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Diagnostic laparoscopy in critically ill intensive-care-unit patients

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Summary. The diagnosis of intraabdominal sepsis in critically ill intensive-care-unit patients remains a challenge. Diagnostic laparoscopy has been performed in seven such patients following admission for coronary artery bypass surgery, gram-negative sepsis, major burns, pneumonia, myocardial infarction, and postpneumonectomy. Laparoscopy revealed acalculous cholecystitis in two patients (one removed laparoscopically), gangrenous colon in two, cirrhosis with liver infarction in one, and, in two patients, no pathology. Although five patients died postoperatively, none was related to the laparoscopy. There were no intraoperative complications and no known pathology was missed.

Because of its ease and accuracy, diagnostic laparoscopy should be considered in all critically ill patients suspected of harboring intraabdominal pathology. Further studies are needed to fully establish its efficacy and safety.

Key words: Laparoscopy – Intensive care unit

Unexplained sepsis or abdominal pain remains a major diagnostic challenge. This is despite advances in noninvasive testing such as ultrasound, computerized tomography, and nuclear medicine scans [1, 7, 10] and the increasing safety of mesenteric arteriography [3]. The inherent instability of many intensive-care-unit (ICU) patients makes the use of these diagnostic tools problematic. Laparotomy remains the definitive diagnostic method. However, its use has not led to an overall decrease in mortality as the procedure itself carries many short- and long-term risks [8].

Laparoscopy, long a valuable gynecologic tool, has gained increasing favor with general surgeons [4]. Already widely accepted as the standard method of cholecystectomy, it is also being tested as an alternative to appendectomy and bowel resection.

We have hypothesized that performing laparoscopy on critically ill patients will increase diagnostic accuracy and decrease the amount of time needed to make definitive diagnosis. This will limit the amount of time these patients would have spent previously undergoing tests in less-monitored settings. We have reviewed our early results to assess the safety and accuracy of laparoscopy.

Clinical materials and methods

The records of seven patients undergoing diagnostic laparoscopy while in one of the ICUs at either the Johns Hopkins Hospital or the Francis Scott Key Medical Center, Baltimore, MD, were reviewed to determine indications and outcomes for this procedure. The time period covered was June 1, 1991, to November 7, 1991.

Results

There were five males and two females with an average age of 64.3 years (range, 36–85). There were two patients in the critical unit following coronary-artery bypass surgery and two for pneumonia (one of whom also had steroid-dependent chronic obstructive pulmonary disease). There was one patient each with the diagnosis of myocardial infarction, 80% total body-surface-area burn, and postpneumonectomy. Six of these patients were mechanically ventilated prior to laparoscopy. Abdominal pain was the indication for laparoscopy in two patients and unexplained sepsis in five (Table 1). No other diagnostic methods, such as computerized tomography, ultrasound, or lavage, were used prior to laparoscopy in any of these patients.

Five patients were transported to the operating room for laparoscopy and in two patients it was performed in the ICU. All procedures were done under general anesthesia, though in four patients (including the two procedures done in the ICU), this consisted of only intravenous Pavulon and midazolam. Four procedures were done using percutaneous entry into the

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Table 1. Preoperative evaluation[a]

Case/sex/age	Admission diagnosis	Indication	Ventilator
1/M/78	80% TBSA burn	Sepsis, MSOF	FiO_2 = 80%, PEEP = 10
2/F/46	Myocardial infarction	Pain	N/A
3/M/74	Pneumonia, COPD	Pain	FiO_2 = 50%, PEEP = 5
4/M/56	S/P pneumonectomy	Sepsis, ARDS	FiO_2 = 100%, PEEP = 12
5/F/36	Gram-negative pneumonia	Sepsis	FiO_2 = 60%, PEEP = 8
6/M/75	S/P CABG and MVR	Sepsis; MSOF	FiO_2 = 50%, PEEP = 5
7/M/85	S/P CABG	Sepsis	FiO_2 = 40%, PEEP = 5

[a] Abbreviations: TBSA = total body surface area; MSOF = multisystem organ failure; PEEP = positive end-expiratory pressure; COPD = chronic obstructive pulmonary disease; CABG = coronary artery bypass graft; MVR = mitral valve replacement; N/A = not applicable

Table 2. Laparoscopic findings and management

Case/sex/age	Location	Findings	Management
1/M/78	ICU	Acalculous cholecystitis	Cholecystectomy
2/F/46	OR	Gangrenous colon	Total abdominal colectomy
3/M/74	OR	Cirrhosis, liver infarction	Expectant
4/M/56	ICU	Normal	N/A
5/F/36	OR	Gangrenous colon	Total abdominal colectomy
6/M/75	OR	Acalculous cholecystitis	Laparoscopic cholecystectomy
7/M/85	OR	Normal	N/A

abdominal cavity and three were done by the open technique. The abdomen was initially inflated to only 10 cm of water pressure in all patients but additional pressure was needed in two patients to successfully visualize all parts of the abdomen. A second port was inserted to run the bowel in the two patients with normal findings and additional ports were inserted to assist in laparoscopic cholecystectomy in a third patient. Laparoscopy revealed acalculous cholecystitis in two patients (one of whom underwent successful laparoscopic cholecystectomy), gangrenous colon in two patients, and cirrhosis and liver infarction in one patient. In two patients the findings were normal (Table 2).

There was no associated hypoxemia, hypercarbia, or hypotension during the performance of the laparoscopies.

Five patients died following laparoscopy: the two postpump patients (one from multisystem organ failure and the other from a stroke); the burn patient from multisystem organ failure; the patient with cirrhosis from liver failure; and the postpneumonectomy patient from adult respiratory distress syndrome. The other two patients recovered uneventfully (Table 3). Because of the illness of these patients and the relative rapidity with which they deteriorated postlaparoscopy, only one had further diagnostic testing, which was a negative exploratory laparotomy.

Table 3. Patient outcome

Case/sex/age	Outcome	Comment
1/M/78	Died	Died of MSOE, no other pathology on autopsy
2/F/46	Survived	Alive and well
3/M/74	Died	Died of liver failure, autopsy otherwise unrevealing
4/M/56	Died	Died of progressive ARDS
5/F/36	Survived	Subsequent exploration to drain abscess
6/M/75	Died	Subsequent laparotomy revealed no pathology
7/M/85	Died	Died of massive CVA after resolution of sepsis

Discussion

Since its first demonstrated successful use in performing cholecystectomy in 1987, laparoscopy has had a rapid and unprecedented acceptance by general surgeons as a useful operative tool [4]. Appendectomy, bowel resection, lysis of adhesions, and even definitive ulcer surgery are but a few of its many uses. Gynecologists have long appreciated the laparoscope as a valuable diagnostic implement in addition to its therapeutic uses. The laparoscope's diagnostic use in general surgery has so far been limited to staging cancer [9] and evaluating trauma, which has met with mixed results.

Diagnosing intraabdominal sepsis or catastrophes in critically ill patients remains elusive at best. The high false-negative results of noninvasive testing and the increased morbidity resulting from diagnostic delays initially led some surgeons to encourage the performance of exploratory laparotomy in patients with unexplained multisystem organ failure [5, 6]. Further studies, however, documented negative rates too unacceptably high to support universal application of this procedure [2, 8].

We have hypothesized that diagnosis could be improved with minimal morbidity by performing laparoscopy in patients with unexplained sepsis or abdominal pain. While most patients have been transported to the operating room for this, it has twice been done (for the two sickest patients in the series) in the ICU itself. The equipment and an anesthesiologist were brought to the patient's bedside and the procedure was performed. One patient had negative findings and the other acalculous cholecystitis. This latter patient, whose procedure was done early in our laparoscopic experience, was then transferred to the operating room for an open cholecystectomy. He would now be a candidate for a laparoscopic procedure, possibly in the ICU.

The two patients with normal findings deserve further comment. The first patient had ARDS following a pneumonectomy. He remained alert after his laparos-

copy and manifested no abdominal findings in the 48 h before his death from progressive respiratory insufficiency. Autopsy, unfortunately, was refused by his family. The second patient, with sepsis postcoronary artery bypass, showed resolution of this problem after laparoscopy. He was in the process of being weaned from the ventilator when he suffered a massive cerebral infarct (confirmed by head CT scan). This was fatal and permission for autopsy was again not granted.

We have so far limited our use of diagnostic laparoscopy to patients with no prior abdominal surgery except for appendectomy or tubal procedures. This has been because of our concern that preexisting adhesions may obscure findings such as infarcted bowel. It seems, however, that there is no reason why this can't be expanded in the future to patients with previous major surgery, even in the early postoperative period to assess for anastomotic leaks.

While no invasive diagnostic procedure may ever have 100% accuracy or safety, our initial results with diagnostic laparoscopy are very encouraging. It has thus far proven to be completely accurate and without complication. Its use should be considered for all critically ill patients suspected of harboring intraabdominal pathology.

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