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Original Article

Surgery Section

Retrieval of Gall Bladder Through Umbilical Port versus Epigastric Port During Laparoscopic Cholecystectomy: A Prospective Interventional Study

ATEET FULMALI[1], DIVISH SAXENA[2], SIDDHARTH P DUBHASHI[3], BHUPENDRA MEHRA[4]

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ABSTRACT

Introduction: Cholelithiasis affects 10-15% of the population and the majority of these cases are asymptomatic, often detected incidentally through abdominal sonography. Laparoscopic cholecystectomy is the gold standard treatment for symptomatic gallstones. The choice of retrieval method for the gall bladder, either from the umbilical or epigastric port, lies in the hands of the operating surgeon. No study has recommended the superiority of extraction from either port; however, the incidence of port-site hernia and infection is more common with the umbilical port.

Aim: The aim of the present study was to compare the retrieval of the gall bladder from either port concerning postoperative pain, retrieval time and the incidences of port-site infection and hernia.

Materials and Methods: The present prospective interventional study was conducted in the Department of Surgery at AIIMS, Nagpur, India, over one and a half years, involving 88 patients undergoing laparoscopic cholecystectomy for symptomatic cholelithiasis, with 44 patients assigned to both the umbilical and epigastric retrieval ports. Pain scores were compared using the Visual Analog Scale (VAS) at 12, 24 and 48 hours postsurgery. Patients were subsequently followed up for port-site infection and port-site hernia. Categorical variables were expressed as percentages or proportions. The chi-square test was applied for categorical variables and the independent t-test was used for continuous variables.

Results: The study initially enrolled 110 patients; however, ten were lost to follow-up and 12 were excluded due to intraoperative biliary spillage and conversion to open surgery. This resulted in 44 patients in each arm. The mean age of the sample population was 47.11±15.62 years for the epigastric port group and 48.86±14.62 years for the umbilical port group. The female-to-male ratio for the epigastric extraction port was 1.32:1, while for the umbilical extraction port, it was 2.44:1. The mean VAS score postoperatively from either port was found to be statistically significant at 48 hours. The mean time for gall bladder retrieval was 6.36±4.44 minutes for the epigastric port, compared to 7.91±6.32 minutes for the umbilical port, which was not statistically significant. There were no reported cases of port-site infection or hernia.

Conclusion: The present study concluded that the retrieval of the gall bladder from either port does not have a significant impact on retrieval time, postoperative pain, surgical site infections, or port-site hernias.

Keywords: Cholelithiasis, Port site infection, Retrieval time, Visual analog scale

INTRODUCTION

Cholelithiasis, one of the most common ailments, affects 10-15% of the population. Patients experiencing symptoms related to gallstones necessitate cholecystectomy [1]. For over 90% of patients, cholecystectomy is curative, alleviating symptoms entirely [1].

Laparoscopic cholecystectomy is regarded as the "gold standard" procedure for managing various conditions such as acute and chronic cholecystitis, symptomatic cholelithiasis, biliary dyskinesia, acalculous cholecystitis, gallstone pancreatitis and gall bladder masses/polyps [2]. Most individuals experience postoperative pain and discomfort following laparoscopic cholecystectomy, which may be attributed to microvascular stretching and rupture, nerve traction due to peritoneal distention, trauma from port insertion, stretching of the port during gall bladder retrieval and residual carbon dioxide used for creating pneumoperitoneum [3].

Gall bladder retrieval is an essential step in laparoscopic cholecystectomy and is believed to influence postoperative port-site pain and infection [3]. The choice of gall bladder retrieval through the epigastric or umbilical port depends on the surgeon's preference or institutional policies.

Although laparoscopic cholecystectomy has a lower incidence of Surgical Site Infections (SSIs), port site infections can have a substantial impact on overall outcomes, leading to delayed returns to work, higher costs and poor aesthetic results that disappoint both patients and surgeons [4]. Another complication of laparoscopic cholecystectomy is the development of port site hernia, also known as Trocar Site Hernia (TSH). SSIs are most commonly observed in umbilical port sites, followed by epigastric port sites, with studies emphasising the significance of umbilical flora in SSI development [4]. While no study recommends the superiority of extraction from either port, the incidence of port site hernia and infection is more common with the umbilical port [4].

The present study aimed to compare the retrieval of the gall bladder from either port concerning postoperative pain, retrieval time and incidences of port site infection and hernia.

MATERIALS AND METHODS

The present single-centre prospective interventional study was conducted at the Department of Surgery, All India Institute of Medical Sciences, Nagpur, India, from January 2023 to July 2024, following approval from the Institute Ethics Committee (IEC/Pharma/2023/526).

Inclusion criteria: Patients aged over 18 years who underwent elective laparoscopic cholecystectomy for symptomatic cholelithiasis.

Exclusion criteria:

- Patients with co-morbidities such as uncontrolled diabetes mellitus and immunosuppressive conditions.

- Patients with intraoperative spillage of bile.
- Patients who underwent Endoscopic Retrograde Cholangiopancreatography (ERCP) before Laparoscopic Cholecystectomy.
- Patients not willing to participate in the study.

Sample size calculation: According to Open Epi software version 3.0, with a confidence interval of 95 percent, a power of 80 percent and a loss to follow-up of 10 percent, the sample size was calculated to be 110 patients. Ten patients were lost to follow-up and 12 patients were excluded due to intraoperative biliary spillage and conversion to open surgery, resulting in a final sample of 88 patients, with 44 patients in each group. The group allocation was as follows:

- Group A: Retrieval through Epigastric Port
- Group B: Retrieval through Umbilical Port

Study Procedure

All cases underwent laparoscopic cholecystectomy using standard port placement, including a 10 mm umbilical port, a 10 mm epigastric port and 5 mm right subcostal and right lumbar ports [Table/Fig-1]. All recruited patients were operated on by the same team of surgeons, following similar pre and postoperative treatment protocols.

[Table/Fig-1]: Standard port placement for laparoscopic cholecystectomy: A-10 mm umbilical port, B-10 mm epigastric port, C-5 mm right subcostal mid-clavicular line port, D-5 mm right lumbar mid-axillary line port.

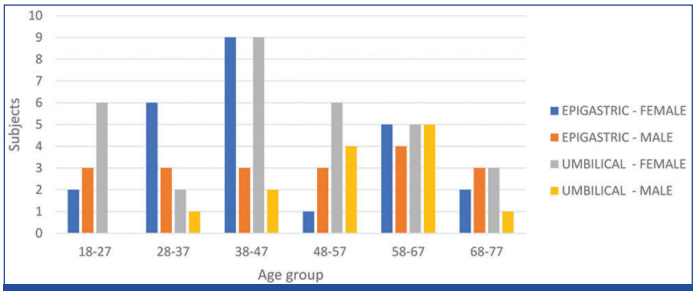
The retrieval time for each group was measured from the complete dissection of the gall bladder from the gall bladder fossa to the complete delivery of the gall bladder. Postoperative pain was assessed at 12, 24 and 48 hours after surgery using the VAS. Port-site infection was evaluated on the 5th, 7th and 14th days postoperatively using the Southampton grading system [5]. Sutures were removed on the 7th postoperative day and the histopathology report was recorded in each patient's pro forma. A follow-up period of six months was conducted monthly to assess the development of port-site hernia.

STATISTICAL ANALYSIS

Data were analysed using Statistical Package for the Social Sciences (SPSS) software version 29.0.10. Continuous variables were expressed as mean and standard deviation, while categorical variables were expressed as percentages or proportions. The chi-square test was used for categorical variables and the independent t-test was used for continuous variables.

RESULTS

The mean age of the sample population was 47.11±15.62 years for the epigastric port group and 48.86±14.62 years for the umbilical port group [Table/Fig-2]. A female preponderance was noted in both groups and the mean Body Mass Index (BMI) was comparable across both groups [Table/Fig-3]. The most common presenting complaint was abdominal pain in 80 patients (90.9%), followed by epigastric fullness in 30 patients (34.1%). The presenting complaints were comparable in each group [Table/Fig-4].



[Table/Fig-2]: Bar diagram showing gender and age distribution with respect to both groups with maximum incidence of presentation seen in age group 38-47 years.

BMI Group	Gender		Total
	Female	Male	
Normal	25 (28.40%)	10 (11.36%)	35
Underweight	-	4 (4.54%)	4
Overweight	10 (11.36%)	9 (10.22%)	19
Pre-obese	19 (21.5%)	8 (9.09%)	27
Obese	2 (2.27%)	1 (1.13%)	3
Total	56	32	88

[Table/Fig-3]: Body Mass Index (BMI) with gender distribution.

Symptom	Epigastric port	Umbilical port	p-value
Pain In Abdomen	40 (45.5%)	40 (45.5%)	1.000
Epigastric Fullness	18 (20.5%)	12 (13.6%)	0.181
Jaundice	1 (1.1%)	4 (4.5%)	0.171
Fever	3 (3.4%)	4 (4.5%)	0.698
Past History	4 (4.5%)	8 (9.1%)	0.219
Asymptomatic	3 (3.4%)	3 (3.4%)	1.000

[Table/Fig-4]: Table showing symptomatology with respect to each group. Chi-square test was used

Regarding comorbid conditions, 28 (31.8%) patients had hypertension, 17 (19.3%) had diabetes mellitus and 6 (6.81%) had hypothyroidism. The distribution of associated comorbidities was comparable in both groups. On ultrasound imaging, gall bladder stones were detected in 84 out of 88 patients. Among these 84 patients, 48 (57%) had multiple stones, while 36 (43%) had single stones. Additionally, 67 patients (79.8%) had sub-centimetric stones, while 17 patients (20.2%) had stones larger than 1 cm.

All patients underwent laparoscopic cholecystectomy under general anesthesia. The mean operative time and mean gall bladder retrieval time with respect to the port of extraction are shown in [Table/Fig-5]. There was no noticeable difference in pain levels when the gall bladder was extracted from either port at 12, 24, or 48 hours [Table/Fig-6]. The mean hospital stay in the epigastric port group was 4.14±2.29 days, while in the umbilical port group it was

Port of extraction	Mean operative time (minutes)	Gall bladder retrieval time (minutes)
Epigastric port (Group A)	98.81±28.15	6.36±4.44
Umbilical port (Group B)	93.42±25.11	7.91±6.32
p-value	0.347	0.188

[Table/Fig-5]: Table showing comparison of mean operative time and retrieval time for both groups.

Port of extraction	Postoperative Mean±SD VAS score		
	12 hours	24 hours	48 hours
Epigastric port (Group A)	7.34±1.70	4.39±1.67	1.77±1.22
Umbilical port (Group B)	7.25±1.38	4.36±1.63	2.02±1.44
p-value	0.784	0.949	0.381

[Table/Fig-6]: VAS scores value when extraction of gall bladder is done through either port.
*Independent t-test

3.41±1.83 days, with an insignificant p-value of 0.381. None of the patients developed surgical site infection or port-site hernia during the six-month follow-up period in either group.

DISCUSSION

The etiopathogenesis of cholelithiasis is multifactorial. The disease is more common in middle-aged individuals and the female gender is a crucial risk factor for the occurrence of gallstones. The peak incidence is observed in the third and fourth decades, as cholesterol saturation increases with age, while bile acid synthesis decreases. This decrease occurs because Cholesterol 7α-hydroxylase (CYP7A1), the enzyme that limits the rate of bile acid formation, becomes less active [6].

While most people with gallstones are asymptomatic, 20% experience symptoms at some point and 7% undergo surgery for this condition [7,8]. Silecchia G et al., recommend elective laparoscopic cholecystectomy for asymptomatic patients who:

- Have a life expectancy of more than 20 years
- Have gallstones larger than 2 cm
- Have calcified stones
- Have calculi smaller than 3 mm with a patent cystic duct
- Have gall bladder polyps larger than 1 cm
- Have gall bladder dyskinesia
- Have a porcelain gall bladder
- Have uncontrolled diabetes mellitus
- Live in areas with endemic gall bladder cancers [9].

In the present study, the proportion of patients with a normal BMI in Group A and Group B was 37% and 54%, respectively. The strong correlation between cholelithiasis and obesity highlights that increased bile cholesterol levels and changes in adipokines and gut hormones linked to obesity can impact gall bladder function and increase the risk of gallstone development [10].

Obesity has been associated with higher rates of morbidity at the port site due to several factors, including:

- Thicker abdominal walls
- The need for longer trocars, which create more fulcrum at the port site
- Larger skin incisions for adequate fascial exposure
- Increased force of retraction
- Proper fascial closure, which carries a potential risk for developing port-site hernias [11].

In our study, the gall bladder retrieval time was not statistically significant. However, a meta-analysis conducted by Kulkarni AA et al., favors epigastric port retrieval, showing a mean time difference of 5.6 minutes that was statistically significant [12]. The retrieval time may be longer in obese patients, attributed to the oblique tract running through the falciform ligament. In contrast, the umbilical port has a straight tract, allowing for more stretchability [13]. However, shifting the camera to the epigastric port, changing the gas insufflation connection and reorienting laparoscopic anatomy may favor retrieval through the epigastric port [14].

Postoperative pain: Following laparoscopic cholecystectomy, postoperative pain can be attributed to:

- Parietal pain due to skin incision and trocar insertion and the presence of a large stone during gall bladder retrieval
- Visceral pain resulting from manipulation and dissection of the gall bladder
- Referred pain to the shoulder tip due to residual carbon dioxide irritating the diaphragm [15].

During the first 48 hours, parietal pain typically predominates and it is more commonly associated with epigastric port retrieval due to stretching of the sheath and muscles, as well as tearing of the skin at the time of retrieval. Conversely, umbilical port retrieval may result in less pain owing to the open technique of port insertion, making it slightly wider to facilitate retrieval [16].

In the present study, VAS scores were lower in patients with umbilical port retrieval during the first 48 hours. A randomised controlled trial involving 104 patients conducted by Anand A et al., found that gall bladder extraction from the umbilical port led to decreased postoperative pain at all time points. The minimum time for this decline to become statistically significant was nine hours postoperatively. Infiltration of local anesthetics at the port site, near-complete removal of carbon dioxide and administration of postoperative analgesia can significantly alleviate pain [17].

Although the incidence of surgical site infection is significantly lower for laparoscopic cholecystectomy compared to open cholecystectomy, the increasing trend of daily laparoscopic procedures can lead to port-site infections, primarily due to breaches in aseptic techniques. In the case of epigastric port retrieval, the trocar and the contaminated gall bladder specimen pass through the fat-laden falciform ligament and the adipose tissue has an innate capacity to retain infection. Additionally, the spillage of stones or contaminated bile can contribute to port-site infections [12,18]. This situation is reflected in increased hospital stays, delayed returns to work, higher patient costs and poor aesthetic outcomes [19].

The absence of port-site infections in our study can be attributed to our stringent exclusion criteria, which excluded patients with uncontrolled comorbidities, acute cholecystitis, empyema of the gall bladder and bile or stone spillage. Preoperative skin preparation with povidone-iodine in all cases, administration of broad-spectrum intravenous antibiotics and the use of endobags for gall bladder retrieval can help minimise port-site infections.

Another well-researched consequence associated with an increase in laparoscopic surgeries is the incidence of port-site hernias. Patients at an increased risk for port-site hernias are often those who are obese, as full-thickness fascial closure poses challenges and is technically demanding [20]. The umbilical port, being an anatomical scar, is notorious for the development of port-site hernias due to its increased stretchability, the relatively straight extraction tract and the challenge of closure under direct vision if it lies deep. Proper fascial closure for trocar sizes of 10 mm or larger is mandatory and a minimum follow-up period of two years is recommended to detect port-site hernias, as most studies typically report one-year follow-ups [21].

Limitation(s)

Our study has several limitations, including a small sample size and a short duration of follow-up. To provide further insight into port-site morbidities, a larger sample size and longer follow-up period will be required in a randomised controlled trial.

CONCLUSION(S)

The present prospective interventional study concludes with no significant differences in the retrieval of the gall bladder from either of the ports. Ultimately, the choice of port for retrieval depends on the surgeon's practice and technique. All precautions should be taken to prevent surgical site infections and proper fascial suturing techniques for port closure can help reduce the development of port-site hernias.

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PARTICULARS OF CONTRIBUTORS:
1. Junior Resident, Department of Surgery, All India Institute of Medical Sciences, Nagpur, Maharashtra, India.
2. Associate Professor, Department of Surgery, All India Institute of Medical Sciences, Nagpur, Maharashtra, India.
3. Professor and Head, Department of Surgery, All India Institute of Medical Sciences, Nagpur, Maharashtra, India.
4. Professor, Department of Surgery, All India Institute of Medical Sciences, Nagpur, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Divish Saxena,
Associate Professor, Department of Surgery, All India Institute of Medical Sciences, Nagpur, Maharashtra, India.
E-mail: drdivishsaxena@yahoo.co.in

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