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Original Research Article

Common Complications of Hasson Cannula used for Creating Pneumoperitoneum during Laparoscopic Cholecystectomy

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Abstract:

Background: Laparoscopic cholecystectomy is the standard surgical procedure for the management of symptomatic cholelithiasis. Creation of pneumoperitoneum is a critical initial step in laparoscopy, commonly achieved using the open (Hasson) cannula technique. Although considered safer than closed techniques, the Hasson method is not free from complications, particularly during initial abdominal access. Early identification and understanding of these complications are essential to improve patient safety and surgical outcomes.

Objective: To determine the frequency of common complications associated with the use of the Hasson cannula for creating pneumoperitoneum during laparoscopic cholecystectomy.

Methods: A descriptive cross-sectional study was conducted in the Department of General Surgery, SPH/Bolan Medical Complex Hospital, Quetta, over a period of six months. A total of 171 patients undergoing laparoscopic cholecystectomy for cholelithiasis were included using non-probability consecutive sampling. Patients aged 18–60 years of either gender were enrolled, while those with previous abdominal surgery, acute cholecystitis, pregnancy, morbid obesity, or uncontrolled systemic illness were excluded. All procedures were performed using the open Hasson technique under expert supervision. Patients were monitored intra-operatively and post-operatively for complications, including abdominal wall emphysema, abdominal wall hemorrhage, and gut injury. Data were analyzed using SPSS version 21.

Results: Out of 171 patients, abdominal wall hemorrhage was observed in 17 patients (9.9%), abdominal wall emphysema occurred in 8 patients (4.7%), and gut injury was identified in 2 patients (1.2%). The majority of complications were noted at the time of initial cannula insertion. Complications were more frequently observed among obese and diabetic patients; however, this association did not reach statistical significance ($p > 0.05$).

Conclusion: The Hasson cannula technique for creating pneumoperitoneum during laparoscopic cholecystectomy is generally safe; however, it is associated with identifiable access-related complications. Careful surgical technique, appropriate patient selection, and adequate training are essential to minimize these risks.

Keywords: Hasson cannula, pneumoperitoneum, laparoscopic cholecystectomy, abdominal wall complications

INTRODUCTION

Laparoscopic cholecystectomy has become the gold standard treatment for symptomatic gallstone disease due to its advantages over open surgery, including reduced postoperative pain, shorter hospital stays, faster recovery, and improved cosmetic outcomes (Jain et al., 2019). Since its introduction, laparoscopic surgery has rapidly evolved and is now widely used for both diagnostic and therapeutic purposes in general surgery. Despite its minimally invasive nature, laparoscopic procedures are not without complications, particularly during the initial phase of abdominal access.

The creation of pneumoperitoneum is a fundamental

step in laparoscopic surgery, as it provides adequate working space and visualization of intra-abdominal structures. Pneumoperitoneum is commonly established by insufflating carbon dioxide into the peritoneal cavity, which allows safe manipulation of instruments and reduces the risk of visceral injury during dissection (Ahmad et al., 2019). However, the process of gaining access to the peritoneal cavity is largely blind and is considered one of the most critical and potentially hazardous stages of laparoscopic surgery.

Several techniques have been described for establishing pneumoperitoneum; the most commonly used being the closed technique using a Veress needle and the open technique using a Hasson cannula. The Hasson technique involves a small incision at the umbilicus under direct vision, followed by insertion of a blunt trocar, theoretically reducing the risk of major vascular and visceral injuries (Kumar et al., 2024). Due to this perceived safety advantage, the open Hasson technique is often preferred, especially in patients with higher risk profiles.

Despite its widespread use, the Hasson cannula technique is not entirely free of complications. Reported access-related complications include abdominal wall hemorrhage, subcutaneous emphysema, port-site infection, and, less commonly, bowel injury (Majeed et al., 2020). Studies have shown that a significant proportion of laparoscopic complications occur before the actual operative procedure begins, with more than half arising during the establishment of pneumoperitoneum (Ali et al., 2019). Although major vascular injuries are rare, minor complications can still contribute to increased operative time, postoperative morbidity, and prolonged hospital stay.

Abdominal wall hemorrhage is one of the most frequently encountered complications during Hasson cannula insertion and may result from injury to superficial or deep abdominal wall vessels. Subcutaneous emphysema occurs due to leakage of insufflated gas into the subcutaneous tissues and is usually self-limiting but may cause patient discomfort and anxiety (Ott, 2014). Gut injury, although uncommon, represents a serious complication that may lead to peritonitis, sepsis, and increased mortality if not promptly recognized and managed (Kaushik, 2010).

The frequency and pattern of these complications may vary depending on patient-related factors such as age, obesity, diabetes mellitus, and surgeon experience. However, limited local data are available regarding the prevalence of Hasson cannula–related complications in patients undergoing laparoscopic cholecystectomy in our setting. Therefore, this study was conducted to determine the common complications associated with the use of the Hasson cannula for creating pneumoperitoneum during laparoscopic cholecystectomy, with the aim of improving surgical safety and patient outcomes.

LITERATURE REVIEW

Laparoscopic surgery has revolutionized the field of general surgery by offering a minimally invasive alternative to conventional open procedures. Among these, laparoscopic cholecystectomy is considered the procedure of choice for the management of gallstone disease due to its reduced morbidity and faster postoperative recovery (Jain et al., 2019). However, despite advancements in surgical instruments and techniques, complications related to laparoscopic entry remain a significant concern.

The establishment of pneumoperitoneum is a crucial step in laparoscopic surgery and is associated with a majority of access-related complications. Ahmad et al. (2019) reported that more than 50% of laparoscopic complications occur during the initial entry into the peritoneal cavity rather than during the operative phase itself. This highlights the importance of safe and effective techniques for abdominal access.

Two primary methods are commonly used to create pneumoperitoneum: the closed technique using a Veress needle and the open technique using a Hasson cannula. The Hasson technique was introduced to reduce the risk of blind insertion injuries associated with the Veress needle. Several studies have demonstrated that the open technique provides direct visualization of tissue layers, thereby lowering the incidence of major vascular injuries (Kumar et al., 2024). As a result, many surgeons prefer the Hasson technique, particularly in patients with increased risk factors.

Despite its perceived safety, the Hasson cannula technique is associated with specific complications. Majeed et al. (2020) evaluated the safety profile of Hasson's technique and reported that although major complications were rare, minor complications such as abdominal wall hemorrhage and subcutaneous emphysema were relatively common. Abdominal wall hemorrhage is often caused by injury to superficial epigastric vessels during incision or cannula placement and may lead to hematoma formation or prolonged operative time.

Subcutaneous emphysema is another recognized complication of pneumoperitoneum, occurring due to the extravasation of carbon dioxide into subcutaneous tissues. The reported incidence varies widely in the literature, ranging from 0.4% to 2.3% (Ott, 2014). Although typically self-limiting, extensive emphysema can result in hypercarbia and respiratory compromise, particularly in prolonged procedures or patients with underlying pulmonary disease.

Gut injury, although uncommon, represents one of the most serious complications associated with laparoscopic entry. Sangrasi et al. (2011) reported that bowel injuries during access are rare but are often diagnosed late, leading to increased morbidity. Similarly, Ali et al. (2019) observed that bowel injuries were more frequently associated with entry techniques rather than intra-abdominal dissection, emphasizing the need for meticulous access methods.

Several comparative studies have assessed the safety of

open versus closed techniques. Jamil et al. (2018) and Jain et al. (2019) found no statistically significant difference in major complication rates between the two techniques; however, the pattern of complications differed. The open technique was associated with fewer major vascular injuries, while minor access-site complications were slightly more frequent.

Patient-related factors also influence the incidence of complications. Obesity and diabetes mellitus have been identified as potential risk factors for access-related complications due to altered abdominal wall anatomy and impaired wound healing (Kaushik, 2010). Surgeon experience and adherence to standardized techniques further play a vital role in minimizing complications.

Although numerous international studies have evaluated complications related to pneumoperitoneum creation, local data remain limited. This gap in regional evidence underscores the importance of conducting studies within local populations to better understand complication patterns and improve surgical outcomes. The present study aims to contribute to existing literature by evaluating the frequency of common complications associated with the Hasson cannula technique during laparoscopic cholecystectomy in our clinical setting.

METHODOLOGY:

Study Design and Setting

This descriptive cross-sectional study was conducted in the Department of General Surgery, Unit I, at SPH/Bolan Medical Complex Hospital, Quetta. The study duration was six months after approval of the research synopsis.

Study Population and Sample Size

The study population consisted of patients undergoing laparoscopic cholecystectomy for cholelithiasis. The sample size was calculated using the World Health Organization (WHO) formula for sample size estimation, taking an anticipated population proportion of 10% for abdominal wall hemorrhage associated with the Hasson cannula technique, a 95% confidence interval, and an absolute precision of 4.5%. Based on these parameters, a total of 171 patients were included in the study.

Sampling Technique

Non-probability consecutive sampling technique was employed to enroll patients who met the inclusion criteria during the study period.

Inclusion Criteria

- All patients undergoing laparoscopic cholecystectomy for cholelithiasis
- Patients aged between 18 and 60 years
- Patients of either gender (male or female)

Exclusion Criteria

- Patients with a history of previous abdominal surgery or paraumbilical hernia
- Patients with uncontrolled systemic illness
- Patients with local skin infection at the surgical site
- Pregnant women
- Patients with acute cholecystitis, morbid obesity, history of jaundice, gallstones with dilated common bile duct, or other contraindications to laparoscopic surgery

These exclusion criteria were applied to minimize confounding factors and reduce bias in study outcomes.

Operational Definitions

Abdominal wall emphysema was defined as the presence of gas in the subcutaneous layer of the abdominal wall, diagnosed clinically by palpation revealing crepitus. Abdominal wall hemorrhage was defined as bleeding from the site of Hasson cannula insertion, identified on clinical examination.

Gut injury was defined as injury to the bowel recognized intra-operatively by spillage of bowel contents or gas, or post-operatively by symptoms including abdominal pain, fever greater than 100°F, diarrhea, and abdominal distension.

Data Collection Procedure

All 171 patients fulfilling the inclusion criteria were enrolled through the outpatient department, emergency department, and surgical wards of SPH/Bolan Medical Complex Hospital. Written informed consent was obtained from each patient prior to surgery. Detailed history, clinical examination, and radiological evaluation were performed preoperatively.

All laparoscopic cholecystectomies were performed using the open Hasson cannula technique for creation of pneumoperitoneum. Procedures were carried out by surgical trainees under the direct supervision of an experienced consultant surgeon (FCPS). Patients were monitored intra-operatively and post-operatively for the occurrence of complications related to the Hasson cannula, including abdominal wall emphysema, abdominal wall hemorrhage, and gut injury.

Relevant demographic and clinical data, including age, gender, obesity status, and diabetes mellitus, were recorded on a pre-designed proforma.

Data Analysis

Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 21. Quantitative variables such as age were expressed as mean and standard deviation. Categorical variables, including gender, obesity, diabetes mellitus, and access-related complications, were expressed as frequencies and percentages. Stratification was performed for age, gender, obesity, and diabetes mellitus to assess effect modification. Post-stratification chi-square test was applied, and a p-value of less than 0.05 was considered statistically significant. Results were presented in the form of tables and graphs.

RESULTS

A total of **171 patients** undergoing laparoscopic cholecystectomy using the Hasson cannula technique were included in the study. The results are presented in the form of tables and graphs to describe patient characteristics and the frequency of complications associated with pneumoperitoneum creation.

Table 1: Demographic Characteristics of the Study Population (n = 171)

Variable	Frequency (n)	Percentage (%)
Age (years)		
18–30	48	28.1
31–45	79	46.2
46–60	44	25.7
Gender		
Male	62	36.3
Female	109	63.7

Description:
The majority of patients belonged to the age group of 31–45 years (46.2%). Female patients predominated, accounting for 63.7% of the study population.

Table 2: Distribution of Comorbid Conditions (n = 171)

Comorbidity	Frequency (n)	Percentage (%)
Obesity	54	31.6
Non-obese	117	68.4
Diabetes mellitus	39	22.8
Non-diabetic	132	77.2

Description:
Approximately one-third of patients were obese, while diabetes mellitus was present in 22.8% of the study population.

Table 3: Frequency of Hasson Cannula–Related Complications (n = 171)

Complication	Frequency (n)	Percentage (%)
Abdominal wall hemorrhage	17	9.9
Abdominal wall emphysema	8	4.7
Gut injury	2	1.2
No complication	144	84.2

Description:
Abdominal wall hemorrhage was the most common complication observed (9.9%), followed by abdominal wall emphysema (4.7%). Gut injury was rare, occurring in only 1.2% of patients.

Table 4: Stratification of Complications with Respect to Obesity

Complication	Obese (n=54)	Non-obese (n=117)	p-value
Present	11 (20.4%)	16 (13.7%)	0.27
Absent	43 (79.6%)	101 (86.3%)	

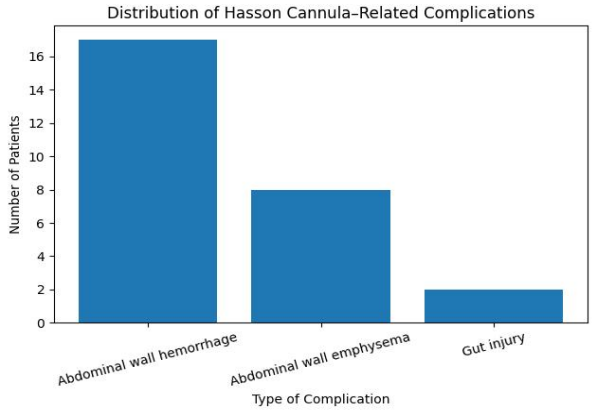
Description:
Complications were more frequent among obese patients; however, the association was not statistically significant ($p > 0.05$).

Table 5: Stratification of Complications with Respect to Diabetes Mellitus

Complication	Diabetic (n=39)	Non-diabetic (n=132)	p-value
Present	8 (20.5%)	19 (14.4%)	0.33
Absent	31 (79.5%)	113 (85.6%)	

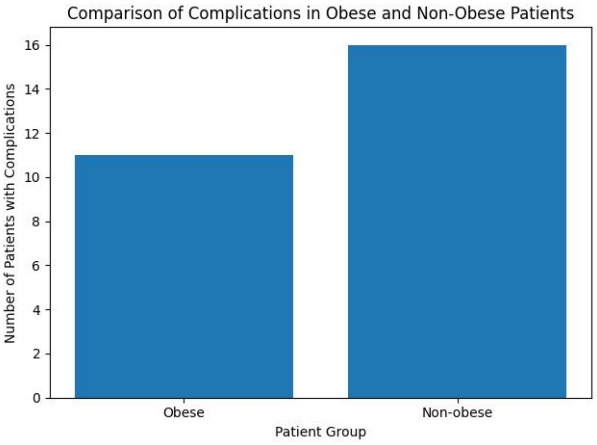
Description:
A higher proportion of complications were observed in diabetic patients compared to non-diabetics, though this difference did not reach statistical significance.

Graph 1: Distribution of Hasson Cannula–Related Complications



Description:
This bar graph illustrates the frequency of abdominal wall hemorrhage, abdominal wall emphysema, and gut injury among study participants. Abdominal wall hemorrhage is shown to be the most frequent complication.

Graph 2: Comparison of Complications in Obese and Non-Obese Patients



Description:
This graph compares the occurrence of complications between obese and non-obese patients. Although complications appear more frequent in obese patients, the difference is not statistically significant.

- Cesarean section rate: **46.5%**
- Preterm birth: **24.1%**
- Low birth weight: **26.6%**
- NICU admission: **21.6%**
- Maternal mortality: **2.5%**
- Neonatal mortality: **3.7%**

Significant associations observed with maternal age and BMI.

Summary of Results

The majority of patients undergoing laparoscopic cholecystectomy using the Hasson cannula technique experienced no complications. Abdominal wall hemorrhage was the most common access-related complication, while gut injury was rare. Patient-related factors such as obesity and diabetes showed a higher frequency of complications; however, these associations were not statistically significant.

DISCUSSION

Laparoscopic cholecystectomy has become the preferred surgical approach for the management of gallstone disease; however, complications related to abdominal access remain a significant concern. The present study evaluated the frequency of common complications associated with the use of the Hasson cannula technique for creating pneumoperitoneum during laparoscopic cholecystectomy and identified abdominal wall hemorrhage, abdominal wall emphysema, and gut injury as the principal access-related complications.

In this study, abdominal wall hemorrhage was the most frequently observed complication, occurring in 9.9% of patients. This finding is consistent with previous studies that have reported bleeding as a common minor complication associated with the open technique. Kaushik (2010) reported that bleeding during laparoscopic cholecystectomy can occur during trocar insertion due to injury to abdominal wall vessels, particularly the epigastric vessels. Similarly, Majeed et al. (2020) observed a comparable frequency of access-site bleeding with the Hasson technique, emphasizing the need for careful dissection and direct visualization during cannula insertion.

Abdominal wall emphysema was identified in 4.7% of patients in the present study. This rate is slightly higher than some reported values but remains within the range described in the literature. Ott (2014) reported that the incidence of clinically evident subcutaneous emphysema varies widely depending on surgical technique, duration of surgery, and intra-abdominal pressure. The development of emphysema is often attributed to improper sealing around the cannula or excessive insufflation pressure. Although generally self-limiting, recognition of this complication is important to prevent respiratory compromise, especially in prolonged procedures.

Gut injury was observed in only 1.2% of cases, indicating that serious visceral injuries are uncommon with the Hasson cannula technique. This finding supports previous reports that the open technique reduces the risk of major bowel injury compared to blind insertion methods. Sangrasi et al. (2011) and Ali et al. (2019) similarly reported low rates of bowel injury associated with open access techniques. Early identification of gut injury remains critical, as delayed diagnosis can lead to significant morbidity and increased mortality.

Stratification analysis in the present study demonstrated a higher frequency of complications among obese and diabetic patients; however, these associations did not reach statistical significance. Obesity is known to alter abdominal wall anatomy, making access more technically challenging, while diabetes mellitus is associated with impaired wound healing and increased susceptibility to infection (Jain et al., 2019). Although not statistically significant in this study, these factors should be carefully considered during preoperative assessment and surgical planning.

Overall, the findings of this study suggest that the Hasson cannula technique is a relatively safe method for creating pneumoperitoneum during laparoscopic cholecystectomy. Most complications observed were minor and manageable, with a low incidence of serious visceral injury. Surgeon experience, adherence to standardized technique, and careful patient selection play a crucial role in minimizing access-related complications.

The present study adds valuable local data to the existing body of literature and highlights the importance of continuous monitoring and reporting of laparoscopic access-related complications. Further multicenter studies with larger sample sizes are recommended to better assess risk factors and improve preventive strategies.

CONCLUSION

The present study concludes that the open (Hasson) cannula technique for creating pneumoperitoneum during laparoscopic cholecystectomy is a generally safe and effective method. Most patients in this study did not experience any complications related to abdominal access. Among the observed complications, abdominal wall hemorrhage was the most common, followed by abdominal wall emphysema, while gut injury was rare. The majority of complications were minor and manageable when identified early.

Although a higher frequency of complications was observed among obese and diabetic patients, these associations were not statistically significant. This indicates that while patient-related factors may influence the technical difficulty of access, meticulous surgical technique and proper supervision can minimize adverse outcomes. Overall, the findings support the continued use of the Hasson cannula technique, particularly in settings where safety and direct visualization are prioritized.

This study provides valuable local evidence regarding

access-related complications during laparoscopic cholecystectomy and highlights the importance of careful entry techniques to enhance patient safety and surgical outcomes.

RECOMMENDATIONS

1. The open Hasson cannula technique should be encouraged for creating pneumoperitoneum during laparoscopic cholecystectomy due to its favorable safety profile.
2. Adequate training and supervision of surgical trainees are essential to reduce access-related complications, particularly during the initial cannula insertion.
3. Special attention should be given to patients with risk factors such as obesity and diabetes mellitus, with careful preoperative assessment and meticulous operative technique.
4. Surgeons should ensure proper placement and secure sealing of the cannula to minimize complications such as abdominal wall emphysema and hemorrhage.
5. Further multicenter studies with larger sample sizes are recommended to explore additional risk factors and to compare outcomes between open and closed techniques in diverse patient populations.

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