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DIAGNOSTIC PERITONEAL LAVAGE IN THE EVALUATION OF ABDOMINAL TRAUMA USING THE DIPSTICK
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ABSTRACT

Objective: **To determine the accuracy and sensitivity of diagnostic peritoneal lavage in the assessment of intra-abdominal injury using the dipstick method.**
Design: **Prospective study, involving the performance of diagnostic peritoneal lavage in the out patient department and surgical wards prior to surgical intervention.**
Setting: **Kenyatta National Hospital-General Surgical and Orthopaedic wards and out-patient department. The study was conducted over a duration of six months, starting from January 1995 to July 1995.**
Results: **Ninety six patients with penetrating(68) and blunt(28) abdominal trauma underwent diagnostic peritoneal lavage as evaluation of the severity of abdominal trauma. Dipstick (combur 9 strips) was used to evaluate lavage effluent for red blood cells, white blood cells, protein and bilirubin. Forty three patients had positive diagnostic peritoneal lavage (DPL) results, of which 40 (93%) had positive findings at laparatomy and three (7%) had negative findings at laparatomy. The remaining 53 patients had negative DPL results and were managed conservatively. One patient with a negative DPL result became symptomatic and had a positive laparatomy. Conservatively managed patients were discharged after 24 hours observations without any complications. DPL had an accuracy and sensitivity of 93% and specificity of 98%.**
Conclusion: **Diagnostic peritoneal lavage is a cheap, safe and reliable method for assessment of abdominal trauma. The method is easy to perform by trained junior doctors in the OPD, or as a bedside procedure. Use of this method reduced negative laparotomy rate from 50% to 6.9% and average duration of stay from 6.5 days to 1.9 days. This method is recommended as a basic tool in the assessment of abdominal trauma patients.**

INTRODUCTION

Prior to 1960 most abdominal trauma was managed by laparotomy. As a result there was a high negative laparotomy rate, as high as 63% in some series(1). Kibosia reported a negative laparotomy rate of 50% in stab wound patients at the Kenyatta National Hospital(2). Introduction of selective management for abdominal trauma by Shaftan in 1960, resulted in reduction of negative laparotomy rate from 63% to 30%(1). At Kenyatta National Hospital, Kibosia reduced the negative rate to 26%(2). Selective management relies on continuous monitoring and examination for signs of peritonitis, abdominal distension or haemodynamic instability. Despite the doctrine of selective management, the rate of negative laparotomy was still high at more that 25%.

Evaluation of the severity of abdominal trauma in the absence of modern imaging techniques is usually difficult and inaccurate. Physical examination alone is often inadequate for abdominal evaluation of the multiple injured patient, especially when associated with alcohol or drug intoxication(3). Bull and Mathewson found that 23% of 78 patients had significant intra-abdominal injury confirmed at laparotomy but no significant physical findings pre-operatively, while 18% of 100 patients with possible penetrating injury had negative findings at laparotomy despite physical examination findings suggestive of visceral injury(4). Abdominal trauma therefore can be difficult to diagnose and assess accurately based on clinical findings alone. Diagnostic peritoneal lavage using urinary dipstick has been shown to have an accuracy of 95% to 100% and a specificity of 91% to 99%(5-9). This has resulted in reduction of negative laparotomy to less than 5%(10) and has few complications, which are not associated with any mortality in most studies. The complication rate is between 2.2% and 4.8%(1) The technique is performed using minimal equipment (i. e. cut-down or mini-laparotomy set). It is relatively easy to perform and can be done in the out-patient department by a trained junior doctor (11,12). DPL is a rapid, safe and accurate method of diagnosing intra-abdominal injury(13). In this study use of DPL, resulted in a reduction of negative laparotomy rate to 6.9% and average duration of hospital stay to 1.9 days respectively.

MATERIALS AND METHODS

Ninety six patients with abdominal trauma were recruited in the study. The inclusion criteria were abdominal trauma patients over the age of 13 years; haemodynamically stable patients and patients who gave informed consent

Patients with previous abdominal surgery, gunshot injury, evidence of bowel perforation on abdominal X-ray, peritonitis and bowel evisceration were excluded from the study. Clinical examination was conducted and the findings recorded. Presence and severity associated injuries was also recorded.

Modified Perrys procedure was used to perform DPL(11). A naso-gastric tube was inserted and the urinary bladder decompressed by catheterisation. A mid-line point, infra-umbilical and 1/3 of the distance between the symphysis pubis and umbilicus was selected. The skin of the lower abdomen was cleaned and draped with sterile towels. 15 to 20 mls of 2% lignocaine were infiltrated at the selected site down to the peritoneum. The latter was opened under direct vision. If more than 10mls of blood were aspirated at this stage, immediate laparotomy was performed. A sterile foleys catheter was introduced into the abdominal cavity and connected to a giving set. One litre(15 mls/kg body wt) of warm normal saline was rapidly infused into the abdominal cavity for about 10 minutes, while the patient was moved from side to side and in reverse trendelenburg position. The lavage fluid was then siphoned off and evaluated using a dipstick. The results were interpreted using the following criteria:-

Positive DPL

(i) >10mls of blood aspirated from the abdomen immediately on opening the peritoneum.
(ii) Red blood cell count of >100,000 cells/ml in penetrating abdominal trauma and >50,000 cells/ml in blunt abdominal trauma.
(iii) White blood cell count of >500 cells/ml
(iv) Total protein content of > 1gm/l
(v) Presence of bilirubin

Negative DPL

(i) Red blood cell count of >50,000 cells/ml in penetrating abdominal trauma and <25,000 cells/ml in blunt trauma
(ii) White blood cell count of >100 cells/ml
(iii) Total protein content of <0.5 gm/l

Equivocal DPL

(i) Rbc count >50,000 and <100,000 cells/ml in penetrating abdominal trauma and >25,000 and <50,000 in blunt trauma
(ii) Wbc count >100 and <500 cells/ml
(iii) Protein content >0.5 gm/l and >1gm/l

Patients with any one positive criteria underwent laparotomy. Those with equivocal results were re-assessed clinically two hours later and DPL repeated if indicated. All patients with negative results were observed and if stable discharged after 24 hours. Findings at laparotomy were recorded. Any complications associated with DPL and their management were also recorded. The average hospital stay was also noted.

RESULTS

Out of the 96 patients selected in the study, 28 had blunt abdominal trauma and 68 had penetrating abdominal trauma. Of these 89 were male and seven were female (Table 1). Their ages ranged from 17 to 56 years of age, with a mean age of 24 years for penetrating abdominal trauma and 29 years for blunt trauma (Table 2). Assault was found to be the leading cause of abdominal trauma, amounting to 73% of all cases. Road traffic accidents(RTAs) and falls from a height contributed 24% and 3% respectively (Table 3). The majority (97%) of penetrating trauma cases were due to stabs with knives. Most blunt abdominal traumas were as a result of RTAs.

Table 1

Distribution of abdominal injuries in the different sexes

Sex	Penetrating abdominal trauma(%)	Blunt abdominal trauma(%)	Total
Male	64(93)	25(89.3)	89
Female	4(7)	3(10.7)	7
Total	68(100)	28(100)	

Table 2

Frequency distribution of age in patients with abdominal trauma

Age(years)	Penetrating abdominal trauma(%)	Blunt abdominal trauma(%)
10-19	9(13)	5(18)
20-29	44(65)	8(28.5)
30-39	12(17.5)	12(43)
40-49	3(4.5)	3(5)
Total	68(100)	28(100)

Table 3

Cause of abdominal injury

Cause of injury	No.	%
Assault	70	73
Road traffic accidents	23	24
Fall from a height	3	3
Total	96	100

Thirty five point four percent of the patients presented with features of peritoneal irritation, 30.2% had correctable shock and 30% presented with haemorrhage from wounds. Three point one per cent had associated head injuries. Other injuries associated with abdominal trauma were thoracic injuries (5.2%) orthopaedic injuries (3.1%). Most extra-abdominal injuries were seen in conjunction with blunt abdominal trauma. Although many patients presented with multiple extra-abdominal injuries, only the dominant injury is considered above (Figure 1). Forty three patients had positive DPL results, of which 40(93%) had positive laparotomy and three(7%) had negative laparotomy results (Table 4).

Fifty three patients had negative DPL results, of whom one later developed overt peritonitis and was re-explored. The average duration of hospital stay for patients who were managed conservatively following negative DPL was 1.9 days as compared to 6.5 days for patients who had negative mandatory laparotomy (Table 5).

Table 4

Results of DPL and laparotomy

	Positive Laparotomy(%)	Negative Laparotomy(%)	Total
Positive DPL	40(93)	3(7)	43
Negative DPL	1	0	1
Total	41	3	44

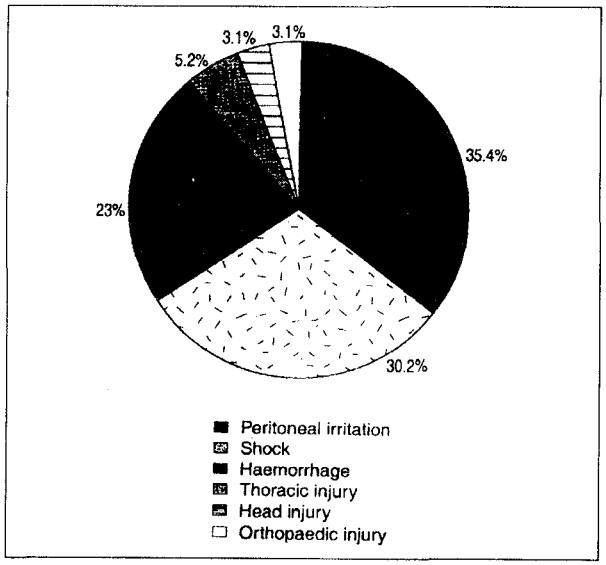
Table 5

Duration of hospital stay following DPL, Laparotomy and conservative management

Management method	Mean hospital stay (days)
Negative DPL	1.9
Laparotomy without significant injury (Negative Laparotomy)	6.5
Laparotomy with injury	12
Selective conservative management	2.9

Figure 1

Clinical presentation



COMPLICATIONS

Two patients had minor mesenteric vessel injuries and one had a serosal tear of small bowel following DPL. This represented a 3. 1% complication rate. None of these complications were significant.

DISCUSSION

Diagnostic peritoneal lavage using the open method was used to assess 96 abdominal trauma patients. Lavage fluid was analysed using urinary dipstick (combur 9). This method was found to have an accuracy and a sensitivity of 93%, which compares favourably with studies done elsewhere. In our study the negative laparotomy rate, currently standing at 26-50%, was reduced to 6.9%, which also resulted in reduction of hospitalisation from 6.5 days to 1.9 days. Utilisation of DPL, would reduce the cost of hospitalising an abdominal trauma patient from an average of US$ 97.00 to US$15.00. The method is relatively safe with a complication rate of 3.1%. There were no fatalities associated with DPL in our study.

Trauma is the most common cause of sudden death among young adults and children. It is the third commonest cause of death in all ages(14). In Kenyatta National Hospital, it accounts for the most frequent indication for admission into the general surgical and orthopaedic wards(15). Isolated abdominal trauma does not usually kill, but abdominal injuries contribute to 25% of death from multiple trauma. Blunt abdominal trauma, especially where associated with cranio-cerebral injury, has a mortality of 20%(16,17) Accurate clinical assessment of intra-abdominal injury is difficult and often associated with a high negative laparotomy rate of over 25%(1,2). At Kenyatta National Hospital, negative laparotomy for abdominal trauma is between 26% and 50%(2). This has resulted in a high morbidity rate and increased duration of hospital stay, averaging 12 days after positive laparotomy and 6.5 days after negative laparotomy. Patients with negative DPL, results stayed in hospital for an average of 1.9 days as compared to 6.5 days for patients who were managed by mandatory laparotomy.

Diagnostic peritoneal lavage (DPL) has emerged as an invaluable tool in the management of abdominal trauma, especially in polytrauma patients (18,19). Patients with equivocal physical signs, intoxicated patients and polytrauma patients especially those with head injury are best assessed by DPL. Combination of DPL with clinical signs improves diagnostic accuracy and reduces the number of negative laparotomies to less than 5%(10).

The equipment required for the procedure is minimal (a cut down or mini-laparotomy kit)(11,12) and sophisticated laboratory assessment of lavage fluid is not necessary. DPL using the dip stick method is a rapid, safe and accurate method of diagnosing intra-abdominal injury. DPL however, has shortcomings and gives poor results in retroperitoneal injuries where it will miss 50% of retroperitoneal haematomas when the retroperitoneum is intact(13). The method is also unreliable in detecting diaphragmatic injuries (19,20). Baron *et al.* (20) suggested that where available, CT scan and DPL are complimentary and that DPL was an effective screening tool. In such cases, CT scan was used as a reserve tool for stable patients with positive DPL, to specify the organs injured(22).

Most studies seem to suggest that DPL is more accurate, specific and sensitive and has fewer complications than CT scan. Meyer *et al.* (21) reviewed 60 children with blunt abdominal trauma. CT scan using both oral and IV contrast was performed before DPL. Positive results were confirmed by operation in 18 patients. CT scan had sensitivity of 67% while DPL had sensitivity of 94%. Both methods had 100% specificity, but DPL had an accuracy of 98%, as compared to 89% for CT scan. The authors concluded that DPL was more advantageous than CT scan as an initial screening study in evaluating children with blunt abdominal trauma(22). DPL also compares favourably with ultrasonography in the evaluation of abdominal trauma. In a prospective study comparing DPL, CT scan, and US Liv *et al.* (22) reported an accuracy of 94.5%, 92.7% and 96.4% for DPL, US and CT scan respectively. Specificity and sensitivity were 84.2% and 100% for DPL, 94.7% and 97.2% for ultrasound. Ultrasonography was found to miss isolated small intestinal perforations. The authors recommended the use of the three modalities for evaluation of abdominal trauma patients with equivocal clinical findings(23). McKenney in 1994 found that US had a specificity of 100%, sensitivity of 83% and an accuracy of 97%. This compares well with figures for CT scan and DPL. He suggested that US might be used in place of CT scan and DPL, in assessing blunt in abdominal trauma(24). our set up unfortunately, little experience in acute ultrasonograpy and CT scanning is available for acute emergencies. DPL, using the dip stick method is cheap, accurate, safe and easy to perform. It can be done in the out patient department with minimal staff or as a bedside procedure in the ward. DPL using the dip stick method should be part of the standard protocol for management of abdominal trauma. This would reduce morbidity and mortality and the cost of management of abdominal trauma patients. Currently the cost of managing surgical patients at Kenyatta National Hospital is US$8.00 per day(25). The current methods of assessing abdominal trauma patients is associated with an average hospital stay of 12 days at an average cost of US$97.00 per hospitalisation. This would reduce to US$15.00 for patients assessed by DPL, who on average are hospitalised for 1.9 days. It is therefore recommended that diagnostic peritoneal lavage using the dip stick method be adopted as a basic diagnostic tool for evaluation of both blunt and penetrating abdominal trauma.

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