Complementary roles of diagnostic peritoneal lavage and computed tomography in the evaluation of blunt abdominal trauma

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
The use of diagnostic peritoneal lavage (DPL) in a complementary role with computed tomography (CT) for the evaluation of blunt abdominal trauma.

Type of intervention
Diagnosis and secondary screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised haemodynamically stable patients over 18 years old with blunt abdominal trauma. The inclusion criteria specified haemodynamically stable (systolic blood pressure >90 mmHg during emergency room admission) adult patients with blunt trauma who required abdominal evaluation for suspected intra-abdominal injuries. Awake and alert (13 on the Glasgow Coma Scale, GCS) blunt trauma patients with abdominal tenderness on physical examination, or complaints of abdominal pain, were included in the study. Also included were blunt trauma patients with a GCS of 13 or less, for reasons of unreliable physical examination. Elevated ethanol levels were not criteria for study entry. Patients were entered in the study independently of the extent and severity of extra-abdominal injuries. Patients with pelvic fractures were also included in the study.

The exclusion criteria were prior laparotomy wounds, pregnancy, morbid obesity (400 lb is the maximum CT scan capacity), allergy to iodine, intravenous or oral contrast, or haemodynamic instability (systolic blood pressure <90 mmHg during emergency room admission). Awake and alert (GCS >13) blunt trauma patients with negative abdominal physical examination were also excluded.

Setting
The setting was secondary care. The study was conducted in Alabama, USA.

Dates to which data relate
Both the effectiveness and resource use data were collected between February 1999 and July 2000. The year to which the prices referred was not reported.

Source of effectiveness data
The effectiveness data were derived from a single study.

Link between effectiveness and cost data
The costing was undertaken retrospectively, probably on the same study sample that was used in the effectiveness analysis, although this was not explicitly stated.

**Study sample**
The study sample consisted of eligible patients with abdominal blunt trauma, who presented at an urban Level I trauma centre from February 1999 to July 2000. No power calculations, to determine the sample size required to detect statistically significant differences in the outcomes, were performed. The initial study sample was likely to have been appropriate for the clinical study question, although no further evidence was provided. In total, 252 patients were entered in the study. Of these, 127 were randomised to the DPL-CT arm and 125 were randomised to the CT arm. All patients in the DPL-CT group underwent DPL. Twenty-six of them underwent subsequent CT, as required by DPL results, and another one died before undergoing the required CT. In the CT group all but one patient underwent CT. This patient underwent exploratory laparotomy before CT, owing to clinical signs.

**Study design**
The study was a randomised controlled trial (RCT) that was conducted at an urban Level I trauma centre in Alabama, USA. Randomisation was accomplished with sealed manila envelopes directing the trauma surgeon to DPL-CT or CT alone. No blinding method was described. The patients were followed up, apparently until the evaluation for suspected intra-abdominal injuries was completed. No loss to follow-up was reported.

**Analysis of effectiveness**
It was not stated whether the analysis was conducted on an intention to treat basis. The health outcomes used were the diagnostic sensitivity and the exploratory laparotomy rate related to each of the strategies assessed. The diagnostic sensitivity was expressed as the number of diagnosed injuries versus the number of known injuries that were missed from the diagnosis. The groups were comparable in terms of baseline characteristics such as age, gender, GCS and mortality following trauma.

**Effectiveness results**
Injuries were diagnosed in 18 (14%) patients in the DPL-CT arm and in 24 (19%) patients in the CT arm, (p>0.05).

There were no known missed cases with injuries in the DPL-CT arm, whereas there were 3 (12.5%) in the CT arm, (p>0.05).

Seven (39%) patients in the DPL-CT arm underwent exploratory laparotomy versus 10 (42%) in the CT arm, (p>0.05).

**Clinical conclusions**
Both DPL-CT and CT alone were sensitive methods for the diagnosis of injuries in patients with blunt abdominal trauma. No difference in non-therapeutic laparotomy rates was observed.

**Measure of benefits used in the economic analysis**
No summary measure of benefit was used in the economic analysis. The study was therefore categorised as a cost-consequences analysis.

**Direct costs**
The perspective of the study was not stated, but it was consistent with that of a private patient (or third-party payer). The costs included patient charges for a DPL (physician charge, DPL kit and laboratory charge) and patient charges for an abdominal-pelvic CT (radiology procedure charge, radiologist interpretation charge). The costs and the quantities were reported separately for each diagnostic procedure. The average calculated costs were based on actual data derived from patients in the study sample who underwent DPL and/or CT between February 1999 and July 2000. The unit costs...
were obtained from the University of South Alabama. Discounting was unnecessary, as the costs were incurred during less than one year, and was therefore not performed. The price year was not stated, but it was likely to have been 1999/2000.

**Statistical analysis of costs**
The costs were treated deterministically. No statistical analysis of the costs was undertaken.

**Indirect Costs**
The indirect costs were not included in the analysis.

**Currency**
US dollars ($).

**Sensitivity analysis**
No sensitivity analysis was performed.

**Estimated benefits used in the economic analysis**
See the 'Effectiveness Results' section.

**Cost results**
The average charge to the patient for abdominal evaluation was $650 in the DPL-CT arm and $1,611 in the CT arm.

The DPL-CT modality provided a cost-saving of 147%.

The costs of potential complications due to DPL, and the costs of non-therapeutic laparotomy following the diagnostic strategies evaluated, were not included in the analysis.

**Synthesis of costs and benefits**
Not relevant. The study was categorised as a cost-consequences analysis since no summary measure of benefit was used.

**Authors’ conclusions**
The use of diagnostic peritoneal lavage (DPL) in a complementary role with computed tomography (CT) as the initial screen for the evaluation of haemodynamically stable abdominal trauma patients had a low non-therapeutic laparotomy rate. It was a sensitive and cost-effective method for the identification and management of blunt abdominal injuries.

**CRD COMMENTARY - Selection of comparators**
The selection of the comparator (CT alone) was implicitly justified since it represented the most commonly used method for the evaluation of patients with blunt abdominal trauma. You should decide whether this strategy represents a widely used health technology in your own setting.

**Validity of estimate of measure of effectiveness**
The analysis was based on a RCT, which is the ‘gold’ standard method for the evaluation of effectiveness. The method of randomisation limited potential selection bias. The study sample was likely to have been representative of the patient population. The patient groups were shown to be comparable at analysis. It was not stated whether the basis of the analysis was intention to treat. Statistical analyses were performed to aid interpretation of the results, but the study size
was insufficient to allow the detection of statistically significant differences in effectiveness. No further statistical tests, to account for potential biases and confounding factors, were undertaken. Although it was unclear whether blinding took place, this might have helped limit potential biases.

Validity of estimate of measure of benefit
The authors did not derive a summary measure of health benefit.

Validity of estimate of costs
The study perspective was not reported, but it was consistent with that of the private patient (or third-party payer). All the categories of cost relevant to this perspective were included in the analysis. Some costs, such as those for hospitalisation, DPL complications, exploratory laparotomy and monitoring, were omitted from the analysis. These costs might have affected the authors' results reported, as they might have been dissimilar in the two groups. For example, the laparotomy rates differed between the two groups and associated costs were also likely to differ, although this difference in rates was not shown to be statistically significant.

The unit costs and the quantities were reported separately for each procedure, which enhances the reproducibility of the results. Since the costs reflected patient charges and not opportunity costs, they cannot therefore be interpreted in a perspective other than that of a private patient or third-party payer. No statistical or sensitivity analysis of the costs was carried out, which limits the interpretation of the study findings. Discounting was appropriately not undertaken, as the time horizon of the study was less than a year. The year to which the prices referred was not explicitly reported, which may hinder the generalisability of the results.

Other issues
The authors compared some of their findings with those of other studies and found them to be consistent. The issue of generalisability of the results to other settings was not addressed. The authors reported that a limitation of the study was the small study size, which did not allow for statistically significant conclusions to be drawn. The results of the analysis were presented in full and the authors' conclusions reflected the scope of the analysis.

Implications of the study
The authors suggested that, in trauma centres and emergency rooms that employ CT as their sole screening method for the evaluation of blunt abdominal trauma, DPL-CT should be considered as a sensitive and cost-effective method for the identification of intra-abdominal injury. It was recommended that larger multi-institutional studies should be conducted to compare the DPL-CT screening strategy with CT alone, and also with focused abdominal sonography for trauma supplemented by CT scan.

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