL. Among negative results, laparotomies were performed for 5 (9.1%) patients. Among positive results, 47 patients had organ injuries at laparotomy and 6 (11.3%) did not have any organ injuries (false positive). The overall accuracy, sensitivity and specificity of DPL were 87%, 90% and 85%, respectively, that were comparable to the other reports ($p < 0.05$). DPL correctly identified the presence or absence of organ injuries in 87% of the patients (positive predictive value = 84%, negative predictive value = 91%).

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Key words: Diagnostic peritoneal lavage, abdominal trauma, intestinal injury, solid organ injury

INTRODUCTION

Trauma is the main cause of death within the first four decades of life and is often associated with permanent disability (1-3). The diagnosis of significant intra-abdominal injury is one of the most difficult problems in the management of trauma (1,4,5). Failure to recognize and treat occult hemorrhage is a common mistake. The clinical history and physical examination alone are often unreliable, as nearly half the patients may have no complaints or external signs of abdominal injury on admission to hospital (5,6). Rapid assessment and

appropriate treatment of potentially life-threatening conditions is therefore essential. The optimal method of evaluating abdominal trauma remains controversial. A combination of a sensitive screening test and a specific test, may be a safe and efficient approach to it.

In many trauma centers in Iran, there are difficulties in access to modern ultrasound and computed tomography scanning equipment (CT scan) for evaluation of trauma patients, especially unstable cases.

Diagnostic peritoneal lavage (DPL) is considered by many as a rapid means of assessment, and the most important investigation for the early detection of intraperitoneal injury, which is fortunately not dependent on the operator (3,6). This study aims to assess the efficiency of DPL as a diagnostic method in evaluating abdominal trauma patients in Sina Hospital.

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MATERIALS AND METHODS

Between 1999 and 2000, 800 patients with abdominal trauma were admitted to Sina Hospital, a teaching hospital of Tehran University of Medical Sciences. Indications for DPL were one of the following: 1) shock or unexplained hypotension on admission; 2) equivocal physical examination; 3) penetrating abdominal wound; 4) head injury with altered mental status (GCS<9). DPL was indicated in 111 patients. DPL was performed by four second year residents of general surgery, under supervision of their chief residents. Patient characteristics (age, gender and type of trauma, indication for DPL, results of DPL and laparotomy) were gathered in questionnaires and analyzed by SPSS. DPL was considered positive if one of the following criteria was met: 1) aspiration of more than 10 ml of gross blood; 2) red blood cell count of 100.000/mm³ or greater; 3) white blood cell count of 500/mm³ or greater; 4) Gram's stain positive for bacteria; 5) the presence of bile, fecal and food matter. Laparotomy was performed for patients with positive DPL, except in three patients who had borderline DPL result with stable vital signs and without any evidence of peritoneal irritation. The attending surgeon decided to observe them and they were discharged from the hospital without any problems. The patients with negative DPL were observed and followed during their hospital stay. Sensitivity was defined as the ability of DPL to detect an injury if present, and was calculated by dividing the number of true positive DPLs by the number of positive laparotomies. Specificity was defined as the ability of DPL to rule out an injury if none existed, and was calculated by dividing the number of true negative DPLs by the number of patients without injury. Finally, the accuracy of the DPL was determined by dividing the sum of true positive and true negative DPLs by the total numbers of DPLs performed. Student t-test and Chi-square analysis were used to analyze continuous and categorical variables, respectively. A P-value<0.05 was considered significant.

RESULTS

Over a period of 36 months, 111 (13.9%) DPLs were performed for 800 patients with abdominal

trauma at Sina Hospital. There were 95 (86%) males and 16 (14%) females with an average age of 32 ± 13 years. (range = 9-64 years). Table 1 outlines the indications for DPL.

Fifty-two (47%) patients were victims of blunt abdominal trauma, 19 (17%) patients had penetrating abdominal trauma and 40 (36%) patients had sustained multiple traumas. Figure 1 outlines the results of DPLs.

Fifty-six (50.5%) patients had positive DPLs, among them 53 underwent laparotomy. Forty-seven had intra-abdominal injury (true positive) and in 6 patients no traumatic injury was discovered at laparotomy (false positive). Three patients with positive DPL were observed and they were discharged from the hospital without any problems (false positive).

The intra-abdominal injuries of the 47 patients with true positive DPL are shown in table 2.

Fifty-five (49.5%) patients had negative DPLs, among them 50 patients were observed and followed during their stay in the hospital and discharged without any general surgical problems (true negative).

Five patients with negative DPLs underwent laparotomy due to clinical deterioration and they proved to have traumatic organ injuries (false negative, table 3).

Table 1. Indications for DPL

Indication	Frequency (%)
Equivocal physical examination	39 (35.14)
Shock or unexplained hypotension	36 (32.43)
Penetrating abdominal wound	19 (17.12)
Altered mental status	17 (15.31)
Total	111 (100)

Table 2. Frequency of 102 organ injury in 47 patients with true positive DPL

Injury	Frequency (%)
Spleen	27 (26.5)
Mesentery	16 (15.7)
Liver	14 (13.7)
Colon	13 (12.7)
Small intestine	10 (9.8)
Pancreas	4 (3.9)
Diaphragm	4 (3.9)
Stomach	2 (2)
Others	12 (11.8)
Total	102 (100)

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Table 3. DPL results and abdominal injury in patients with false negative DPL (n=5)

Abdominal Injury	DPL Results		
	RBC	WBC	Other criteria
Bladder (intraperitoneal rupture)	15000	400	-
Colon (perforation 1×1 cm)	1100	100	-
Diaphragm (rupture) and spleen (capsule tears)	25000	360	-
Diaphragm (rupture) and spleen (capsule tears)	60,000	490	-
Mesentery	1000	320	-

Table 4. Sensitivity and specificity of DPL

	Gold Standard*	
	(+)	(-)
DPL (+)	47	9
DPL (-)	5	50

Sensitivity=0.90 (CI: 0.79-0.96)

Specificity=0.85 (CI: 0.74-0.92)

Positive Predictive Value of DPL= 0.84 (CI: 0.79-0.96)**

Negative Predictive Value of DPL= 0.91 (CI: 0.79-0.96)

Accuracy=87%

*Gold standard (+)= Presence of organ injuries in laparotomy
Gold standard (-)= Discharge from hospital without abdominal operation or absence of any organ injuries at laparotomy

**The numbers in the parentheses are 95% Confidence Interval.

DISCUSSION

Since initial physical examination can be misleading in up to 45% of trauma patients, especially when the abdominal examination is unreliable due to altered sensorium, or when the examination is equivocal, and also in patients admitted with shock or unexplained hypotension, diagnostic methods can rule out intraperitoneal injury. Compared with diagnostic methods such as ultrasonography and abdominal CT scan, DPL can be done quickly at the bedside and is therefore useful for excluding abdominal injuries in centers in which CT scan or sonography are unavailable, and especially

for unstable patients. It is considered a positive test for hemoperitoneum when there is grossly 10 ml blood on aspiration in DPL. The RBC count 100,000/mm³ or greater on the effluent is also considered positive. Other criteria for a positive test include the WBC count of 500/mm³ or greater, presence of bile, bacteria, food or fecal matter (1). Using the above criteria, our accuracy, sensitivity and specificity are comparable to the other reported values (87% versus 98%) and (90% versus 95%) and (85% versus 99%, respectively), (1). DPL correctly identified the presence or absence of intra-abdominal injury in 87% of the patients with positive predictive value (PPV) of 84% and negative predictive value (NPV) of 91% (table 4). In conclusion, DPL is a safe procedure with a high sensitivity, specificity and accuracy in the evaluation of all types of abdominal trauma.

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