LAPAROSCOPIC SURGERY A PARADIGM SHIFT IN TREATMENT OF ACUTE ABDOMINAL EMERGENCIES

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Abstract

Laparoscopic surgery has revolutionized the management of abdominal emergencies, offering a minimally invasive alternative with a history of skepticism that turned to widespread acceptance after the 1980s' technological advancements. Its adoption in emergencies draws from its elective success, touting reduced incision sizes, diminished pain, lower infection risks, and expedited recovery. This retrospective study analyzed clinical records from Târgu Mureș County Clinical Emergency Hospital's General Surgery Department I over eight years. It focused on laparoscopic versus open surgical approaches for various abdominal emergencies, excluding thoracic, vascular, and traumatic cases. Data encompassed demographic details, operative duration, postoperative complications, conversion rates, and hospitalization length, analyzed using Graph Pad Prism and EasyMedStats©, with ethical oversight by SCJU Clinical Hospital Tg. Mures. Laparoscopic procedures outnumbered open surgeries, with appendicitis being the most common emergency. Notably, laparoscopic approaches saw fluctuating but generally declining admissions from 2014 to 2021, mainly due to the COVID-19 pandemic. Operative times were shorter for laparoscopy across all procedures, with hospital stays also reduced for laparoscopic methods except in incisional hernia repairs, where times were comparable. Conversion rates varied, with hernia repairs least likely to convert and appendectomies most likely. The study underscores the preferential role of laparoscopy in emergency surgical care, aligning with shorter operative times and hospital stays. Despite higher conversion rates for certain conditions, the benefits of laparoscopy remain compelling. Ongoing advancements in laparoscopic technology will further solidify its pivotal role in modern surgical practice.

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Introduction

Laparoscopic surgery has brought about a transformation in the field of abdominal emergencies, representing a significant shift in surgical interventions. Its origins can be traced back to the century with notable contributions from pioneers like Georg Kelling and Hans Christian Jacobaeus [1-6]. Initially met with skepticism, laparoscopic surgery gradually gained acceptance with the integration of video technology in the 1980s, significantly improving visibility and precision. The application of techniques in emergency surgery is based on the success observed in laparoscopic procedures [4-8]. This transition is rooted in the advantages of laparoscopy over open surgery. Notably, it requires small incisions, reducing pain, lower risk of wound infections, and faster recovery times [7-17]. The enhanced visualization of the laparoscope enables variable surgical maneuvers, ultimately improving patient outcomes in critical situations where timing and accuracy are paramount. Laparoscopic surgery has proven to be invaluable for diagnosing and managing a range of conditions during abdominal emergencies, including appendicitis and perforated ulcers. Its ability to swiftly assess and intervene without incisions has revolutionized emergency care by offering patients a less invasive option while facilitating a quicker return to normal activities [18-22]. The evolution and widespread adoption of surgery for emergencies underscore its significant role in advancing surgical practice by providing a minimally invasive yet highly effective treatment approach within emergency surgical care [22-26].

Materials and Method

This retrospective observational cohort study was conducted through analysis of clinical observation records with the primary objective of critically evaluating the efficacy and outcomes associated with the laparoscopic approach in managing acute surgical abdomen cases within the Department of General Surgery I at Târgu Mureș County Clinical Emergency Hospital; the data compilation spanned an extensive period of eight years (January 2014 and December 2021), offering a robust dataset for analysis and ensuring a thorough understanding of the longitudinal trends in laparoscopic surgery outcomes. Inclusion criteria were strictly delineated to encompass patients presenting with the acute surgical abdomen, admitted over the specified timeframe, with the study meticulously documenting and analyzing their treatment journey while cases entailing thoracic pathology, peripheral vascular conditions, and traumatic acute abdomen were deliberately excluded to maintain focus and clarity, given that these conditions are extensively covered in separate studies; critical data points from patient recorded encompassing type of surgical intervention, operation time, conversion rate and hospital admission period. Statistical analysis was performed using Graph Pad Prism Version 9 and EasyMedStats© software. While this retrospective study adhered rigorously to ethical standards in healthcare research, approval was secured from the institutional review board of SCJU Clinical Hospital Tg. Mures, with stringent adherence to patient confidentiality and data protection norms in line with prevailing medical research ethics and regulations.

Results

The total number of laparoscopic surgeries surpasses that of open surgeries, indicating a higher overall prevalence or preference for the laparoscopic approach in the data presented. Acute appendicitis has the highest number of surgeries, both open and laparoscopic. Acute cholecystitis and peptic ulcers also have a considerable number of surgeries, but the preference leans more towards open surgery compared to

laparoscopic methods. Incarcerated hernias: both types of incarcerated hernias (incisional and non-incisional) show a notable difference in the number of open versus laparoscopic procedures, with open surgeries being more frequent. Acute adhesive small bowel obstruction: similar to the hernia cases, there is a marked preference for open surgeries over laparoscopic surgeries for this condition (Figure 1).

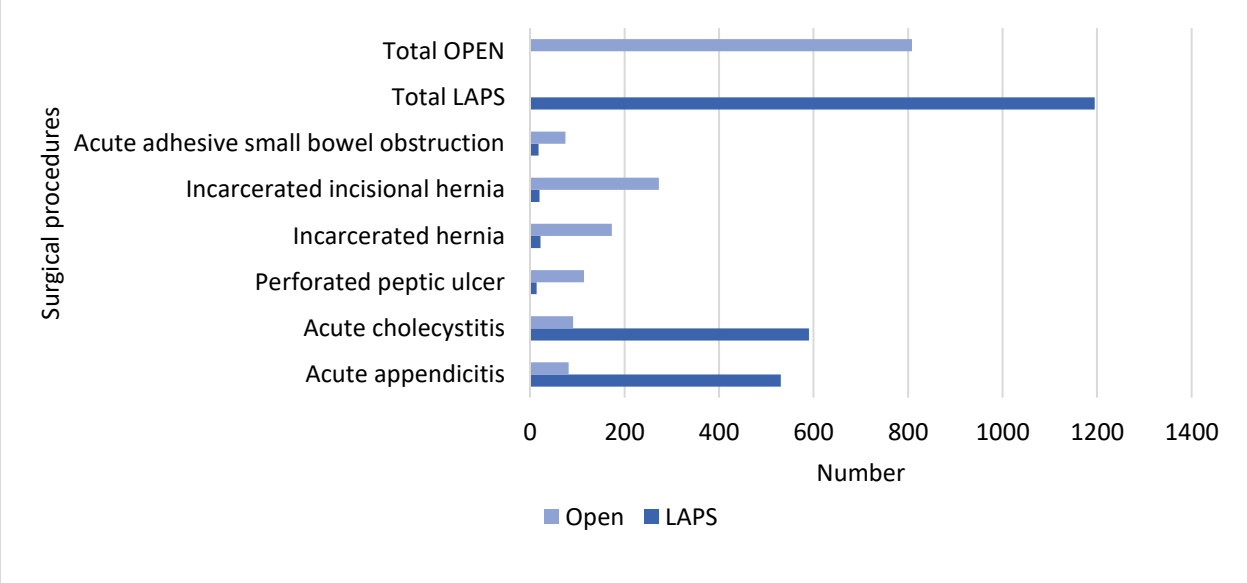

Figure 1 - Surgical procedures OPEN vs LAPAROSCOPIC

There is a declining trend in the total number of emergency hospital admissions from 2014 to 2021, mainly due to the COVID-19 pandemic period with early contraindications of laparoscopic procedures. The peak occurred in 2018, with 348 admissions, while the lowest was in 2021, with 185 admissions. The number of laparoscopic approaches to emergency admissions seems to fluctuate year by year. There was an initial increase from 2014 to 2017, reaching its peak in 2017 with 293 cases. Subsequently, there is a notable decline with some fluctuations, ending with 73 cases in 2020 and 2021. The frequency of open approaches appears to have a somewhat inverse relationship with the laparoscopic approaches. Starting at 276 cases in 2014, there was a sharp decline until 2016, followed by a rise peaking in 2018, and then a decline again, mirroring the pattern of total cases but at lower numbers (Figure 2).

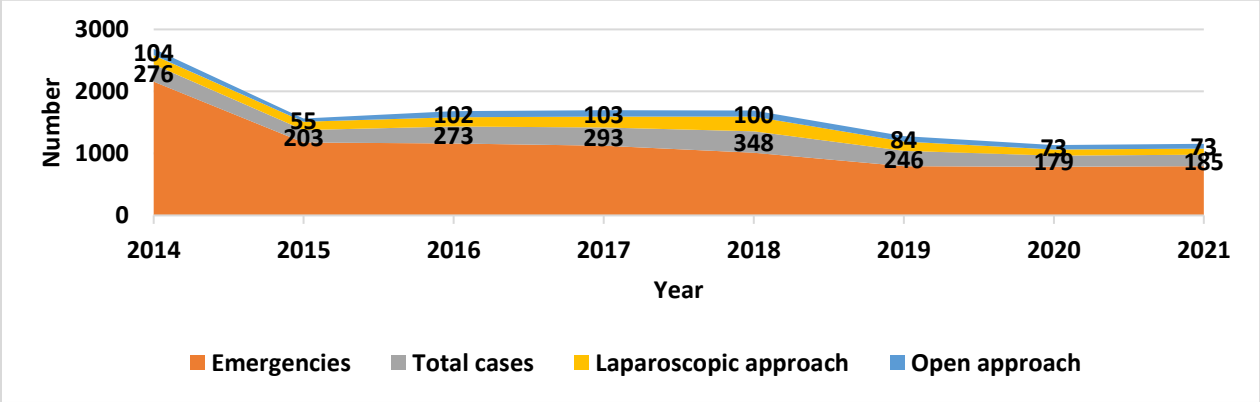

Figure 2 - The evolutions of emergency hospital admissions OPEN vs LAPAROSCOPIC

Regarding operative time, laparoscopic appendectomy is reported with an average operative time of 62.98 minutes, while open appendectomy has a slightly longer average operative time of 71.00 minutes. Laparoscopic cholecystectomy had an average operative time of 79.91 minutes, while open cholecystectomy had a significantly longer average operative time of 117.76 minutes (including initial laparoscopic attempt and conversion time) (Figure 3).

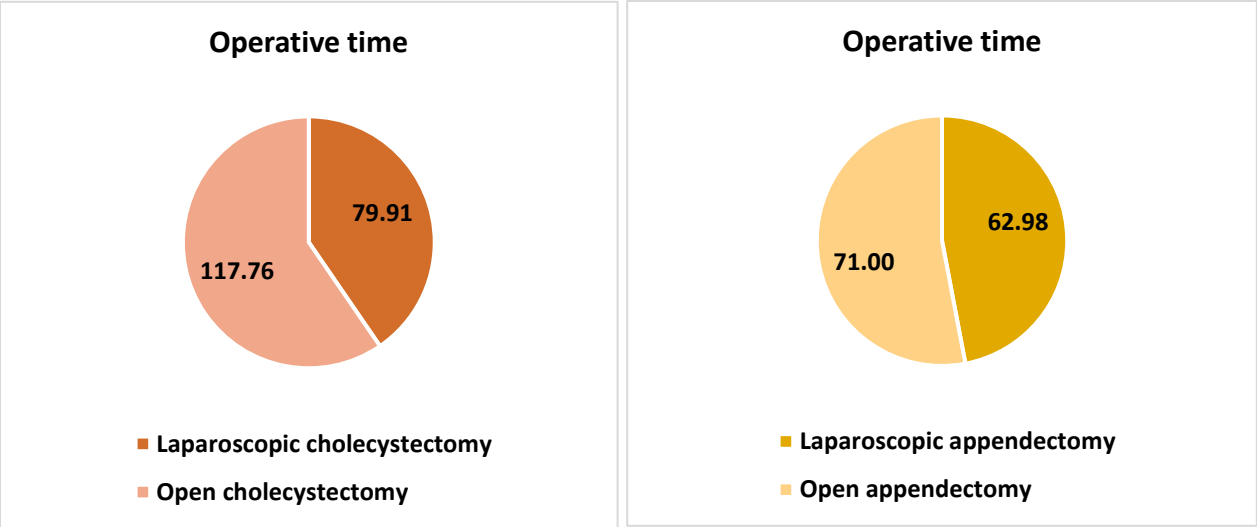

Figure 3 - Operative time for Appendectomy and Cholecystectomy

Laparoscopic hernia repair is noted to take 68.74 minutes on average. The open hernia repair takes a longer average time of 114.06 minutes. For laparoscopic incisional hernia repair, the average operative time is 123.10 minutes. The open incisional hernia repair takes a marginally longer average time, at 123.99 minutes, nearly equivalent to the laparoscopic time (Figure 4).

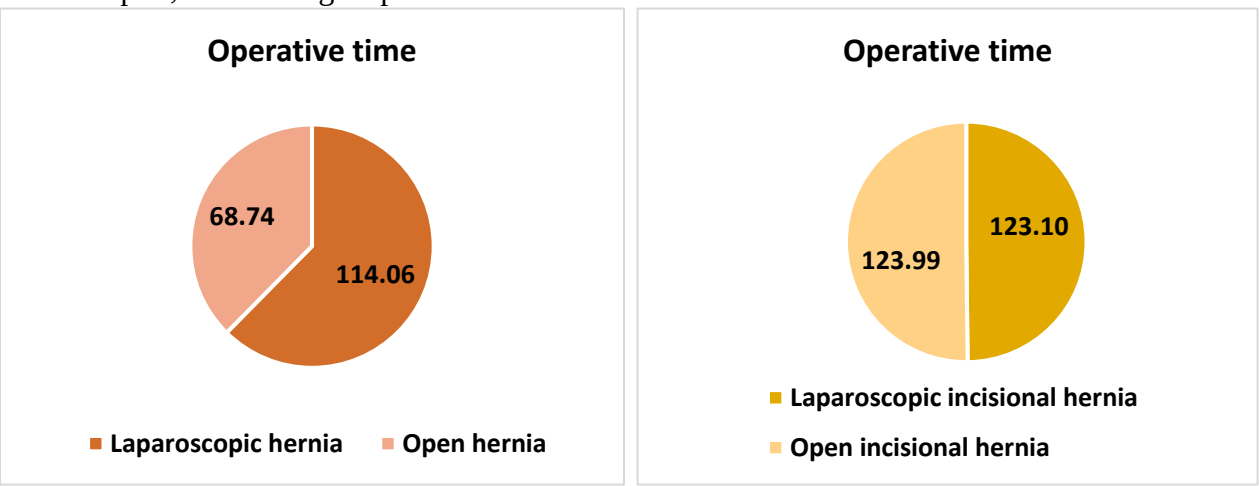

Figure 4 - Operative time for Hernia and Incisional Hernia

Laparoscopic perforated ulcer repair has an average operative time of 64.94 minutes, while open perforated ulcer repair has a longer average operative time of 78.09 minutes. The operative times for acute adhesive small bowel obstruction: the laparoscopic approach has an average operative time of 78.75 minutes. The open approach takes longer, with an average time of 107.49 minutes (Figure 5).

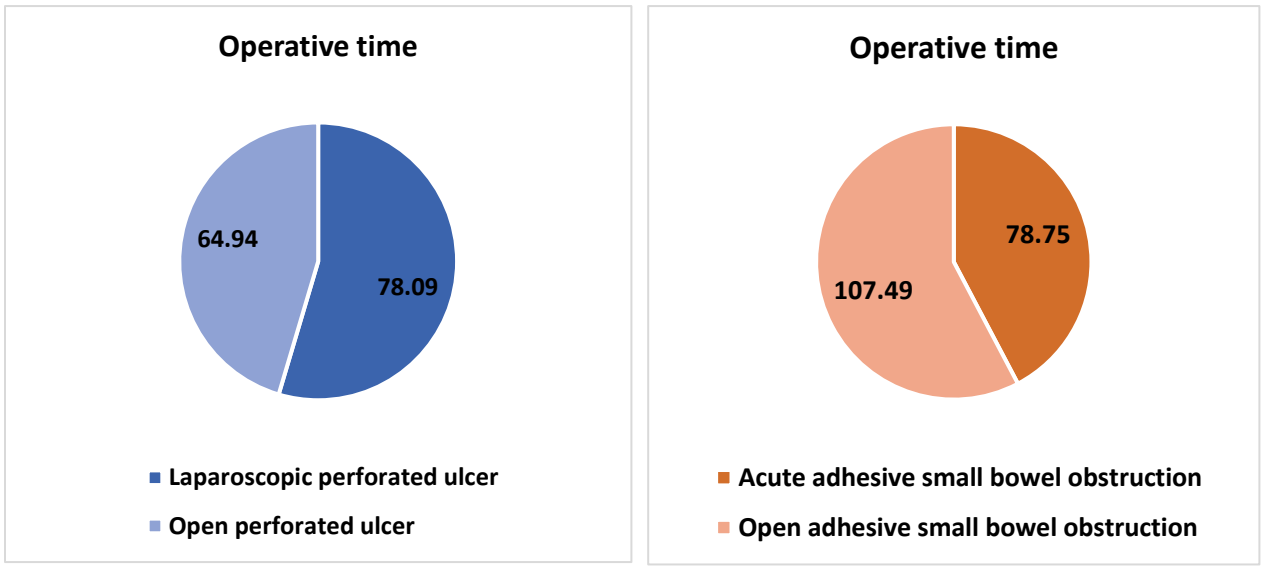

Figure 5 - Operative time for Perforated peptic ulcer and Adhesive small bowel obstruction

Perforated peptic ulcer: patients undergoing laparoscopic repair of a perforated peptic ulcer have a significantly shorter average hospital stay of 2.63 days compared to those undergoing open surgery, who stay for an average of 7.26 days. Acute adhesive small bowel obstruction: for this condition, laparoscopic surgery results in an average hospital stay of 3.3 days, whereas open surgery leads to a considerably more extended stay of 8.58 days. Incisional hernia: laparoscopic repair of incisional hernias is associated with an average hospital stay of 4.06 days, in contrast to open repair, which has an average stay of 8.6 days. The mean hospital stay following laparoscopic hernia repair is 3.72 days, while open hernia repair leads to a slightly more extended stay of 4.7 days. Appendectomy: laparoscopic appendectomy patients have an average stay of 3.48 days, shorter than the 4.94 days for those who had an open appendectomy. Cholecystectomy: patients who undergo a laparoscopic cholecystectomy have an average hospital stay of 3.2 days. This is less than half the duration compared to open cholecystectomy patients, with a mean stay of 7.5 days (Figure 6).

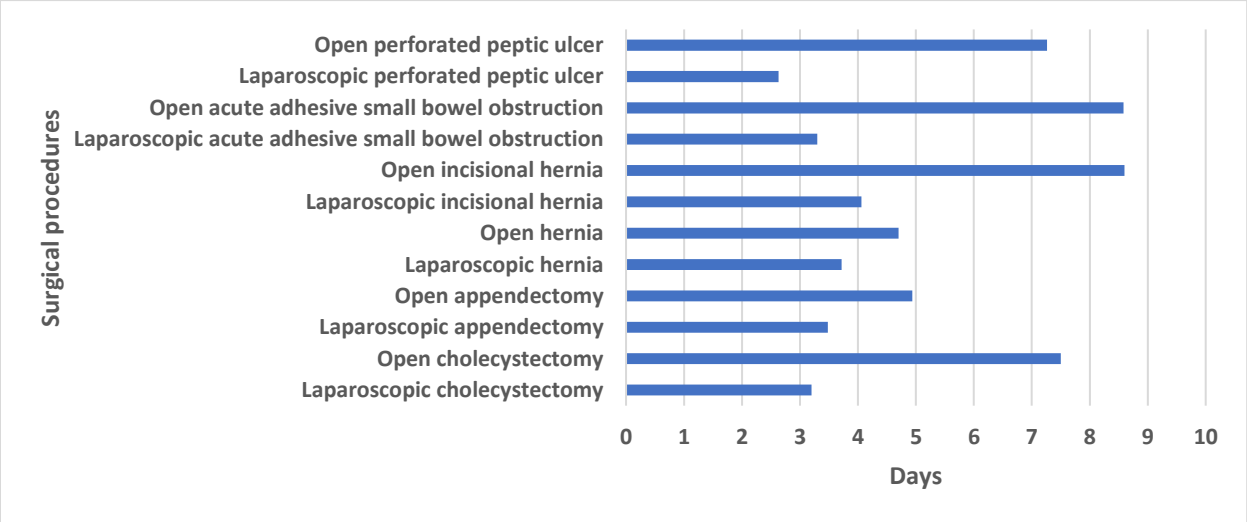

Figure 6 - Average hospital stay per surgical procedure

Laparoscopic cholecystectomy: stands with a conversion rate of 33 cases. Laparoscopic appendectomy: this shows a higher conversion rate of 51, indicating a greater likelihood of needing to switch to an open procedure compared to laparoscopic cholecystectomy. Laparoscopic hernia repair: interestingly, the conversion rate is 0. Laparoscopic incisional hernia repair: there has been a slight increase in the conversion rate to 3 cases. Laparoscopic acute adhesive small bowel obstruction: the conversion rate of 4 cases is slightly higher than incisional hernia repairs. Laparoscopic perforated peptic ulcer repair indicates a conversion rate of 5 cases, which is the highest rate after appendectomy (Figure 7).

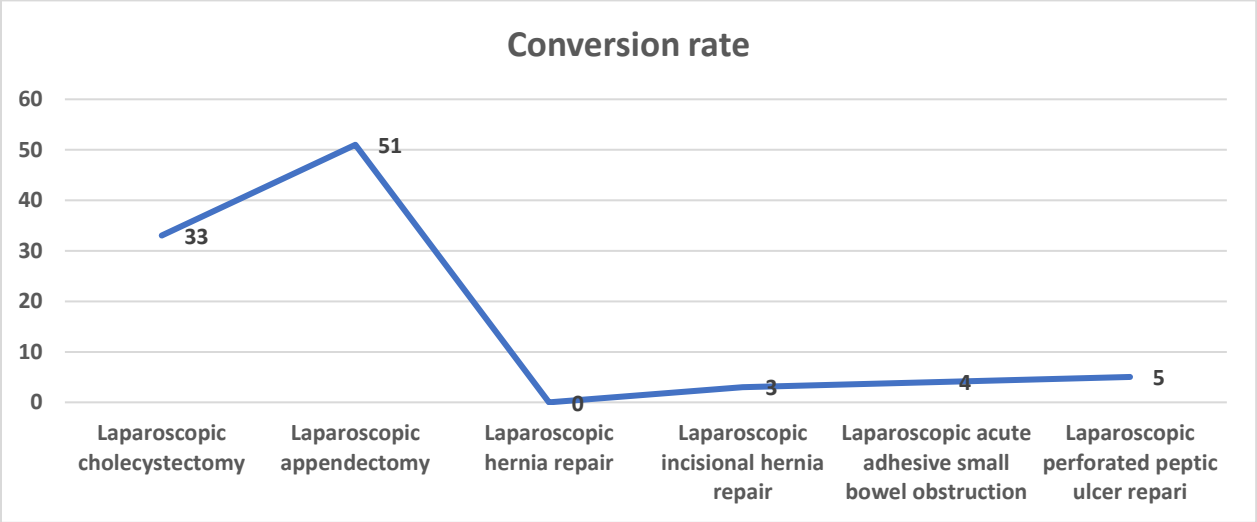

Figure 7 - Conversion rate LAPAROSCOPY to OPEN based on procedures

Discussions

The management of acute appendicitis, the most common cause of surgical abdominal emergencies, has evolved significantly over time. From McBurney's first documented appendectomy in 1889 to Hans de Kok's inaugural laparoscopically assisted appendectomy in 1977, surgical techniques have undergone remarkable advancements [7-9]. Di Saverio's 2020 research highlights the laparoscopic approach as the most effective treatment for acute appendicitis, particularly beneficial for specific demographics like obese patients, the elderly, and pregnant women, as noted in studies by Wang (2019) and Lee (2019) [23-25]. For pregnant women, laparoscopy, with modifications tailored to gestational age, has been recommended by Jackson (2008) as an excellent option by experienced teams [26].

Despite its longer operative time and higher costs, laparoscopic appendectomy, as reported by De Kok (1977) and Werkgartner (2014), significantly reduces postoperative pain, wound infection rates, and hospitalization durations [27-28]. The laparoscopic method has also been the gold standard in acute cholecystitis treatment for simple and gangrenous forms across varied age groups, as evidenced by Agresta (2012) and Agrusa (2013) [29-30]. This approach is linked to reduced rates of morbidity and mortality, shorter hospital stays, and fewer skin infections and pneumonia cases.

However, the laparoscopic approach does have an increased risk of common bile duct (CBD) injury compared to the open approach, with incidences of 0.46-0.47% versus 0.19-0.20%, as Peschaud (2006) reports [31]. Borzellino (2008) argues that laparoscopy does not increase the risk of

postoperative complications [32]. In situations involving intense inflammation of the gallbladder pedicle, subtotal cholecystectomy is considered an acceptable alternative, although it carries a higher risk of CBD injury. The timing of intervention in acute cholecystitis is critical. Campanile (2012) found that the conversion rate is 9.5% if surgery is performed within the first two days of symptom onset, increasing to 16.1% after four days [33]. Coccolini (2015) observed significant differences between laparoscopic and open approaches in terms of mortality (0% vs. 3.17%), morbidity (17.53% vs. 27.56%), and operative times (reducing from 108.2 minutes in 1998 to 73.2 minutes in 2007). The bile duct fistula rates were 1.16% for laparoscopic and 0.92% for open approaches [34].

Regarding conversion rate, operating time, and hospital admission time, we compared our results with those of other studies in recent literature. For acute appendicitis, Kucuk (2014) reported a rate of 1.3% conversion rate, Agresta (2012) found a slightly higher rate of 4.6%, and Thereaux (2014) observed a rate of 3.5% [29,35-36]. These figures contrast with the current study's result, which shows a notably higher conversion rate of 9.62%. In the case of acute cholecystitis, the conversion rate is contingent upon the timing of the surgical intervention. If the laparoscopic procedure is conducted within the first two days of symptom onset, the rate is 9.5%, as per Campanile (2012) [33]. However, this rate escalates to 16.1% if the surgery is delayed until four days post-symptom onset. Comparative data from other studies are also provided, with the CholeS Study Group (2016) reporting a conversion rate of 3.4% across a substantial sample of 8820 patients and Nassar A.H (2022) finding an even lower rate of 0.49% among 5738 patients [2-3]. The study in question reports a conversion rate of 5.59% for acute cholecystitis, situating it between the above-mentioned rates. The discussion of incarcerated hernia surgery shows a diversity of conversion rates from different studies, with rates of 1.03% for TAPP and 9.7% for TEP, as reported by Sartori (2022) in a meta-analysis of 433 patients, 4% TAPP by Zanoni (2022), and a 0% TAPP rate reported by Liu (2022) [4-6]. Additionally, Shah's study (2008) presents a conversion rate of 1.78% in the case of IPOM [8]. The current study observed no conversions (0%) in incarcerated hernia surgeries. For perforated peptic ulcers, a wide range of conversion rates are presented in different studies: Tartaglia (2023) reports a range of 10.4% to 52.7%, while Coe (2022) documents a conversion rate of 31% [9-10]. We reported a conversion rate of 22.22%, which falls within the lower end of the range reported by Tartaglia but is below the rate reported by Coe. Regarding acute adhesive small bowel obstruction, Valverde (2019) reported a conversion rate of 38.5%, and Gomez (2021) with a notably lower rate of 1.4% [11,37]. Our study highlighted a conversion rate of 35.71%, close to the rate reported by Valverde but significantly higher than that reported by Gomez.

For different laparoscopic surgeries, as recorded in various studies, operative times differ among literature sources for laparoscopic appendectomy studies. Kumar (2016) reports an average time of 44.57 ± 6.68 minutes. Zhang (2022) is noted as having a shorter operative time, though the exact figure is not given, and Jeon (2016) records an operative time of 57.6 minutes [38-40]. The study in question shows an operative time of 62.98 minutes for laparoscopic appendectomy, which is longer than the times reported in the abovementioned studies. In the case of laparoscopic cholecystectomy, several operative times are reported: Coccolini (2015) reports an operative time of 73.2 minutes, Nassar A.H (2022) finds a much longer average time of 195 minutes based on a large cohort of 5738 patients, the CholeS Study Group (2016) records an operative time of 120 minutes from a substantial patient group of 8820 [2,3,34]. Our current study shows an

operative time of 79.91 minutes, placing it on the lower end of the spectrum compared to the times listed. Lastly, for laparoscopic hernia repair, Liu (2022) reports an operative time of 61.6 ± 17.7 minutes for TAPP (transabdominal preperitoneal) procedures, Sartori (2022) provides a range of 94.4 ± 40.2 minutes from a meta-analysis of 433 patients, Shah (2008) details an operative time of 96 ± 40.8 minutes for ventral hernia repairs [4,6,8]. The study reports two results for laparoscopic hernia repair: between 114.06 minutes and 123.10 minutes, which are higher than the times provided by the other sources. For perforated peptic ulcer repair: The study by Muacevic (2022) reports an operative time of 109.35 ± 17.02 minutes. Tartaglia (2023) lists an operative time of 119.4 ± 68.8 minutes [9]. Our results are significantly lower, at 78.09 minutes, suggesting a more efficient procedure time than the referenced studies. Valverde (2019) reports an operative time of 103.11 ± 48.2 minutes concerning acute adhesive small bowel obstruction [11]. Gomez (2021) provides two separate figures for different techniques: 167.5 minutes for the multiport approach and 129.2 minutes for the SILS (Single Incision Laparoscopic Surgery) approach [37]. Our findings are 78.75 minutes, considerably less than the figures reported by Valverde and Gomez, indicating a potential improvement in operative efficiency for this condition.

Regarding the hospital admission period for laparoscopic appendectomy, Kumar (2016) reported an average hospital stay of 2.63 ± 0.60 days [38]. Zhang (2022) reported a shorter hospital stay, though the exact duration is not specified [39]. Jeon (2016) reported a more extended average stay of 5.55 days [40]. The current study shows an average hospital stay of 3.48 days, within the range but higher than Kumar's result. Coccolini (2015) reports an average stay of 2.43 days in laparoscopic cholecystectomy [34]. Nassar A. (2022) recorded a much more extended stay of 11 days in a large sample of 5738 patients [2]. The CholeS Study Group (2016) documented an even more extended average stay of 14 days in a cohort of 8820 patients [3]. We reported an average hospital stay of 4.45 days, shorter than Nassar and CholeS Group but longer than Coccolini's finding. Liu (2022) reported an average stay of 3.9 ± 2.2 days for laparoscopic hernia repair [6]. Sartori (2022) conducted a meta-analysis of 433 patients, finding an average stay of 4.8 ± 2.2 days [4]. Shah (2008) reported an average stay of 2.8 ± 1.5 days for ventral hernia repairs [8]. The current study presents an average stay of 3.72 days, within the range of reported studies. For laparoscopic perforated peptic ulcer repair, Muacevic (2022) reported an average hospital stay of 5.10 ± 0.87 days. Tartaglia (2023) reported a more extended hospital stay of 6.6 days [9]. The current study shows a significantly shorter hospital stay of 2.63 days, suggesting more efficient recovery or hospital processes. Finally, Valverde (2019) reported a hospital stay of 5 days for acute adhesive small bowel obstruction [11]. Gomez (2021) provided two figures based on the surgical approach: 2.2 days for multiport and 3.2 days for SILS (Single Incision Laparoscopic Surgery) [37]. Our study indicates an average hospital stay of 3.3 days, which is shorter than Valverde's reported stay but falls within the range provided by Gomez for different surgical techniques.

Conclusions

In conclusion, our study reaffirms the growing prominence of the laparoscopic approach in various emergency surgical scenarios. While challenges such as higher conversion rates in specific procedures like laparoscopic appendectomy exist, the overall benefits, including shorter operative times for specific conditions and reduced hospital stays, highlight this technique's advantages. Future research and advancements in laparoscopic technology and techniques are poised to enhance its efficacy further and expand its

applicability, solidifying its role as a cornerstone in the landscape of modern surgical care.

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