



(RESEARCH ARTICLE)



Diagnostic accuracy of laparoscopy in non-traumatic emergency abdominal surgery

Ammari Smail *

Department of General Surgery, Ain Taya Hospital, Algiers, Faculty of Medicine of Algiers, Algiers University 1, Algeria.

World Journal of Advanced Research and Reviews, 2024, 22(02), 1443–1449

Publication history: Received on 09 April 2024; revised on 17 May 2024; accepted on 20 May 2024

Article DOI: <https://doi.org/10.30574/wjarr.2024.22.2.1546>

Abstract

Introduction: Laparoscopy with high diagnostic accuracy allows for complete and direct visualization of the intraperitoneal viscera, significantly reducing therapeutic errors.

The objective of our study was to evaluate the diagnostic accuracy of laparoscopy in the management of non-specific acute abdomen.

Material and Methods: Descriptive and prospective, evaluative study conducted between February 2018 and October 2021, focusing on the role of emergency abdominal laparoscopy.

Results: Specificity, sensitivity, positive predictive value, and negative predictive value of laparoscopy in our patients were 100%. Intraoperatively, laparoscopy corrected the preoperative diagnosis in 15.73% of cases. It prevented unnecessary laparotomies in 05 cases.

Conclusion: Laparoscopy has a very high diagnostic accuracy. It can be safely used in emergency abdominal surgery, as a substitute for laparotomy.

Keywords: Laparoscopy; Diagnostic accuracy; Non-traumatic emergency; Abdominal surgery

1. Introduction

Laparoscopy with high diagnostic accuracy enables complete and direct visualization of the intraperitoneal viscera, significantly reducing therapeutic errors, allowing for concomitant surgical treatment, improving postoperative conditions, and managing certain patient categories such as obese individuals and pregnant women [1,2]. Some authors are convinced that laparoscopy can have an exclusively diagnostic role. When performed correctly, its diagnostic yield surpasses various complementary investigations and explorations. Mortality and morbidity are also reduced [3].

Indeed, in emergency situations, hastily performed preoperative radiological explorations, especially at night, may overlook essential diagnoses, particularly in cases with challenging differential diagnoses. In such situations, laparoscopy allows exploration of the entire peritoneal cavity through a minimally invasive incision, regardless of the pathology or organ involved. This is in contrast to conventional surgery, which either does not allow exploration of the entire peritoneal cavity through elective routes or requires large incisions for complete exploration.

The objective of our study was to evaluate the diagnostic accuracy of laparoscopy in the management of non-traumatic acute abdomen.

* Corresponding author: Ammari Smail

2. Material and Methods:

2.1. Study Design

This was a descriptive and prospective evaluative study conducted between February 2018 and October 2021. Our study focused on 337 patients who underwent laparoscopic surgery for non-traumatic acute abdominal emergencies.

2.2. Study Population

We included all adult patients aged 15 years and older presenting solely with non-traumatic acute surgical abdominal emergencies where laparoscopy was already recognized as the gold standard or had a strong level of evidence. These included acute appendicitis and its complications (such as abscesses, phlegmons, and generalized peritonitis), acute lithiasic cholecystitis with symptom onset within the past 7 days, peritonitis due to perforated peptic ulcer, acute intestinal obstructions due to adhesions, ectopic pregnancies, ovarian cyst torsions, and non-specific acute abdominal pain.

We excluded patients classified as ASA (IV), those in septic shock or hypovolemic shock, and traumatic emergencies from this study.

2.3. Patients Recruitment

Patients were recruited through surgical and gynecological emergencies during on-call shifts (24 hours). Prior to hospitalization, all patients underwent a comprehensive and meticulous clinical examination.

All hospitalized patients received a standard preoperative assessment including: complete blood count, blood grouping, prothrombin time, urea, creatinine, blood glucose, chest X-ray (CXR), and electrocardiogram (ECG). The majority of our patients underwent abdominopelvic ultrasound. Depending on clinical indications, additional complementary tests, both biological and radiological (CT and/or MRI), were requested to support the diagnosis (based on the pathology).

All patients underwent preoperative anesthesia consultation with ASA classification. A detailed record was established for each patient. In cases of significant discordance between clinical, radiological, and laboratory findings, laparoscopy was used for diagnostic and potentially therapeutic purposes.

2.4. Evaluation Parameters:

- Perioperative morbidity (Complications related to the surgical approach).
- Postoperative morbidity: (Postoperative complications).
- Overall mortality rate and mortality rate by pathology.
- Length of hospital stay.
- Diagnostic accuracy of laparoscopy.
- Rate of purely diagnostic laparoscopy.

3. Results

In our study, 337 patients were included and underwent surgery. Among them, 190 were female (56.4%), with a mean age of 38 years \pm 15 years (range 15 to 82 years). The body mass index (BMI) was greater than 25 in 179 patients (53.11%). Comorbidities were found in 109 patients (32.3%), and abdominal scarring was present in 90 patients (26.7%). Patients were classified as ASA I in 74.8% (252 patients), ASA II in 22% (74 patients), and ASA III in 3.3% (11 patients). Pregnant women accounted for 4.2% (08 patients), with a mean gestational age of 15 weeks \pm 7.29 weeks (range 7 to 29 weeks).

Preoperative abdominopelvic ultrasound was performed in 320 patients (95%).

In the remaining 17 patients (5%), either ultrasound was not necessary (e.g., intestinal obstructions due to adhesions) or patients already had a CT scan upon arrival at the surgical emergencies. Abdominopelvic CT scan was performed only when necessary and in the absence of contraindications in 56 cases (16.61%). MRCP was performed in 07 patients (2.07%).

We encountered radioclinical discrepancies in 14 patients (4.16%). Radiological explorations (especially abdominopelvic ultrasound) performed hastily in emergency settings are sometimes inconclusive and prone to confusion.

These cases involved suspected acute appendicitis in 07 patients (2.1%). There was a discrepancy between the clinical presentation and inconclusive ultrasound findings. CT scan was not accessible.

A precise diagnosis was possible preoperatively in 310 patients (92%) based on clinical data and/or complementary examinations (biological and radiological).

Preoperative diagnosis was uncertain in 08.1% of cases (n=27 patients):

- In 13 patients (3.86%), there was a strong suspicion of ovarian cyst torsion based on concordance between clinical data and preoperative ultrasound findings. Pelvic MRI was not available to formally confirm the diagnosis of adnexal torsion.
- In 07 patients (2.1%), there was suspicion of acute appendicitis. There was a discrepancy between the clinical presentation and inconclusive ultrasound findings. CT scan was not accessible.
- In another 07 patients (2.1%), there were non-specific acute abdominal pains, where no specific diagnosis was made preoperatively despite biochemical and morphological assessments (ultrasound and CT scan).

Laparoscopy was used for therapeutic purposes in 310 patients (92%), for diagnostic and therapeutic purposes in 20 patients (5.94%), and purely for diagnostic purposes in 07 cases (2.1%).

Table 01 summarizes the different operated pathologies, along with preoperative diagnosis and intraoperative diagnostic correction.

Table 1 Surgical pathologies

| Preoperative diagnosis | | | Intraoperative diagnosis | | |
|---|-----|------|---|-----|------|
| Pathologies | N | % | Pathologies | N | % |
| Acute appendicitis (Simple and complicated) | 177 | 52.6 | Acute appendicitis (simple and complicated) | 178 | 53 |
| Acute lithiasis cholecystitis | 88 | 25.9 | Acute lithiasis cholecystitis | 88 | 25.9 |
| Adnexal torsion | 24 | 04.5 | Adnexal torsion | 27 | 07.5 |
| Ectopic pregnancy | 23 | 06.9 | Ectopic pregnancy | 23 | 06.9 |
| Perforation of bulbar ulcer | 10 | 3 | Perforation of bulbar ulcer | 09 | 2.7 |
| | | | Ileal perforation | 01 | 0.3 |
| Adhesive acute intestinal obstruction | 08 | 2,4 | Adhesive acute intestinal obstruction | 7 | 2.1 |
| | | | Small bowel obstruction on stromal tumor | 01 | 0.3 |
| Non-specific acute abdominal pain. | 07 | 2,1 | Acute appendicitis | 01 | 0.3 |
| | | | Adnexal torsion | 03 | 0.89 |
| | | | Retrocecal internal hernia | 01 | 0.3 |
| | | | No etiology | 02 | 0.6 |

Comparing preoperative diagnoses (Table 03) with intraoperative findings (Table 04), we observed that laparoscopic exploration during surgery corrected the preoperative diagnosis in 53 cases (15.73%) (Table 02).

Table 2 Summary of intraoperative recovery cases of preoperative diagnosis

| Preoperative diagnosis | n | % | Corrected intraoperative diagnosis |
|--|----|--------|---|
| Suspicion of ovarian cyst torsion | 13 | 3.86 % | Torsions of proven ovarian cysts |
| Uncomplicated acute appendicitis | 09 | 2.67 % | Appendicular abscess |
| Suspicion of acute appendicitis | 07 | 2.07 % | Acute appendicitis |
| Uncomplicated acute appendicitis | 05 | 1.48 % | Appendix plastrons |
| Uncomplicated acute appendicitis | 03 | 0.89 % | Generalized appendix peritonitis |
| Uncomplicated acute appendicitis | 02 | 0.59 % | Torsions of ovarian cysts |
| Uncomplicated acute appendicitis | 02 | 0.59 % | Acute appendicitis + associated Meckel diverticulum |
| Uncomplicated acute appendicitis | 01 | 0.3 % | Acute appendicitis + associated ovarian cyst |
| Appendicitis aigue non compliquée + Grossesse extra-utérine gauche | 01 | 0.3 % | Acute appendicitis + intrauterine pregnancy |
| Plastron appendiculaire | 01 | 0.3 % | Abscessed appendiceal mass |
| Acute non-specific abdominal pain | 03 | 0.89 % | Acute appendicitis |
| Acute non-specific abdominal pain | 01 | 0.3 % | Ovarian cyst right hemorrhagic |
| Acute non-specific abdominal pain | 01 | 0.3 % | Retrocaecal internal hernia |
| Right ectopic pregnancy | 01 | 0.3 % | LEFT ectopic pregnancy |
| Torsion of the left ovarian cyst | 01 | 0.3 % | Right ovarian cyst torsion |
| Perforation of a duodenal ulcer | 01 | 0.3 % | Perforation of an ileal loop |
| Acute intestinal obstruction due to adhesion | 01 | 0.3 % | Obstruction due to a stromal tumor |
| Total | 53 | 15.73% | |

3.1. Diagnostic Accuracy of Laparoscopy

Calculation of Specificity, Sensitivity, Positive Predictive Value, and Negative Predictive Value of Laparoscopy in our Patients:

A notable observation: all intraoperative diagnoses established by laparoscopy in our study were accurate. Indeed:

- In 335 patients, laparoscopy identified an etiology corresponding to the clinical symptoms (true positives).
- In 02 patients, no organic lesion was found (this diagnosis is also accurate), indicating true negatives.

The diagnostic accuracy, diagnostic sensitivity, diagnostic specificity, positive predictive value, and negative predictive value of laparoscopy were 100% in our study.

Table 3 Specificity, sensitivity, positive predictive value, and negative predictive value of laparoscopy in our patients.

| | Etiological diagnosis established | No etiological diagnosis found | Total | |
|----------------------|-----------------------------------|--------------------------------|-------|-------------|
| Positive laparoscopy | 335 (True positives) | 0 (false positives) | 335 | VPP = 100 % |
| Laparoscopy negative | 0 (False negatives) | 02 (True negatives) | 02 | VPN = 100 % |
| total | 335 | 02 | 337 | |
| | Sensitivity = 100 % | Specificity= 100 % | | |

The average operating time was 52.09 minutes \pm 24.14 minutes, (Range 14 to 178 minutes). The average hospital stay was 1.5 days (range 1 to 8.5 days).

No deaths were recorded, and the rate of postoperative complications was 6.2%.

4. Discussion

Laparoscopy, with its high diagnostic accuracy, allows for complete and direct visualization of the intraperitoneal viscera, significantly reducing therapeutic errors, enabling concurrent surgical treatment, improving postoperative conditions, and facilitating the management of certain patient categories such as obese individuals and pregnant women [1,2].

The diagnostic accuracy, diagnostic sensitivity, diagnostic specificity, positive predictive value, and negative predictive value of laparoscopy in our study were 100%.

This flawless diagnostic precision of laparoscopy in our study is attributable to several factors. The sample size, indeed, with a larger sample than ours, this precision would likely be lower. The involvement of multiple operators and lack of experience in emergency surgery in general and laparoscopic surgery in particular could also reduce the diagnostic precision rate of laparoscopy (in our study, there was only one operator who had previously undergone basic laparoscopic surgery training).

Some authors are convinced that laparoscopy can have an exclusively diagnostic role. When performed correctly, its diagnostic yield surpasses various complementary investigations and explorations. Mortality and morbidity are also reduced [3]. The series by Cuesta on 63 patients with generalized peritonitis demonstrated the purely diagnostic role of laparoscopy, avoiding laparotomy in 59% of patients [4,5].

Several series have demonstrated that laparoscopy avoids unnecessary laparotomies in 36% to 95% of cases [6,7,8]. Laparoscopy confirmed the preoperative diagnosis in 84.27% of cases and corrected the preoperative diagnosis in 15.73%. In Carlo Caruso's series, the diagnostic accuracy is 100%. Laparoscopy corrected the preoperative diagnosis in 5.6% of cases, avoiding unnecessary laparotomy [9]. Moreover, numerous studies have demonstrated the feasibility and safety of diagnostic laparoscopy under general anesthesia [6,10]. Its overall morbidity in the hands of experts ranges from 0% to 8%, with no mortality directly related to this procedure reported [6,11,12]. The diagnostic accuracy of laparoscopy ranges from 89% to 100% [13,14,15] (Table 04).

Table 4 Emergency Laparoscopic Diagnostic Accuracy Rate

| Series | Caruso [9] | Cissé [16] | Fecteau [17] | Muhim [18] | Hallfeldt [19] | Zantut [20] | Golash [21] | Our study |
|--|------------|------------|--------------|------------|----------------|-------------|-------------|-----------|
| Sample size | 300 | 100 | 50 | 176 | 15 | 1320 | 233 | 337 |
| Rate of diagnostic accuracy of laparoscopy | 100 % | 96 % | 90 % | 89 % | 100% | 96 % | 90 % | 100% |

5. Conclusion

Our results suggest that laparoscopy allows for high diagnostic accuracy, enabling exploration of the entire abdominal cavity, with a positive predictive value and negative predictive value approaching 100%. It can be safely used in emergency abdominal surgery, as a substitute for laparotomy. However, we remain convinced that the diagnostic utility of laparoscopy is intimately linked to its therapeutic value.

Compliance with ethical standards

Statement of ethical approval

The data and files of patients presented in this manuscript are available at the Department of General Surgery of the University Hospital of Ain Taya.

Statement of informed consent

All patients consent to their inclusion in this work and the publication of the results.

Author Contributions

All authors contributed to this work.

Funding

Funding will be provided by the lead author, with no funding from any other source.

Availability of Data and Materials

The data (Patient records, information sheets for each patient) are available and entered in Excel and Word formats

References

- [1] Vincenzo Mandalà and all. The role of laparoscopy in Emergency abdominal surgery.
- [2] Domínguez LC, Sanabria A, Vega V, Osorio C. Early laparoscopy for the evaluation of nonspecific abdominal pain: a critical appraisal of the evidence. *Surg Endosc.* 2011 Jan;25(1):10-8. doi: 10.1007/s00464-010-1145-4. Epub 2010 Jun 30. PMID: 20589513.
- [3] Teklali Y, and all : diagnostic laparoscopy in children about 68 cases. *Journal of pidiatry and pukriculture*, Vol 16 - N° 4 - mai 2003. 194-197.
- [4] Vons C. Laparoscopy Aimed diagnostic in abdominal emergencies *Surgery* 1999 ; 124 : 182-186.
- [5] Adams ID, Chan M, Clifford PC, Cooke WM, Dallos V, de Dombal FT, Edwards MH, Hancock DM, Hewett DJ, McIntyre N, et al. Computer aided diagnosis of acute abdominal pain: a multicentre study. *Br Med J (Clin Res Ed).* 1986 Sep 27;293(6550):800-4. doi: 10.1136/bmj.293.6550.800. PMID: 3094664; PMCID: PMC1341582.
- [6] Agresta F, Ansaloni L, Baiocchi GL, Bergamini C, Campanile FC, Carlucci M, Cocorullo G, Corradi A, Franzato B, Lupo M, Mandalà V, Mirabella A, Pernazza G, Piccoli M, Staudacher C, Vettoretto N, Zago M, Lettieri E, Levati A, Pietrini D, Scaglione M, De Masi S, De Placido G, Francucci M, Rasi M, Fingerhut A, Uranüs S, Garattini S. Laparoscopic approach to acute abdomen from the Consensus Development Conference of the Società Italiana di Chirurgia Endoscopica e nuove tecnologie (SICE), Associazione Chirurghi Ospedalieri Italiani (ACOI), Società Italiana di Chirurgia (SIC), Società Italiana di Chirurgia d'Urgenza e del Trauma (SICUT), Società Italiana di Chirurgia nell'Ospedalità Privata (SICOP), and the European Association for Endoscopic Surgery (EAES). *Surg Endosc.* 2012 Aug;26(8):2134-64. doi: 10.1007/s00464-012-2331-3. Epub 2012 Jun 27. PMID: 22736283.
- [7] Society of American Gastrointestinal and Endoscopic Surgeons (SAGES). Guidelines for diagnostic laparoscopy practice/clinical guidelines. Los Angeles : Sages ; 2007.
- [8] Stefanidis D, Richardson WS, Chang L, Earle DB, Fanelli RD. The role of diagnostic laparoscopy for acute abdominal conditions: an evidence-based review. *Surg Endosc.* 2009 Jan;23(1):16-23. doi: 10.1007/s00464-008-0103-x. Epub 2008 Sep 24. PMID: 18814014.
- [9] Caruso C, La Torre M, Benini B, Catani M, Crafa F, De Leo A, Neri T, Sacchi M. Is laparoscopy safe and effective in nontraumatic acute abdomen? *J Laparoendosc Adv Surg Tech A.* 2011 Sep;21(7):589-93. doi: 10.1089/lap.2011.0030. Epub 2011 Jul 20. PMID: 21774701.
- [10] Poulin EC, Schlachta CM, Mamazza J. Early laparoscopy to help diagnose acute non-specific abdominal pain. *Lancet.* 2000 Mar 11;355(9207):861-3. doi: 10.1016/S0140-6736(99)00432-8. PMID: 10752698.
- [11] Gagné DJ, Malay MB, Hogle NJ, Fowler DL. Bedside diagnostic minilaparoscopy in the intensive care patient. *Surgery.* 2002 May;131(5):491-6. doi: 10.1067/msy.2002.122607. PMID: 12019400.
- [12] Pecoraro AP, Cacchione RN, Sayad P, Williams ME, Ferzli GS. The routine use of diagnostic laparoscopy in the intensive care unit. *Surg Endosc.* 2001 Jul;15(7):638-41. doi: 10.1007/s004640000371. Epub 2001 May 14. PMID: 11591958.
- [13] Gerhardt RT, Nelson BK, Keenan S, Kernan L, MacKersie A, Lane MS. Derivation of a clinical guideline for the assessment of nonspecific abdominal pain: the Guideline for Abdominal Pain in the ED Setting (GAPEDS) Phase 1 Study. *Am J Emerg Med.* 2005 Oct;23(6):709-17. doi: 10.1016/j.ajem.2005.01.010. PMID: 16182976.

- [14] Muhammed Ashraf Memon and all. The role of minimal access surgery in the acute abdomen. *Abdominal emergencies ; surgical clinics of north america*. Volume 77 * number 6 december 1997. Pages 1333-1353.
- [15] Hünnerbein M, Rau B, Hohenberger P, Schlag PM. The role of staging laparoscopy for multimodal therapy of gastrointestinal cancer. *Surg Endosc*. 1998 Jul;12(7):921-5. doi: 10.1007/s004649900747. PMID: 9632861.
- [16] Cissé M, and all. Emergency laparoscopy at Aristide Le Dantehospital : the first 100 cases General Surgery Department, university hospital Aristide Le Dantec, Dakar, Senegal. *E- memories of the National Academy of Surgery*, 2009, 8 (3) : 78-81.
- [17] Fecteau G, Desrochers A, Francoz D, Nichols S. Diagnostic Approach to the Acute Abdomen. *Vet Clin North Am Food Anim Pract*. 2018 Mar;34(1):19-33. doi: 10.1016/j.cvfa.2017.10.001. Epub 2017 Dec 9. PMID: 29233583.
- [18] Al-Mulhim AS, Nasser MA, Abdullah MM, Ali AM, Kaman L. Emergency laparoscopy for acute abdominal conditions: a prospective study. *J Laparoendosc Adv Surg Tech A*. 2008 Aug;18(4):599-602. doi: 10.1089/lap.2007.0199. PMID: 18721012.
- [19] Hallfeldt, K., Trupka, A., Erhard, J. et al. Laparoscopie d'urgence pour les plaies abdominales par arme blanche. *Surg Endosc*. 12, 907-910 (1998). <https://doi.org/10.1007/s004649900743>.
- [20] Zantut LF, Ivatury RR, Smith RS, Kawahara NT, Porter JM, Fry WR, Poggetti R, Birolini D, Organ CH Jr. Diagnostic and therapeutic laparoscopy for penetrating abdominal trauma: a multicenter experience. *J Trauma*. 1997 May;42(5):825-9; discussion 829-31. doi: 10.1097/00005373-199705000-00012. PMID: 9191663.
- [21] Golash V, Willson PD. Early laparoscopy as a routine procedure in the management of acute abdominal pain: a review of 1,320 patients. *Surg Endosc*. 2005 Jul;19(7):882-5. doi: 10.1007/s00464-004-8866-1. Epub 2005 May 12. PMID: 15920682.