Safety and Feasibility of Using a 5 mm High-Definition 30-Degree Angled Scope in Laparoscopic Cholecystectomy

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Background: The trocar site hernia following laparoscopic cholecystectomy is an important complication after this type of operation. Thus, the scientific community is always welcoming any new approach aiming to reduce its rate.

Patients and methods: The objective of this retrospective study is to assess the rate of trocar site hernia as well as other complications after a new approach 5-10-5-5 with a 5 mm High-Definition Angled Scope. Records and videos of the operations of eligible patients who underwent laparoscopic cholecystectomy at the Aswan University Hospital's general surgery department were included.

Results: 1027 patients were included in the analysis of this study. Most of the participants were females, representing 93.18% of patients. The mean age of participants was 44.48±11.94 years, the mean ± SD operative time was 88.90±28.30 minutes, and the median (IQR) was 83.5 (32.5) minutes. After the follow-up period of 9-49 months, the average follow-up period was 28.63 ± 11.95 months, and no patient developed a trocar site hernia.

Conclusion: The new approach 5-10-5-5 with 5 mm High-Definition Angled Scope technique provides a safe, and effective technique for laparoscopic cholecystectomy.

Key words: 5 mm High-Definition Angled Scope, 5-10-5-5 approach, trocar site hernia, laparoscopy, cholecystectomy.

Introduction

Laparoscopic surgery has emerged as the preferred standard of care for a variety of surgical procedures, offering reduced perioperative complications, accelerated recovery, and superior cosmetic results.[1] It has now become the preferred method for nearly all abdominal surgeries. The concept of laparoscopic surgery was initially introduced by American surgeon Ruddock in the early 1930s, emphasizing its diagnostic superiority over open surgery.[2,3] The inaugural laparoscopic procedure was performed by Professor Mühe of Bħblingen in 1985.[4]

Since its introduction, laparoscopic surgery's minimal morbidity and mortality rates have led to widespread adoption. However, the increased use of laparoscopy in surgical interventions has raised concerns, including the occurrence of trocar site hernias. Despite its rare incidence (1% to 3%), trocar site hernias (TSH) represent a source of morbidity.[5] This is noteworthy as laparoscopic surgery, while requiring small incisions for trocar insertion, continues to be associated with favorable outcomes.

The most common approach uses a 10-mm laparoscope through a 10–12-mm umbilical port, combined with 2 × 5-mm lateral ports and a 5–10-mm epigastric port.[6]

Technical developments in minimally invasive abdominal surgery have introduced novel approaches such as mini-laparoscopic,[7] 3-incision,[8] single incision,[9] and natural orifice,[10] cholecystectomy. These have evolved to reduce post-operative pain and complications, improve patient satisfaction, and allow an earlier return to work compared with the traditional four-port operation. Twelve-millimeter laparoscopic ports are associated with higher rates of trocar site hernias compared with 10-mm ports.[11]

However, there is insufficient data to show that 5-mm ports result in lower rates of trocar site hernias than larger-sized ports.[5] Therefore, this current study aimed to assess the safety, feasibility, and possible advantages or disadvantages of using a HD 5-mm angled scope in laparoscopic cholecystectomy.

Patients and methods

Study design

DOI: 10.21608/ASJS.2024.312863.1155

The study complied with the most recent version of the Declaration of Helsinki and adopted the well-recognized GCP criteria. Furthermore, it was authorized by the Local Ethics Committee and complied with all applicable national rules and regulations. Under the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) Statement checklist, this study was planned as a single-group quasi-experimental investigation.[17]

The study, approved by the institutional review board, Faculty of Medicine, Aswan University, was conducted on patients who attended the general surgery outpatient clinic at Aswan University Hospital from December 2019 until March 2023. Retrospectively, we will review the medical records of patients who underwent laparoscopic cholecystectomy, who were operated upon at our institute in the mentioned period, using a HD 5-mm angled scope. The study covered all cases—male or female, 18 years of age or older—that came to the center and underwent Laparoscopic Cholecystectomy.

For inclusion in the analysis of the study, patients must have undergone laparoscopic cholecystectomy using a HD 5-mm angled scope, have a complete recorded video of the operation available, and complete follow-up data are available.

Records of patients who were operated upon using any scope other than a 5 mm HD angled scope or patients who had an umbilical or paraumbilical hernia done with laparoscopic cholecystectomy were excluded from the analysis.

Technique description

The operative technique for cholecystectomy was the standard four-port approach 10-10-5-5, but we used a 5 mm HD angled scope through a 5.5 mm umbilical port (5-10-5-5). Operative findings were documented and the degree of difficulty dissecting the GB and the cystic duct and artery.[13] The umbilical fascial incision was not closed, and also the umbilical skin incision.

Data regarding the quality of view, the operative findings and duration, procedural difficulties, complications, and conversion were checked for in the records. Operative time and length of hospital stay were also recorded as surrogate markers for operative difficulty and early complications, respectively. Operative complications were recorded in the immediate post-operative period and routine follow-up was done. The demographic data included the incidence, presence of comorbidities, BMI, history of previous abdominal operations, and indications for surgery.

Objectives

This study's main goal is to assess the new method in terms of the rate of trocar site hernia (TSH). The surgical success, length of the procedure, and complications (such as infection, seroma, hematoma) were the secondary outcome variables.

Statistical analysis

Considering the preliminary descriptive nature of this study, a sample size calculation was not performed. Continuous data were presented in mean ± SD (Standard deviation) or median+ IQR (Interquartile range) according to the normality test of the variable distribution. For qualitative data, we used numbers and percentages. SPSS software (Statistical Package for the Social Sciences, version 25.0, SSPS Inc, Chicago, IL, USA) was used for the statistical analyses.

Results

In this study, the data of 1027 patients who underwent laparoscopic cholecystectomy from December 2019 to March 2023 were included in the analysis of this study.

Baseline characteristics

As seen in **(Table 1)**, the average age of patients was 44.48±11.94 years. The majority of cases were female 957 (93.18%). Only 30 cases (2.92%) had normal weight, 318 (30.96%) were "overweight," and 679 (66.11%) were "Obese". The average BMI was 32.75±4.79 Kg/m2. Only 100 (9.74%) had hypertension, 104 (10.13%) DM, and 37 (3.60%) IHD. About half of the cases, 521 (50.73%), were ASA II, 482 (46.93%) were ASA I and only 24 (2.34%) were ASA III.

As for the indication for operation, 905 (88.12%) of patients had chronic calcular cholecystitis and 3 (0.29%) Gallstone pancreatitis. Other indications are shown in **(Table 1).**

Operative details

All cases underwent laparoscopic cholecystectomy the new (5-10-5-5 technique). All the ports had a width of 5 mm except the epigastric one (10 mm).

As depicted in Table 2, the mean ± SD operative time was 88.90±28.30 minutes, and the median (IQR) was 83.5 (32.5) minutes. Port site bleeding occurred in one case **(Fig. 1).** Omental entrapment in veress needle occurred in another case **(Fig. 2).** The first port insertion was made within peritoneal adhesions in one case **(Fig. 3).** An extra port was needed in ectopic GB in one case and another for assessment of a left groin hernia in another case. The success rate of the surgery was 100%, with no case needing to be redone or converted to open surgery. The average ± SD duration of hospital stay was 1.11±0.55 days, and the median (IQR) was 1 (0).

Postoperative follow-up

Only 9 cases (0.88%) experienced seroma, 4 (0.39%) hematoma, and another 18 (1.75%) port-site infection during one month of the post-operative period.

The average follow-up period was 28.63 ± 11.95 months. In 108 cases (10.52%) the follow-up duration was 9-12 months, 320 (31.16%) 13-24 months, and 599 (58.33) 25-49 months. None experienced trocar site hernia during the study's follow-up period.

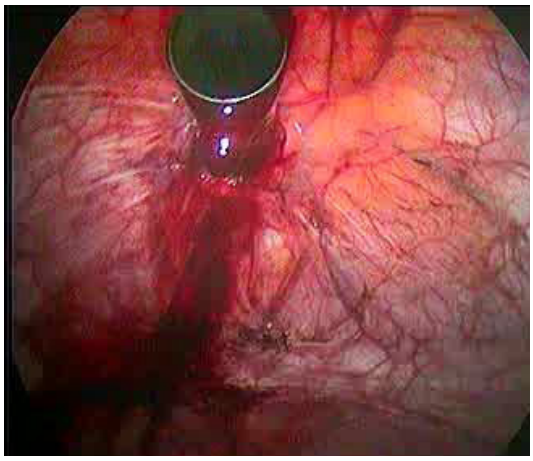

Fig 1: Umbilical port bleeding.

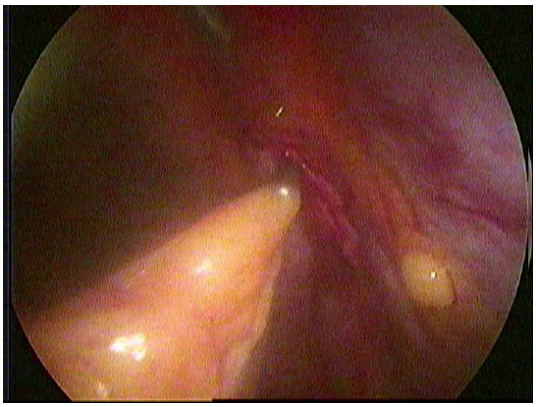

Fig 2: Veress needle entangles the greater omentum.

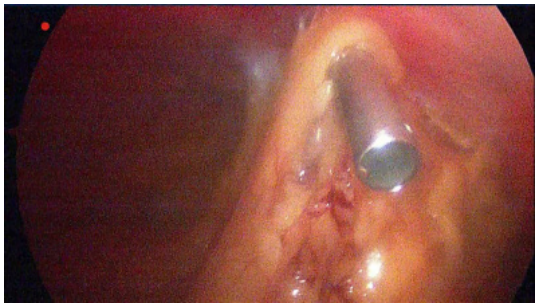

Fig 3: The umbilical port insertion within adhesions.

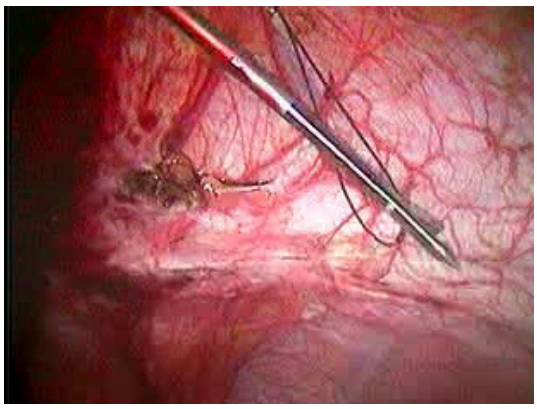

Fig 4: Fascial closure device to control port site bleeding.

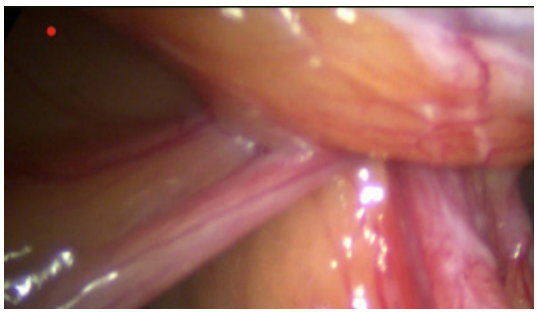

Fig 5: Paraumbilical hernia.

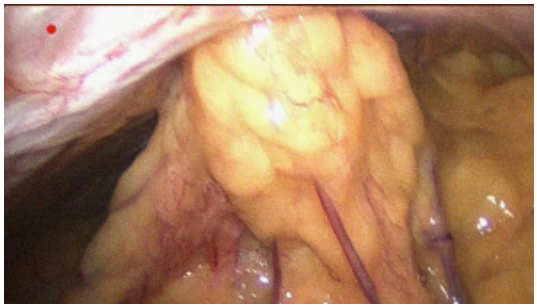

Fig 6: Incisional hernia.

Fig 7: Vision-assisted placement of the umbilical port.

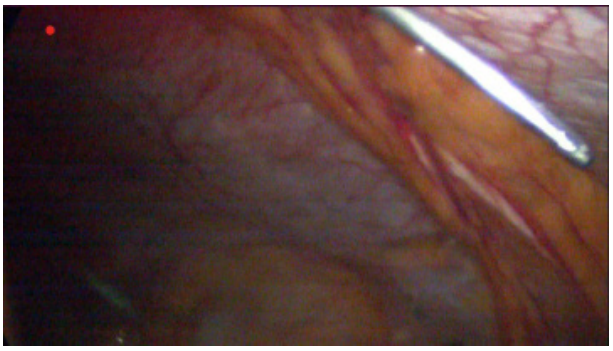

Fig 8: Assessment of veress needle insertion if we are in doubt.

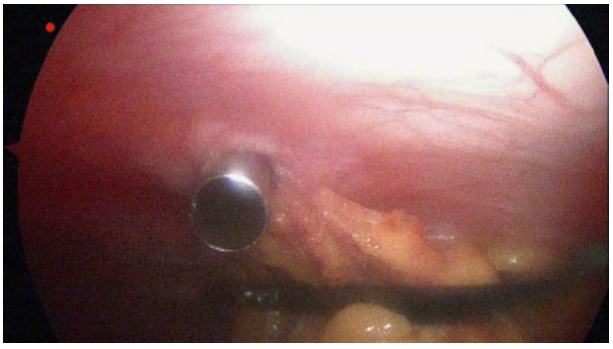

Fig 9: The umbilical port is dissected away from the adhesions.

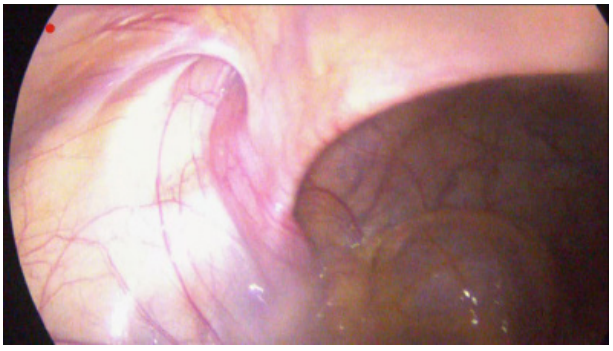

Fig 10: Patent Processus vaginalis where our scope is in the umbilical port.

Fig 11: Patent Processus vaginalis where our scope is in a left lateral port.

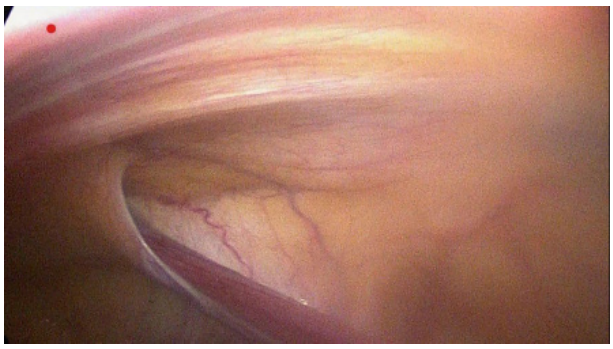

Fig 12: Intraoperative diagnosis of right oblique inguinal hernia.

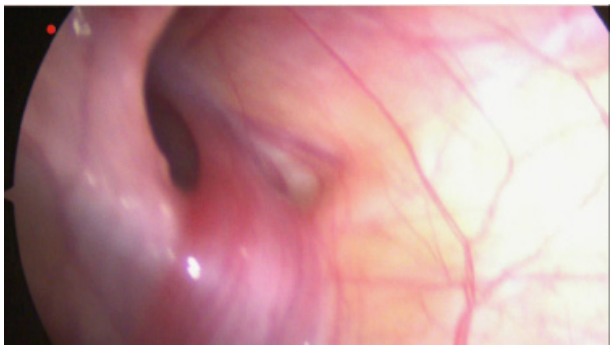

Fig 13: Intraoperative diagnosis of right oblique inguinal hernia.

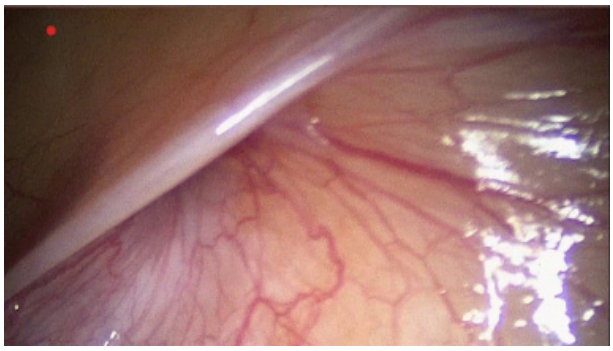

Fig 14: The right medial umbilical ligament obscures the right internal inguinal ring when the scope is in the umbilical port.

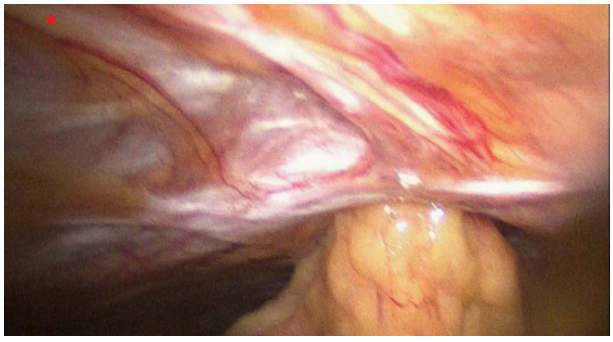

Fig 15: Ventral incisional hernia with multiple defects.

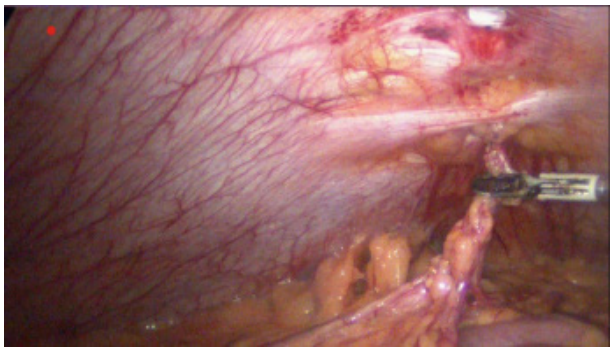

Fig 16: Midline infra umbilical adhesiolysis with bipolar diathermy used with ease through the lateral port.

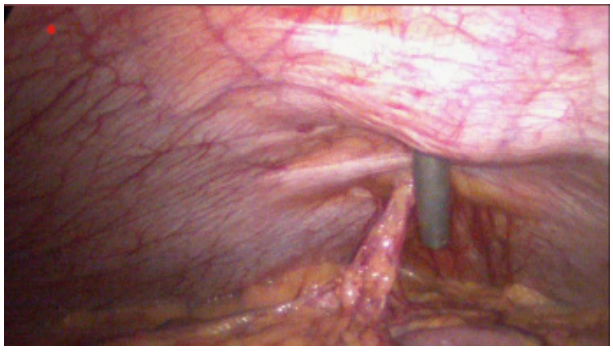

Fig 17: The restricted angulation of the epigastric port limits the exposure of the midline infraumbilical adhesions.

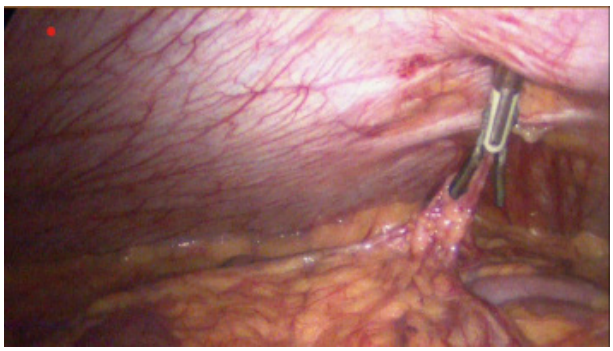

Fig 18: Using bipolar diathermy through the umbilical port is not easy.

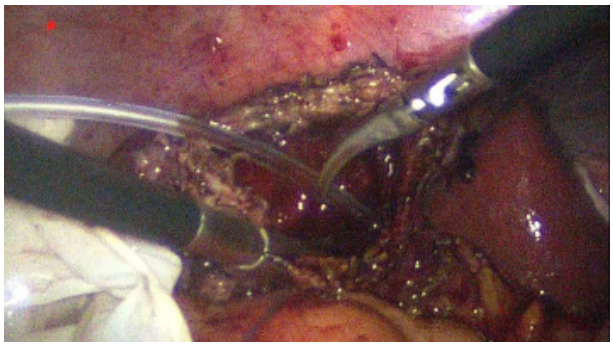

Fig 19: Canulation of the cystic duct.

Table 1: Baseline characteristics

Indication	**Frequency**	**%**
Chronic calculator cholecystitis	905	88.12%
Acute calculator cholecystitis	63	6.13%
Symptomatic gallbladder polyps	16	1.56%
Pyocele of the GB	15	1.46%
Mucocele of the GB	9	0.88%
Adenomyomatosis of the GB	7	0.68%
Perforated GB	5	0.49%
Gangrenous GB	4	0.39%
Gallstone pancreatitis	3	0.29%
Continuous variables		
	Age	**BMI**
Valid number	1023	1027
Mean	44.48	32.75
Standard deviation	11.94	4.79
Minimum	25.00	24.50
Lower quartile	35.00	28.90
Median	44.00	32.60
Upper quartile	54.00	36.90
Maximum	67.00	41.50
Interquartile Range	19.00	8.00

Table 2: Operative and postoperative details

	Operative-time mins	Hospital-stay, days	FU-Time, months
Valid number	1027	1027	1027
Mean	104.28	1.11	28.63
Standard deviation	32.33	0.55	11.95
Minimum	48.00	1.00	9.00
Lower quartile	77.00	1.00	18.00
Median	101.00	1.00	29.00
Upper quartile	131.00	1.00	39.00
Maximum	165.00	5.00	49.00
Interquartile Range	54.00	0.00	21.00

Discussion

In this retrospective study, the new approach of laparoscopic cholecystectomy (5-10-5-5) with a 5 mm High-Definition Angled Scope, was evaluated with a focus on its effectiveness and safety. All cases underwent laparoscopic cholecystectomy with the new (5-10-5-5) technique.

According to the results of the current study, the success rate of the surgery was 100%, with no case needing to be redone or converted to open surgery. Port site bleeding occurred in one case. Omental entrapment in veress needle occurred in another case. First port insertion was made within peritoneal adhesions in one case. An extra-port was needed in ectopic GB in one case and another for assessment of left groin hernia in another case.

The average ± SD duration of hospital stay was 1.11±0.55 days, and the median (IQR) was 1 (0). Only 9 cases (0.88%) experienced seroma, 4 (0.39) hematoma and another 18 (1.75) port-site infection during one month of the post-operative period. The average follow-up period was 28.63 ± 11.95 months. In 108 cases (10.52%) the follow-up duration was 9-12 months, 320 (31.16%) 13-24 months, and 599 (58.33) 25-49 months. None experienced TSH during the study's follow-up period.

Despite the advantages of laparoscopic surgery, awareness of potential complications such as trocar site hernia is crucial. These complications underscore the importance of careful postoperative monitoring and prompt intervention to ensure optimal patient outcomes. The evolving understanding of these complications contributes to refining surgical techniques and improving patient safety in the field of laparoscopic procedures. Laparoscopic surgery, like any surgical procedure, carries various potential consequences, as documented in the existing literature. Among these, trocar site hernia stands out as the most reported complication.[14,9] Trocar site hernia can manifest in three distinct types: early-onset, late-onset, and specific varieties. The early-onset variant, occurring immediately post-surgery, often results in a Richter hernia or other minor bowel obstruction. In contrast, the late-onset type presents a few months after the procedure, characterized by localized abdominal bulging without small intestine obstruction. The specific form involves the protrusion of the intestine and/or omentum, indicating dehiscence of the entire abdominal wall.[16]

The utilization of the HD 5mm angled scope in Laparoscopic Cholecystectomy presents numerous advantages, as evidenced by our current work and experience. One notable benefit is the ability to diagnose and manage bleeding at the veress needle insertion site through the 5mm lateral port. This is achieved while the 5mm camera is inserted through the 5mm right hypochondrial port. Similarly, if bleeding occurs at the umbilical port **(Fig. 1),** various techniques such as bipolar diathermy, fascial closure devices, the Madany closure technique, or external sutures can be employed, all under direct vision using our specialized scope **(Fig. 4).**

The flexibility of the 5mm scope allows for the insertion of the first port both in the umbilicus and the right hypochondrium. This is particularly beneficial in cases where previous operations in the umbilical region or there is a concomitant umbilical, paraumbilical **(Fig. 5)**, or incisional hernia **(Fig. 6)** that necessitates precise, vision-assisted placement of the umbilical port **(Fig. 7)**. Additionally, in situations where doubts arise about the veress needle insertion **(Fig. 8)**, especially concerning potential entanglement with the omentum or risk of injury to a viscus, preferential insertion of the scope through this port is recommended **(Fig. 3).**

Moreover, the 5mm scope proves invaluable when dealing with adhesions that may be encountered by the veress or the first port. A second port can be easily inserted, enabling the assessment and management of adhesions with optimal ergonomics for the entire surgical team **(Figs. 8,9)**.

The 5mm scope's versatility shines in the 5-10-5-5 approach, facilitating the thorough assessment of the camera port and efficient handling of any bleeding complications **(Fig. 1)**. It allows meticulous exploration of the abdomen through various ports and offers the option to insert an extra 5mm port when necessary. For instance, encountering a left groin hernia intraoperatively prompts the insertion of an additional 5mm port close to the hernial defect, allowing for detailed examination and determination of its nature (e.g., patent processus vaginalis **(Figs. 10,11)** or true hernia. While for assessment of the right groin hernia, if encountered, all these data can be obtained through the 5 mm midclavicular or the lateral port **(Figs. 12,13)**, while the medial umbilical ligament may obscure the field if the scope is inserted through the umbilical port **(Fig. 14)**. This approach is similarly beneficial in the proper assessment of ventral hernias **(Fig. 15)** and midline adhesions **(Fig. 16)**.

Contrastingly, the use of the scope through the epigastric port (10 mm) poses limitations in exposing the midline of the anterior abdominal wall and the umbilical region. Its restricted angulation with the sternum **(Figs. 17,18)**, particularly in cases involving a redundant fatty bulky falciform ligament, hinders optimal exposure.

In contrast, the 5mm scope can be easily maneuvered inside the gallbladder, either intentionally or accidentally opened, providing a clear view of stones, masses, or any lesions. This proves efficient in cases of complex operations requiring subtotal cholecystectomy, allowing for the detection, and stenting of the cystic duct orifice **(Fig. 19)**. Additional benefits include its utility in cases of ectopic gallbladders, where an extra 5mm port may be employed.

In summary, the 5mm scope stands out as a versatile and indispensable tool in Laparoscopic Cholecystectomy, offering enhanced visibility, optimal ergonomics, and adaptability to various intraoperative scenarios.

The retrospective nature of this current study is one limitation. The second, it did not compare the novel procedure to a traditional technique. However, the sample size of 1027 is quite enough to highlight the effectiveness and safety of our unique method. Another advantage of this study is the long duration of follow-up. To further bolster the evidence supporting its efficacy and safety, this novel method will be tested in a randomized controlled trial against alternative approaches.

Conclusion

The new approach 5-10-5-5 with a 5 mm High-Definition Angled Scope is a revolutionary technique that we mentioned in our paper. The procedure has been shown to be safe and effective.

Declaration

This study was posted as a preprint on the research gate on July 2024 With DOI: 10.21203/rs.3.rs-4379323/v1.

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