

Evaluation of laparoscopy in the management of abdominal emergencies

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Background/Aim

Laparoscopy has rapidly emerged as the preferred surgical approach for the management of abdominal emergencies. It allows for a correct diagnosis and proper treatment. The main aim of this study was to evaluate the role of laparoscopy as a major diagnostic and therapeutic tool for the management of patients with abdominal emergencies and to find a less invasive diagnostic approach.

Methods

Eighty patients with acute abdominal pain presented to the Department of surgery of Al-Azhar University (Bab El Shearia and Al Husein) hospitals during October 2009 to September 2011 were included in the study. They were divided into two groups: traumatic (40 patients) and nontraumatic (40 patients). Their ages ranged between 14 and 65 years (mean = 39.5 years); 49 patients were males and 31 patients were females. Complete clinical data were obtained. All patients underwent a routine preoperative workup. Laparoscopy was performed for all patients within 24 h of admission. The procedure was carried out under general anesthesia. Both open and closed pneumoperitoneum techniques were practiced.

Results

Diagnostic laparoscopy was beneficial in 79 patients (98.5%). Of them, 42 (52.5%) patients underwent successful therapeutic procedures with laparoscopy: 28 male patients (17 nontraumatic and 11 traumatic) and 14 female patients (12 nontraumatic and two traumatic). Conversion to therapeutic laparotomy was done for 12 patients (15%). In this study, the mean postoperative hospital stay after laparoscopy was 2.1 days and 4.55 days after laparotomy. Wound infections occurred in 2.5% of patients.

Conclusion

Early laparoscopic intervention for abdominal emergencies is as safe and effective as conventional surgery. It results in minor trauma, helps avoid extensive preoperative studies or delays in operative intervention, has a rapid postoperative recovery, and reduces morbidity. Such features make laparoscopy an attractive alternative to open surgery in the management of abdominal emergencies.

Keywords:

abdominal pain, emergencies, inflammatory, laparoscopy, trauma

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Introduction

Acute abdominal pain, defined as any abdominal pain with duration of less than 7 days, is a common presentation at the surgical department, both in primary care and secondary referral hospitals [1]. Acute abdominal pain can present a diagnostic dilemma. Clinical examination often fails to yield a diagnosis, particularly when the symptoms and signs are compounded by obesity. Blood investigations may be diagnostic in some cases, but in most other scenarios they simply indicate the presence of an inflammatory process. Radiology may suggest a diagnosis; however, both radiography and ultrasound have false-negative rates [2].

The acute abdomen is characterized by the sudden appearance of abdominal complaints that oblige the surgeon to decide promptly whether to operate immediately, to

treat conservatively, or to observe the patient. Despite new diagnostic developments such as ultrasonography and computed tomography, it seems that an acute abdominal condition presents a situation in which a surgeon dares to open an abdomen without a clear diagnosis [3]. In the past 20 years, the role of laparoscopy in emergency surgery has increased continuously.

In January 2010, The European Association for Endoscopic Surgery published the clinical recommendations for the role of laparoscopy in abdominal emergencies in adults. According to the European Association for Endoscopic Surgery 2006 Guidelines on the effectiveness of laparoscopy in the acute abdomen and the 2011 consensus, the effectiveness of laparoscopy was strongest (+++) in terms of perforated gastroduodenal ulcers in 2006 but was moderate (++) in 2011; the effectiveness

in acute cholecystitis was ++ in 2006 and was +++ in 2011; for acute appendicitis, it was the same in 2006 and 2011 (+++); and there was no reported effectiveness in terms of mesenteric ischemia and doubtful effectiveness in terms of ventral and incarcerated hernias, acute diverticulitis, and small-bowel obstruction [4]. Diagnostic laparoscopy may be a key to solving the diagnostic dilemma of an unspecific acute abdomen. Furthermore, it allows not only direct inspection of the abdominal cavity but also surgical intervention, if needed [5]. The decision to perform diagnostic laparoscopy is based on clinical judgment, weighing the sensitivities and specificities of other modalities such as computed tomography and ultrasound versus the relative morbidity of minimally invasive laparoscopy [6]. Diagnostic laparoscopy is particularly useful when the presentation of acute abdominal pain suggests an intra-abdominal catastrophe, but the exact diagnosis remains obscure despite standard measures [7]. Marks *et al.* [8] reported that diagnostic laparoscopy for penetrating abdominal or flank injuries resulted in a total reduction in the cost when compared with laparotomy. The aim of this study was to evaluate and establish the role of laparoscopy as a diagnostic and potentially therapeutic modality in patients with abdominal emergencies, either traumatic or nontraumatic.

Patients and methods

This was a prospective, nonrandomized, and uncontrolled study carried out between October 2009 and September 2011 after obtaining approval of the research ethics committee of the Faculty of Medicine, Al-Azhar University. In this study, a total of 80 patients with acute abdominal pain were divided into two groups: traumatic (40 patients) and nontraumatic (40 patients). The patients were presented to the Department of surgery, Al-Azhar University (Bab El Shearia and Al Husein) hospitals. Their ages ranged between 14 and 65 years (mean = 39.5 years); 49 patients were males and 31 patients were females. Written consents were obtained after providing full details of the procedure to the patients. Complete clinical data were obtained and all patients underwent a routine preoperative workup.

Investigations

The following investigations were carried out for all patients: complete blood profile, random blood sugar levels, liver function tests, kidney function tests, prothrombin time and concentration, plain radiography of the abdomen and chest, and abdominal and pelvic ultrasonography. Some patients were subjected to few additional investigations if indicated. Laparoscopy was performed for all patients within 24 h of admission. The procedure was performed under general anesthesia. Both open and closed pneumoperitoneum techniques were practiced.

Inclusion criteria

- (1) Hemodynamic stability after intra-abdominal injury due to a blunt or penetrating trauma.

- (2) Unexplained acute abdominal pain of less than 7 days' duration after the initial diagnostic workup.

Exclusion criteria

- (1) Hemodynamic instability.
- (2) Trauma with head injury.
- (3) Uncorrectable coagulopathy.
- (4) Clear indication for immediate laparotomy (frank peritonitis or hemorrhagic shock).
- (5) Posterior penetrating trauma (suspicion of bowel injury).
- (6) A decompensated cardiorespiratory system.
- (7) Patient refusal.

Procedure

A 10-mm, 0° laparoscope placed by means of an umbilical port was used. Further ports were inserted according to pathological findings. Diagnostic laparoscopy was performed, and if possible, therapeutic approaches were used. The initial clinical diagnosis, laparoscopic diagnosis, complications, and the subsequent outcomes were evaluated. Conversion to laparotomy was done in some cases, when indicated.

Preoperative management

All patients were prepared for diagnostic laparoscopy, including the assessment of risks of general anesthesia. The procedure was explained to the patients, and true informed consent, including the possibility of conversion to open surgery, was obtained from all.

Technique of diagnostic laparoscopy

We began diagnostic laparoscopy with the insertion of a Veress needle to create a pneumoperitoneum. Three to four liters of carbon dioxide were needed to insufflate the abdomen, and at the end of the procedure the gas was allowed to escape. During insufflation, the pressure range was carefully observed and was adjusted at 12 mmHg. This was followed by trocar insertion to introduce the telescope mounted to the camera. In this study, we performed the open technique for insertion of the first trocar in cases associated with abdominal distension. An accessory (5 mm) trocar and cannula were then inserted under vision in the left upper quadrant along the linea semilunaris, halfway between the umbilicus and the costal margin. This was required for insertion of the palpation probe and suction/irrigation cannula. Other accessory cannulae were inserted at other sites as needed. Blunt-tipped, noncrushing forceps were preferred for virtually all manipulations.

General inspection

After inspecting the trocar entry sites and the anterior surfaces of the abdominal viscera, general inspection of the peritoneal cavity and its contents proceeded. This was followed by specific inspection of the diseased organs. We actively manipulated the operating table and patient's organs to explore the abdomen thoroughly. The supracolic compartment was examined with the table in

a head-up tilt. With the use of the palpating probe, the liver was inspected next. The other contents of the right hypochondrium were inspected: gallbladder, antroduodenal segment of the stomach, and hepatic flexure. These organs were exposed by lifting the liver with the palpating probe. The anterior surfaces of the body of the stomach and gastrocolic omentum were visualized next. The proximal stomach and the cardioesophageal junction were inspected after the left lobe of the liver was lifted with the palpating probe. In the left upper quadrant, the spleen, splenic colon, and upper descending colon were inspected. The infracolic compartment was best examined with the patient in the supine position with a lateral tilt (right or left) opposite to the side being examined. The omentum; appendix; cecum; ascending, transverse, and descending colon; and paracolic gutters could be inspected using grasping forceps. The lower aorta and iliac vessels could also be visualized. Both ureters could be identified in thin individuals. The patients were placed in the steep Trendelenburg position for inspection of the pelvic organs. Small-bowel loops were lifted and placed in the abdomen before full inspection of the rectum, bladder, and female pelvic organs. The small intestine was examined in a retrograde manner, starting at the terminal ileum. The first loop was grasped using a traumatic forceps and inspected on either side. The first grasper (close to the cecum) was then released and applied beyond the second and so on. Once the upper jejunum was reached, the table was tilted head down, the omentum placed in the supracolic compartment, and the transverse colon was lifted up.

Technique of diagnostic laparoscopy for trauma

The purpose was to exclude or confirm intra-abdominal injury. The patient was placed supine on the operating table. The laparoscope was inserted through the umbilicus. Accessory 5 mm were trocars placed in the midabdomen on either side of the abdomen to accommodate bowel graspers to run the bowel or manipulate the liver and stomach. In case of blunt abdominal trauma with hemoperitoneum, a standard grading system was used. Formal laparotomy was required for grade 2 or 3 hemoperitoneums required if they could not be managed laparoscopically. Bulging of the omentum over the spleen or a large quantity of intra-abdominal blood in the presence of no obvious liver laceration could indicate that the spleen might have been damaged. Besides hemoperitoneums, bowel content in the paracolic gutter was a clear indication of intestinal injury, which was repaired laparoscopically or, if needed, by formal laparotomy.

Postoperative follow-up

All patients were followed up postoperatively for relief from complaints or appearance of complications.

Results

This study included 80 patients of different ages of both sexes who presented to the emergency department with

symptoms and signs of an acute abdomen; 49 were males (61.25%) and 31 were females (38.75%). Their ages ranged from 14 to 65 years (mean = 39.5). The patients were subdivided into two groups: traumatic (40) and nontraumatic (40). The nontraumatic acute abdomen group ($n = 40$): This group comprised 17 patients (42.5%) with upper abdominal pain (nine males and eight females) and 23 patients (57.5%) with lower abdominal pain (seven males and 16 females).

The laparoscopic findings in patients with upper abdominal pain ($n = 17$) shown in Table 1 reveal that the incidence of acute upper abdominal pain was higher among males compared with females. There was a female predominance among patients with acute calculous cholecystitis and a male predominance among patients with perforated peptic ulcer.

The laparoscopic findings in patients with lower abdominal pain ($n = 23$) shown in Table 2 reveal that the incidence of acute lower abdominal pain was higher among female patients because of gynecological problems.

The traumatic abdominal pain group ($n = 40$): this group comprised 21 patients with a blunt abdominal trauma (52.5%) (16 males and five females) and 19 patients with a penetrating injury (47.5%) (17 males and two females).

The laparoscopic findings in patients with blunt abdominal trauma ($n = 21$) shown in Table 3 reveal a higher incidence of injury among males.

Table 1 Laparoscopic findings in patients with upper abdominal pain ($n = 17$)

Diagnosis	Number of cases	n (%)	
		Male	Female
Subphrenic abscess	1	1 (5.88)	–
Perforated peptic ulcer	4	3 (17.64)	1 (5.88)
Adhesive intestinal obstruction	2	1 (5.88)	1 (5.88)
Acute calculous cholecystitis	5	1 (5.88)	4 (23.52)
Hemorrhagic pancreatitis	1	–	1 (5.88)
Familial Mediterranean fever	1	1 (5.88)	–
Splenic abscess	1	1 (5.88)	–
Mesenteric vein occlusion	2	1 (5.88)	1 (5.88)
Total	17	9 (52.94)	8 (47.06)

Table 2 Laparoscopic findings in patients with lower abdominal pain ($n = 23$)

Diagnosis	Number of cases	n (%)	
		Male	Female
Acute appendicitis	10	6 (26.08)	4 (17.39)
Appendicitis + right ovarian cyst	2	–	2 (8.79)
Appendicitis + left ovarian cyst	1	–	1 (4.35)
Gynecological problems	5	–	5 (21.73)
No need for therapeutic intervention	5	1 (4.35)	4 (17.39)
Total	23	7 (30.43)	16 (69.57)

Table 3 Laparoscopic findings in patients with a blunt abdominal trauma (n=21)

Diagnosis	Number of cases	n (%)	
		Male	Female
Negative exploration	10	7 (33.33)	3 (14.28)
Hepatic tear	2	2 (9.52)	–
Splenic rupture	3	3 (14.28)	–
Jejunal tear	2	1 (4.76)	1 (4.76)
Omental injury	1	1 (4.76)	–
Terminal ileum injury	1	–	1 (4.76)
Diaphragmatic injury	1	1 (4.76)	–
Retroperitoneal hematoma	1	1 (4.76)	–
Total	21	16 (76.19)	5 (23.81)

Table 4 Laparoscopic findings in patients with a penetrating abdominal trauma (n=19)

Diagnosis	Number of cases	n (%)	
		Male	Female
Negative exploration	9	8 (47.06)	1 (5.88)
Hepatic injury	1	1 (5.88)	–
Stomach injury	1	1 (5.88)	–
Splenic and colonic injury	1	1 (5.88)	–
Small intestinal injury	3	3 (17.64)	–
Omental injury	2	1 (5.88)	1 (5.88)
Urinary bladder injury	2	2 (11.76)	–
Total	19	17 (88.24)	2 (11.76)

Table 5 Comparison between postoperative hospital stays

Hospital stay	Minimum (days)	Maximum (days)	Mean (days)
Diagnostic laparoscopy	1	3	2
Diagnostic and therapeutic laparoscopy	2	4	3
Laparotomy	3	7	4.5

The laparoscopic findings in patients with a penetrating abdominal trauma ($n = 19$) shown in Table 4 reveal a negative exploration in 9/19 patients and a higher incidence of small intestinal injury among males.

Hospital stay

The hospital stay was variable according to the procedure. It ranged from 1 to 3 days for patients undergoing diagnostic laparoscopy only. For patients who underwent therapeutic procedures, the hospital stay ranged from 2 to 4 days. For patients who underwent laparotomy, the hospital stay ranged from 3 to 7 days, as shown in Table 5.

Complications associated with laparoscopy

Complications occurred in four patients (5%) after laparoscopy: one patient was complicated with omental injury during insertion of a trocar, which was dealt with using diathermy; one patient was complicated with scrotal emphysema due to pneumoperitoneum, which resolved early in the postoperative period; and two patients developed wound infection later on (Table 6).

Table 6 Complications associated with laparoscopy (n=80)

Complications	Causes	n (%)
Injury to omentum	Insertion of trocar	1 (1.25)
Scrotal emphysema	Pneumoperitoneum	1 (1.25)
Wound infection	Subphrenic abscess and perforated ulcer	2 (2.5)
Total		4 (5)

Discussion

An acute abdomen is a common surgical emergency. Schietroma *et al.* [9] stated that an acute abdomen accounts for 13–40% of all surgical emergencies. It is a potentially lethal condition, and the exact diagnosis of this presentation is usually difficult. It is the duty of the attending surgeon to finalize the diagnosis and management properly. To achieve this goal, exploratory laparotomy may be utilized. The advent of laparoscopic techniques has improved the approach to this problem and could save the patient an unnecessary negative laparotomy. Laparoscopic techniques for acute abdominal problems have been evaluated in this study. The present series included 80 patients varying in age and sex. The largest number of admissions occurred in the age group of 21–30 years (43.5%). Males constituted 61.25% and females constituted 31.75% of patients; the male to female ratio was 1.58:1. The mean age of patients with upper abdominal pathologies was significantly higher than that of patients with lower abdominal pathologies, which indicated that an upper abdominal pathology that gives rise to an acute abdomen occurs mostly during old age in contrast to lower abdominal pathologies. This could be attributed to the occurrence of gynecological emergencies in younger female patients and to the lower age of patients at presentation with acute appendicitis. Our results are consistent with those of Irvin [10] and of Miettinen *et al.* [11], who reported that the largest number of admissions occurred in the age group of 10–29 years. The male to female ratio was 1.51:1. Patients in this study were subdivided into two groups: traumatic (40 patients) and nontraumatic (40 patients). The results of this study indicate that this method of grouping of patients helped to successfully finalize 79 patients (98.5%) (48 males and 31 females) but could not diagnose a case of familial Mediterranean fever. A total of 42 patients (52.5%) underwent successful therapeutic procedures with laparoscopy: 28 males (17 nontraumatic and 11 traumatic) and 14 females (12 nontraumatic and two traumatic). The initial diagnostic laparoscopy helped us plan the incision for laparotomy at the proper site. This also helped us perform minilaparotomy in five females (6.25%). Several researchers report that the accuracy of diagnostic laparoscopy when used in patients with unclear acute abdominal pain syndromes ranges from 70 to 99%. Laparoscopy changed the clinical diagnosis in 30% of patients [2,4,12]. In patients with acute abdominal pain, early laparoscopy is an accurate means of management. Laparoscopic treatment of the surgical pathology was successful in 64–87% of patients. Conversion to laparotomy was done in 7–19% of patients.

Laparoscopic management of an acute abdomen is a safe and effective method with the advantages of a small scar and early recovery [2,13]. Alvarado and colleagues [14–16] reported that laparoscopic surgery was found to be clearly superior for patients with a presumable diagnosis of perforated peptic ulcers. Laparoscopic closure of the ulcer is an alternative procedure to open surgery; it is as safe as the open procedure and allows the surgeon to confirm the diagnosis, which is incorrect in 8% of patients managed conservatively, or search for another cause of the complaints and offers the possibility, if conversion is needed, to perform a shorter laparotomy. The morbidity decreases as there is less delay to surgery. The evolution is excellent; the patients leave the hospital 3 days after surgery. In this study, two patients presented with an acute abdomen with a long history of recurrent attacks of abdominal pain, due to adhesions from previous operations, for which they underwent successful laparoscopic dissection of the adhesions. Intraperitoneal bacteria, endogenous bowel flora, ischemic tissue, retained foreign particles, and the natural inflammatory response of the peritoneum have all been implicated in the formation of adhesions. Clearly, some of these factors will be reduced with a laparoscopic approach as compared with an open surgery [17,18]. Fibrous adhesions within the peritoneal cavity are a major clinical problem. After laparotomy, ~95% of patients are shown to develop adhesions at subsequent surgery [19]. In this study, diagnostic laparoscopy established two patients with mesenteric vein occlusion, for which they underwent laparotomy and resection and reanastomosis. It was reported that the diagnosis of acute mesenteric ischemia is an important consideration in the elderly patient with abdominal pain [20,21]. Laparoscopy can effectively establish or exclude diagnosis [22]. Thirteen patients (16.25%) (six males and seven females) had acute appendicitis, of which three were associated with ovarian cysts (12 patients underwent laparoscopic appendectomy and one patient underwent open appendectomy for the appendicular mass). Abdominal radiography has low sensitivity and specificity for the diagnosis of acute appendicitis [23,24]. Acute appendicitis is one of the multitudes of etiologies that cause right lower quadrant pain. The rate of misdiagnosis is less than 10% in male patients but can be more than 40% in young female patients [25]. Laparoscopic appendectomy offers many advantages over the traditional approach. The main advantage is the ability to perform a diagnostic laparoscopy and survey the entire abdomen through a small trocar site. The existence of acute appendicitis, or any of the other disease processes considered in the differential diagnosis (especially pelvic inflammatory disease), can be readily established. When the appendix is normal, a thorough evaluation of the abdomen is mandatory, and this is clearly easier and more suitable through the laparoscope [26–29]. Golash *et al.* [2] reported that many of these patients will undergo exploration for suspected appendicitis, but a normal appendix is found in only 20–35% of patients. Because of the limited access provided by the gridiron incision, a definitive diagnosis may not be found. Other patients may be treated

conservatively and discharged, only to return with recurrent pain or more definitive symptoms of the pathology. Faggi *et al.* [30] reported that laparoscopy can not only clarify a discrepancy during the preoperative diagnosis but can also reveal, especially in some situations such as pelvic pathologies in women of childbearing age, the most correct surgical approach. Gynecological emergencies presented in 33% of patients (15% ovarian cyst problems, 4% right ovarian endometriosis, 11% ectopic pregnancies, and 3% pelvic inflammatory disease). Pelvic inflammatory disease must be considered in virtually every woman of reproductive age with lower abdominal pain (acute pain is reported in 90% of patients). Differentiation of pelvic inflammatory disease from acute appendicitis is difficult, especially in women of childbearing age. The rate of misdiagnosis approaches 30–50% and the rate of false-positive explorations approaches 40%. Thus, the use of laparoscopy to diagnose pelvic inflammatory disease in young women has been advocated [31,32]. The laparoscopic approach is rapidly becoming the standard care in surgical management of unruptured ectopic pregnancies. It provides a minimally invasive diagnostic capability combined with a variety of therapeutic options [33,34]. Approximately 65–80% of women with positive findings at laparoscopy have clinical improvement after operative management [7,35]. In our study, negative explorations were reported in 19 (47.5%) traumatic patients. Sido *et al.* [36] reported that laparoscopy decreases the rate of unnecessary laparotomies in abdominal trauma and helps diagnose injuries of solid organs. Therapeutic procedures in two patients with a perforated small bowel and in another two patients with bleeding omental adhesion to the liver after blunt trauma were successful; this proved the benefit of laparoscopy in abdominal trauma. Peritoneal lavage gives rise to false-positive results as proven on consequent negative laparotomies. The exact incidence of a false-positive lavage varies from one institution to another. These rates vary from a low percentage of 2% to a high percentage of 7% [37]. Laparoscopy can prevent nontherapeutic laparotomy and delayed diagnosis in patients with suspected blunt bowel injury [38]. Conversion to therapeutic laparotomy was done for 12 patients (15%): nine males (three nontraumatic and six traumatic) and three females (two nontraumatic and one traumatic). Conversion to laparotomy was done for all patients with traumatic splenic rupture, due to multiple splenic lacerations, as the massive intraperitoneal hemorrhage interfered with our manipulation. The high conversion rate in this series might be explained in part by early experience, limited sample size, and the quality of cases. Patients with traumatic splenic rupture, mesenteric vascular occlusion, and an appendicular mass are always converted to laparotomy to avoid complications. Therefore, laparoscopic appendectomy was performed for the less severely inflamed appendix in most of the cases reported. In this work, the postoperative hospital stay after laparoscopy (mean: 2.1 days) was less than that after laparotomy (mean: 4.55 days). It has been reported that the mean hospital stay ranges from 2.4 to 4 days after laparoscopic management of an acute abdomen [2,39].

Minimally invasive surgery is associated with reduced postoperative pain, more prompt return of bowel function, reduced hospital stay, and more rapid return to normal activity [40]. In the present study, after laparoscopic intervention, return of bowel function was not prolonged, and wound infections were mild and required no treatment other than antibiotics and few dressings. The morbidity rate was 5% after laparoscopy. Wound infections occurred in 2.5% of patients after laparoscopy. One patient was complicated with omental injury during insertion of a trocar, which was dealt with using diathermy. Another patient was complicated with scrotal emphysema due to pneumoperitoneum, which was resolved early in the postoperative period. The reported incidence of wound infection is 0.1–3% after laparoscopic procedures for acute abdominal pain. Most infections are superficial and respond well to antibiotics [39,41]. Insertion of a Veress needle or a laparoscopic trocar and cannula into the peritoneal cavity may result in injury to the intestine, bladder, or major retroperitoneal vessels. The reported incidence of visceral injury from insertion of a Veress needle or trocar varies from 0.05 to 0.2% [42]. In this series, the mortality rate was 0%; this could be attributed to our safe and cautious manipulations. Perri *et al.* [39] reported a mortality rate of 0.5%. In the present study, all patients were followed up postoperatively for relief from complaints. One patient who had negative findings on diagnostic laparoscopy continued to suffer from the same preoperative symptoms. Later, we found, using specific serological tests, that this patient had Mediterranean fever. Surgical terms such as acute abdomen reflect the unease with which surgeons undertake major abdominal explorations in the face of clinical uncertainties. The surgeon must be prepared for all eventualities when caring for patients with acute abdominal pain, including averting an unnecessary laparotomy or avoiding a dangerous delay in diagnosis and treatment [7]. Diagnostic laparoscopy is particularly useful when the presentation of acute abdominal pain suggests an intra-abdominal catastrophe, but the exact diagnosis remains obscure despite standard measures. With detailed history taking and a complete physical examination, the differential diagnosis list usually narrows down to a few prime suggestions [7,43]. Laparoscopy has the advantages of proper diagnosis and visualization of the female genital system. Moreover, it is associated with a minimal or no risk of adhesion. Therefore, it is reasonable to offer laparoscopy as the primary procedure for acute right lower abdominal complaints in women of reproductive age. However, exploratory laparotomy remains the mainstay tool of diagnosis and treatment whenever laparoscopic exploration is not sufficient, and the surgeon should not hesitate or delay the conversion whenever necessary. It is obvious that the introduction of laparoscopic techniques has added much to the management of an acute abdomen. We conclude that early interventional laparoscopy is recommended as a diagnostic and therapeutic tool in acute and traumatic abdominal pain, irrespective of the patient's age or sex, to take advantage of the proven benefits of minimal-access surgery and to ensure that no diagnosis is missed.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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