The significance of catheter diameter in diagnostic peritoneal lavage: a prospective, randomized, controlled clinical trial

E. Aysan, A. Kaygusuz, M. Sumak, S. Sirin, D. Can

Department of General Surgery, Istanbul Teaching and Research Hospital, Istanbul, Turkey

Received November 15, 2008; accepted after revision July 20, 2009

Summary. Background: Diagnostic peritoneal lavage (DPL) is a preferred diagnostic approach for patients with abdominal trauma. The aim of this article is to determine the effect of catheter diameter on procedure time and on the incidence of liquid transfer complications in patients with abdominal trauma.

Methods (study design): Sixty-eight patients (49 males, 19 females; age range, 16–82 years; mean age, 32.4 years) with abdominal trauma were prospectively randomized to undergo standard catheter (3 mm) open, wide catheter (5 mm) open, standard semi-open, or wide catheter semi-open DPL. Mean DPL, surgical procedure and liquid transfer time and complication ratio were compared.

Results: Total DPL duration was significantly shorter for the wide catheter open technique than for the standard open technique (19 vs. 28.5 min, \( p < 0.01 \)). Total surgical procedure duration for the wide catheter semi-open technique was also significantly shorter than for the standard semi-open technique (10.25 vs. 18 min, \( p < 0.01 \)). There were two liquid transfer complications with the wide catheter open method, compared with five for the standard open technique, and one and six, respectively, for the wide catheter semi-open and standard semi-open techniques (\( p < 0.01 \)).

Conclusions: Increasing the catheter diameter from 3 mm to 5 mm for open and semi-open DPL procedures decreased the total surgical procedure duration and reduced the incidence of liquid transfer-induced complications.

Keyword: Peritoneal lavage.

Introduction

In last decades, abdominal ultrasound or FAST (focused abdominal sonography for trauma) has become widespread for the evaluation of abdominal traumatized patients. But diagnostic peritoneal lavage (DPL) is accurate, rapid, safe, and superior to abdominal ultrasound and/or FAST for the diagnosis of abdominal blood as the source of hemodynamic instability, requiring emergent surgery, in blunt multi-trauma and pelvic fracture patients [1–5]. DPL is used to evaluate patients suspected of intra-abdominal hemorrhage [6], including patients with blunt abdominal trauma [7]. Although a number of DPL techniques have been described, they can all be classified into three main categories: open, semi-open, and closed [7–9]. Using the open techniques, all anterior abdominal wall layers from the skin to the peritoneum are
traversed, and the catheter is placed into the peritoneal cavity under direct visualization. Using the closed technique, the catheter is percutaneously inserted into the peritoneal cavity, from the skin to the peritoneum, using a trocar. The semi-open technique consists of making an incision in the skin, and sometimes in the fascia, followed by percutaneous insertion of the catheter into the peritoneal cavity [7–10].

There are three main considerations when comparing these three techniques: complication risk, procedure duration, and problems arising from liquid transfer. Relatively fewer complications occur using open techniques because these procedures are performed under direct visualization of the peritoneum and peritoneal cavity. Moreover, open techniques are associated with fewer problems owing to liquid transfer [11, 12]. The primary advantage offered by semi-open and closed techniques is shorter procedure times. However, as these techniques involve blind insertion of a catheter into the peritoneal cavity, they may be associated with an increased risk of intra-abdominal organ injury. Similarly, the catheter may not reach the pelvic cavity or it may form kinks, thereby increasing the risk of problems arising from liquid transfer [12–15].

We have sought to shorten surgical procedure times and to reduce the incidence of problems related to liquid transfer, without increasing the risk of complications during DPL. We hypothesized that all of these aims could be accomplished by simply increasing catheter diameter. We compared the results of open and semi-open procedures performed using a standard DPL catheter of 3-mm diameter with results of open and semi-open procedures using a larger catheter of 5-mm diameter.

**Methods**

The study sample consisted of 412 patients with blunt and/or penetrating abdominal trauma presenting at the Emergency Surgery Department of Istanbul Training and Research Hospital between February 2002 and January 2007. The study was performed by “the Third Surgery Clinic”, one of the four surgery clinics in this hospital. As each surgery clinic is on duty once every four days, the study was conducted by prospectively randomizing 68 patients (49 males, 19 females’ age range, 16–82 years; mean age, 32.4 years) with blunt and/or penetrating abdominal trauma presenting on the days when the Third Surgery Clinic was on duty. DPL techniques were listed in a certain order (standard open, wide catheter open, standard semi-open, and wide catheter semi-open) and were used consecutively.

Patients were excluded if they were aged less than 16 years, had a history of intra-abdominal open or laparoscopic surgeries, or had unstable hemodynamics and spontaneous bleeding of more than 10 ml blood with the insertion of the catheter into the peritoneal cavity. The general surgery specialist on duty at the clinic on that day established the indication for DPL. Patients provided written informed consent if they were conscious and oriented; otherwise, their next of kin provided written informed consent. Those who were unconscious and did not have next of kin available underwent the procedure without being informed. The study protocol was approved by the local ethics committee.

Patients who were not hemodynamically stable (n: 4), who were hemodynamically stable but suspected of intra-abdominal hemorrhage as a result of their initial examination (n: 6), and those who were disoriented owing to alcohol intoxication (n: 3) underwent DPL in the operating room. The remaining patients (n: 55) underwent the procedure in the primary intervention room, located in the emergency clinic. The procedure was performed under local anesthesia and by personnel wearing surgical gloves but without surgical gowns. The demographic characteristics of the patients are shown in Table 1.

The surgeons timed the procedure by consulting their watches. The procedure was split into two parts: surgical procedure time, the time from incision to the completion of catheter placement; and liquid transfer time, and the time from infusion of fluid into the abdomen to retrieval of 200 ml of liquid. Failure was defined as an inability to carry out the infusion or retrieve 200 ml of liquid, and such patients were recorded as having had liquid transfer complications.

The semi-open techniques were performed by a single surgeon, whereas the open procedures also required at least an assistant doctor of general surgery or a general surgery nurse.

**Standard open technique**

A midline vertical skin incision of 2 cm was made below the umbilicus. All abdominal layers and peritoneum were incised. The length of the catheter inserted into the peritoneal cavity was determined by measuring the distance from the umbilicus to the symphysis pubis and by adding approximately 10 cm to that value. A standard silastic DPL catheter of 3-mm diameter (1 Fr) (Peritofix®, B. Braun Melsungen AG) was inserted into the pelvic cavity. The incision was closed using a traumatic silk thread of 000 thickness with interrupted sutures, and one of these sutures was used to fix the catheter. A pre-mixed 1,000-ml glass bottle containing 0.9% NaCl serum (Eczacibasi-Baxter Hospital Supply...