Use of urethral catheters for diagnostic peritoneal lavage in blunt abdominal trauma.

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Background:
Diagnostic peritoneal lavage (DPL) has been reported to be a reliable diagnostic tool in assessing the need for laparotomy in blunt abdominal trauma (BAT) with a diagnostic accuracy of more than 95% when using a peritoneal lavage catheter (PLC). The aim of this study was to determine the diagnostic accuracy of the procedure when small urethral catheters are used as an alternative to the PLC.

Methods:
Open diagnostic peritoneal lavage was performed in 115 patients with blunt abdominal trauma in whom clinical assessment for intra-abdominal injury was uninformative. Two-way silicon-coated rubber Foley urethral catheters size 12Fr were used as substitutes for peritoneal lavage catheter. Peritoneal effluent fluid was analysed both macroscopically and by the laboratory estimation of the white and red blood cell counts and amylase levels.

Results
: A total of 27 Patients (23.5%) had positive DPL results while three (2.6%) had clinically doubtful equivocal DPL results. Both groups were subjected to exploratory laparotomy. The rest of cases (73.9%) improved on non-operative (conservative) management. The diagnostic accuracy was 97.6% for macroscopic and 99.1% for laboratory assessment. There were no complications attributed to DPL. There was a significant association between the DPL results and the laparotomy findings ($p=0.000$). Macroscopic assessment of DPL results was also found to be a reliable diagnostic method in blunt abdominal trauma ($p<0.001$).

Conclusion
: In emergency situations, small urethral catheters size 12Fr are a useful and safe alternative to peritoneal lavage catheters as diagnostic tools in blunt abdominal trauma.

Introduction
Diagnostic peritoneal lavage (DPL) has been used in blunt abdominal trauma (BAT) since Root[1] in the USA first introduced it in 1965. It reliably indicates the need for emergency exploratory laparotomy in BAT victims[1-9]. Clinical assessments in BAT are limited especially in the unconscious and multiply injured patients who cannot localize pain[5,6,7,8,10]. DPL is also superior to the four-quadrant peritoneal tap and minimizes the need for non-therapeutic laparotomy (NTL) in blunt abdominal trauma[2,4]. In situations where radiological diagnostic facilities such as ultrasonography or computed tomography are not available, DPL is a useful tool in BAT as it easily detects a haemoperitoneum, the usual sequel of blunt

abdominal trauma[8].

In Mulago Hospital, DPL was not used until it was introduced in 1999[10]. In previous reports, DPL was performed using peritoneal lavage catheters[1-19]. These catheters are expensive and not available in our hospital. Thus, apart from the clinical evaluation, the only available alternative to DPL in Mulago Hospital has been the old diagnostic method of peritoneal four-quadrant tap. From the literature, alternatives to peritoneal lavage catheter include small Foley urethral catheter[6], intravenous cannula[16] and ordinary infusion set with extra holes made near its end[17]. In this study we present our experience with use a Foley urethral catheter in diagnostic peritoneal lavage in Mulago Hospital in Kampala, Uganda.

Patients and methods

The study was undertaken in the Accident and Emergency (A&E) Unit at Mulago Hospital In Kampala over a seven-month period from July 2000 to January 2001 inclusive.. The study was a prospective study designed to determine the effectiveness of small Foley urethral catheters as substitutes for peritoneal lavage (PLC) in diagnostic peritoneal lavage (DPL) in blunt abdominal trauma (BAT). The study population included 115 victims of BAT with clinically indeterminate intra-abdominal injury, who were clinically difficult to assess either because of altered level of consciousness or due to multiple injuries were unable to localize pain. All patients with clinically obvious BAT had immediate laparotomy and therefore were excluded from the study.

Data was collected using a pre-tested coded questionnaire. The performance of DPL in this study was calculated by comparing the DPL and laparotomy findings and the outcome of the patients who were managed conservatively with clinical observation. Patients with clinically suspicious BAT were identified and resuscitated in the Accident and Emergency Unit (A&E Unit). Each patient had a nasogastric tube and a urethral catheter inserted and where indicated an under-water seal drainage system was established in cases of associated chest trauma.

To minimize risks of visceral injury, open technique of DPL was done in all the 115 patients. Before the procedure, the patients were sedated with parenteral diazepam. Under aseptic technique, 1% lignocaine with adrenaline 1:100,000 were infiltrated into the anterior abdominal wall, in the midline 3cm below the umbilicus. A 3cm long sub-umbilical incision was made through the skin and subcutaneous tissues. A supra-umbilical incision was used in patients with fractured pelvis. Haemostasis was achieved before incising the Linea Alba to expose the extra peritoneal fat. When necessary, further infiltration of the peritoneum with the local anaesthetic was done. A 2 to 3 cm incision was made in the peritoneum. A 2/0 plain catgut purse-string suture was inserted around the peritoneal opening. A size 12 Fr silicon-coated rubber Foley urethral catheter down into the pelvis as the suture was tightened. If blood appeared in the catheter with or without aspiration with a syringe, the results were considered strongly positive. In such a situation, surgery was arranged immediately. In the absence of blood on aspiration, one litre of warm isotonic saline in adults or 15 ml/kg body weight in children was instilled through the peritoneal catheter from a routine infusion set over a period of 10 minutes. The empty body was lowered on to the floor to allow the fluid to reflux by siphoning (Gravity). About 50-90% of the lavage fluid was recovered. If the effluent was not crystal clear, an aliquot was sent to the laboratory for estimation of the white cell counts using a coulter counter machine and amylase level using the clinical chemistry auto-analyser machine. DPL results were determined using standard objective criteria that incorporated macroscopic and laboratory methods of assessing the lavage effluent. Emergency laparotomy was done in all patients with positive DPL results. If the DPL results were equivocal, the peritoneal catheter was left in situ and lavage repeated after 2 hours, and then the catheter was removed. The wound was then closed with one or two stitches of 2/0 nylon suture. If the repeated procedure was also equivocal, then the decision to operate was based on the presence of the clinical features of intra-abdominal injury during the conservative management. If the lavage effluent was crystal clear (negative DPL results), the patient was managed non-operatively (conservatively). Patients were followed up to the 30th postoperative day to monitor for the complications caused by the DPL procedure.

Results

Out of the 115 patients with brunt abdominal trauma studied, 94 (81.7%) were males and 21 (18.3%) were females (Male: Female ratio = 4.5:1). The patients' ages ranged from 6 to 56 years with a mean of 26.7 years and a peak incidence of 21-30 years. Road traffic accidents (RTA) accounted for 93 (80.9%) of the cases. All cases were dynamically stable. The physical findings per abdomen included tenderness (80.0%) and lacerations, abrasions and bruising (52.2%). The fastest DPL was performed in 6 minutes and the longest in 50 minutes. The mean duration was 31.1 minutes (standard deviation ±10.1108). However, in 99 (86.1%) of patients, the procedure was done within 40 minutes (Table1).

Table 2 shows the results of the diagnostic peritoneal lavage in the 115 patients. There were fewer patients with equivocal DPL results on laboratory examination (5.2%) than with macroscopic assessment (27.8%) (Tables 3). Macroscopic assessment of DPL identified 29 (25.2%) of patients with positive DPL, 32 (27.8%) and 54 (47.0%) with negative DPL results. Thirty patients (26.1%), 27 with positive DPL results and 3 with clinically equivocal DPL results had laparotomy done. Most of the 27 patients with positive DPL who had surgery were found to have had serious intra-abdominal injuries such as perforated small bowel, lacerated viscera and retroperitoneal haematoma. Of the 3 patients who had laparotomy for failed conservative management for equivocal DPL, two had small haemoperitoneum and retroperitoneal haematoma.

Eighty-five patients (73.9%), 82 of them with negative DPL and 3 with equivocal results, al improved on conservative (non-operative) management. The macroscopic diagnostic accuracy for DPL in this study was 97.6% as compared with 99.1% for the laboratory assessment. There were no complications directly associated with the DPL procedure.

Table 1. Duration of DPL procedure.

Duration in minutes	No. of patients (n=115)	Percentage (100%)
1-10	11	9.6
11-20	5	4.4
21-30	28	24.3
31-40	55	47.8
41-50	16	13.9

Table 2. Macroscopic assessment of DPL.

Findings	+ve DPL	-ve DPL	Equivocal	No. of patients	%age
Frank blood aspirate	11	0	0	11	9.6
Bloody lavage effluent	13	0	0	13	11.3
Pink lavage effluent -Opaque to newsprint	5	0	0	5	4.3
-Read through newsprint	0	0	32	32	27.8
Crystal clear effluent	0	0	0	54	47.0
Total	29	54	32	115	100.0

Table 3. Comparison between Macroscopic and laboratory DPL assessment.

Method of assessment	DPL Results Positive	Negative	Equivocal	Total
Macroscopy	29	54	32	115
Laboratory	27	82	6	115

Table 4. DPL results and patient management

Form of management	No. of patients	Percentage
Laparotomy for positive DPL	27	23.5
Laparotomy equivocal DPL	3	2.6
Conservative Rx for equivocal	3	2.6
Conservative Rx negative DPL	82	71.3
Total	115	100.0

Table 5. Positive DPL results and laparotomy

Operative findings at laparotomy	Number of cases
Haemoperitoneum	[illegible]
Ruptured spleen	[illegible]
Lacerated liver	4
Retro-peritoneal haematoma	4
Perforated jejunum	1
Lacerated jejunum	1
Lacerated mesentery	1
Lacerated transverse colon	1
Lacerated spleen	1
Lacerated urinary bladder	1

Table 6. Summary of Performance of DPL.

DPL parameter	DPL performance Macroscopic assessment	Laboratory Assessment
Diagnostic accuracy	97.6%	99.1%
Sensitivity	100.0%	100.0%
Specificity	96.4%	98.8%
Positive predictive value	93.1%	96.3%
Negative predictive value	100.0%	100.0%
False positive rate	0.0%	0.0%
False negative rate	0.0%	0.0%
Diagnostic error	2.4%	0.9%
pValue	p< 0.001	p= 0.000

Discussion

The ideal catheter for diagnostic peritoneal lavage (DPL) is the peritoneal lavage catheter (PLC)[1,2,3,4,5,6,8]. However, where the PLC is not available, alternatives including urethral Foley catheter[6], intravenous cannula[16] and the ordinary infusion set[17] may be used. These alternatives are cheaper and more readily available.

In this study, using a silicon-coated rubber Foley catheter size 12 Fr to perform DPL, diagnostic accuracies of 97.6% for macroscopic assessment and 99.1% for laboratory assessment were achieved. The high accuracy of DPL in this study is comparable with results reported when peritoneal lavage catheters (PLC) were used[2,3,8,11,12]. Odimba[8], Rhiner et al[4] and DuPriest et al[11] found diagnostic accuracies of DPL in brunt abdominal trauma to be 93%, 99% and 96-100% respectively. The high diagnostic sensitivity of 100% with specificity values of 96.4 and 98.8% for macroscopic and laboratory assessment respectively were not different from those reported when PLC for DPL were used[3,4]. In our study, there was a significant association between DPL and laparotomy findings (p=0.000). No complications were observed among the patients when followed up to the 30th postoperative day. In particular, there were cases of visceral injury, haemorrhage, peritonitis, wound infection or incisional hernia, which have previously been associated with DPL[8,12]. The rate of complications of diagnostic peritoneal lavage has been reported to be 0-1.5%. Open DPL employed in this study was reported to be free of complications by DuPriest[11].

There were no cases of missed intra-abdominal injuries in our series.

In this review, the average duration of DPL was 31.1 minutes. Odimba[8] reported a range of 21 to 35 minutes with an average of 30 minutes using PLC for open DPL in 227 brunt abdominal trauma cases. In our study, we found some technical difficulties peculiar to the small rubber Foley urethral catheter that resulted in prolonging the duration of the DPL procedure. At times the soft rubber walls collapsed on aspiration with a syringe and nothing would be recovered from the peritoneal cavity even though there was blood. Repeated aspiration was then necessary before resorting to lavage. Occasionally, on aspiration with a syringe, the catheter got blocked with fat and required unblocking by flushing using isotonic saline in a syringe. Unlike the PLC with fairly rigid walls on end hole with at least 6 side holes[11] which facilitate proper drainage, the Foley urethral catheter has no end-hole but only a pair of side-holes which makes drainage a slow process during DPL. However, despite all these limitations of Foley urethral catheter, in our study, we were able to, perform diagnostic peritoneal lavage quickly without causing undue delay for surgery. The time taken was comparable to that reported when ideal peritoneal lavage catheters were used[1,2,3,4,5,6,8]. In conclusion, Foley urethral catheters are reliable and safe substitutes for peritoneal lavage catheters for diagnostic peritoneal lavage in brunt abdominal trauma in emergency situations.

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