

## **Comparison between Open Cholecystectomy, 4-Port Laparoscopic Cholecystectomy and One-Port Laparoscopic Cholecystectomy: A Literature Review**

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### **ABSTRACT**

Cholecystectomy is the most commonly performed surgical procedure to treat gallbladder disease. In recent decades, the technique of laparoscopic cholecystectomy has been developed, which has proven to be a less invasive alternative with better results compared to traditional open cholecystectomy. However, laparoscopic one-port cholecystectomy has recently been introduced as an even less invasive variant. In this literature review article, a comprehensive comparison is made between open cholecystectomy, 4-port laparoscopic cholecystectomy and one-port laparoscopic cholecystectomy, evaluating the epidemiology, clinical significance, definition, surgical technique, advantages and complications of each approach.

**KEYWORDS:** Open Cholecystectomy, 4-Port Laparoscopic Cholecystectomy and One-Port Laparoscopic Cholecystectomy

### **ARTICLE DETAILS**

**Published On:**  
**24 July 2023**

**Available on:**  
<https://ijmscr.org/>

### **INTRODUCTION**

Cholecystectomy, or surgical removal of the gallbladder, is a widely performed procedure for the treatment of gallbladder disease, especially in cases of symptomatic gallstones or associated complications. In recent decades, laparoscopic cholecystectomy has gained popularity as a less invasive alternative to traditional open cholecystectomy. Recently, laparoscopic cholecystectomy of a port has been introduced as an even less invasive variant, which has generated a debate about its efficacy and safety compared to traditional techniques.

Gallbladder disease is a common condition worldwide, and the prevalence of gallstones has increased in recent decades. It affects people of all ages, although it is more common in women and in people with certain risk factors, such as obesity, older age, and a family history of gallstones. It is estimated that millions of people undergo cholecystectomy each year, placing a significant burden on healthcare systems. Gallbladder disease can cause bothersome symptoms, such as abdominal pain, nausea, and vomiting, and can lead to serious complications, such as acute cholecystitis, biliary pancreatitis, and cholangitis. In addition, gallstones can migrate and obstruct the bile ducts, which can result in jaundice and liver damage. Cholecystectomy is considered

essential to relieve symptoms, prevent complications and improve the quality of life of affected patients.

In the ongoing search for less invasive surgical approaches with better outcomes, laparoscopic cholecystectomy has established itself as the standard of care in many medical centers. Compared to open cholecystectomy, laparoscopy offers significant advantages, such as smaller incisions, less postoperative pain, faster recovery, and better cosmetic aesthetics. However, laparoscopic cholecystectomy of a port, which uses a single umbilical incision, has recently been introduced, raising questions about its efficacy and safety compared to previous techniques.

In this literature review article, a comprehensive comparison will be made between open cholecystectomy, 4-port laparoscopic cholecystectomy, and single-port laparoscopic cholecystectomy. Relevant clinical studies and systematic reviews evaluating clinical outcomes, efficacy, safety and patient satisfaction associated with each surgical approach will be analysed. In addition, the differences in terms of surgical technique, advantages and complications of each approach will be discussed.

By better understanding the differences between these surgical approaches, it is hoped to provide a comprehensive view so that surgeons and patients can make informed decisions about the most appropriate type of

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cholecystectomy. This can have a significant impact on surgical outcomes, patient quality of life, and costs associated with treating gallbladder disease.

### Definition of Types of Cholecystectomy

**Open Cholecystectomy:** Open cholecystectomy is the traditional surgical technique used for removal of the gallbladder. It involves making a long incision in the abdomen, allowing direct visualization and access to the gallbladder. Through this incision, dissection and removal of the gallbladder is performed, followed by ligation and section of the bile ducts.

**4-Port Laparoscopic Cholecystectomy:** 4-Port Laparoscopic Cholecystectomy is a less invasive technique that involves making four small incisions in the abdomen. Through these incisions, surgical instruments and a laparoscopic camera are inserted. The abdomen is inflated with gas to create a workspace and gallbladder dissection and removal is carried out using real-time images provided by the laparoscopic camera.

**One-Port Laparoscopic Cholecystectomy:** One-Port laparoscopic cholecystectomy, also known as single-incision laparoscopic cholecystectomy (SILC), is an even less invasive variant in which a single umbilical incision is made through which surgical instruments and the laparoscopic camera are introduced. A specialized technique is used that allows all the necessary steps to be performed through this single incision.

### Surgical Technique

In open cholecystectomy, a larger incision is made in the abdomen, providing ample exposure of the gallbladder. Dissection and removal of the gallbladder are performed using conventional techniques, and careful suturing of the bile ducts and reconstruction of the biliary system is required. In 4-port laparoscopic cholecystectomy, four smaller incisions are used to insert the surgical instruments and laparoscopic camera. Gas is blown into the abdomen to create a workspace, and laparoscopic techniques are used to dissect and remove the gallbladder. This technique requires proper coordination and dexterity to handle the instruments and ensure accurate dissection.

In single-port laparoscopic cholecystectomy, a single umbilical incision is made through which the surgical instruments and laparoscopic camera are inserted. A specialized technique is required that allows all the necessary steps to be performed through this single incision, which implies even greater coordination and careful handling of the instruments.

### Advantages

Laparoscopic cholecystectomy, either 4-port or single-port, has several advantages over open cholecystectomy. These include:

**Less postoperative pain:** Smaller incisions in laparoscopy result in less inflammatory response and less pain compared to the larger incision in open cholecystectomy.

**Faster recovery:** Laparoscopy allows for faster recovery and earlier return to normal daily activities compared to open cholecystectomy.

**Shorter hospitalization time:** Patients undergoing laparoscopic cholecystectomy generally require less hospitalization time than those undergoing open cholecystectomy.

**Better cosmetic aesthetics:** The smaller incisions of laparoscopy result in smaller and less noticeable scars compared to the larger scar of open cholecystectomy.

### Complications

While laparoscopic cholecystectomy is generally considered safer than open cholecystectomy, complications can still occur in both approaches. Complications associated with these procedures may include bleeding, bile duct injury, wound infection, bile leakage, abscess formation, injury to adjacent organs, and deep vein thrombosis.

Laparoscopic cholecystectomy of a port poses additional challenges due to performing all surgical steps through a single umbilical incision. This can result in increased technical complexity and an increased risk of complications, such as ergonomic difficulties, instrument collision, and increased risk of incisional hernia at the site of the single incision.

In summary, this expanded theoretical framework has provided a more detailed look at the different types of cholecystectomy, including the definition, surgical technique, advantages and complications associated with each approach. Understanding these differences is essential for making informed decisions about the most appropriate type of cholecystectomy in different clinical settings. In addition, it highlights the importance of the surgeon's training and experience in each technique to ensure safe and successful results.

## DISCUSSION

The choice of surgical approach for cholecystectomy has evolved significantly in recent decades. Open cholecystectomy, which was the gold standard for a long time, has largely been replaced by laparoscopic cholecystectomy due to its advantages in terms of less invasion, less postoperative pain, faster recovery and better aesthetic results. However, with the advancement of surgical technology, single-port laparoscopic cholecystectomy has been introduced as an even less invasive approach and with the potential to further improve surgical outcomes. In this discussion section, several aspects related to these surgical approaches will be addressed, including clinical outcomes, safety, advantages and disadvantages, and factors to consider when making surgical decisions.

### Clinical Results

Several studies have compared the clinical outcomes of open cholecystectomy, 4-port laparoscopic cholecystectomy and single-port laparoscopic cholecystectomy. Overall, the

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evidence suggests that laparoscopy, either 4-port or one-port, provides similar or even better clinical outcomes than open cholecystectomy. Laparoscopy has been shown to offer a lower rate of postoperative complications, faster recovery, shorter hospital stay, and better quality of life compared to open cholecystectomy.

Regarding the comparison between 4-port laparoscopy and single-port laparoscopy, the current evidence is limited and the results are conflicting. Some studies suggest that single-port laparoscopy may offer a lower complication rate, lower postoperative pain, and better aesthetic outcome compared to 4-port laparoscopy. However, other studies have found no significant differences in terms of clinical outcomes between the two approaches.

It is important to note that clinical results may vary depending on several factors, such as the surgeon's experience, proper patient selection, and the surgical technique used. In addition, the choice of surgical approach should be based on individual patient characteristics and careful evaluation of the risks and benefits of each option.

### Safety

In terms of safety, laparoscopy is generally considered a safe approach and has demonstrated a lower rate of serious complications compared to open cholecystectomy. However, certain considerations must be taken into account in one-port laparoscopic cholecystectomy due to the technical complexity and associated ergonomic challenges. An increased risk of intraoperative complications, such as difficulty in gallbladder dissection and instrument collision, as well as an increased risk of incisional hernia at the site of the single umbilical incision has been reported.

It is critical that surgeons performing laparoscopic cholecystectomy of a port have extensive experience and master proper surgical techniques to minimize the associated risks. The learning curve can be steep and an appropriate learning curve is required to ensure the safety and effectiveness of this approach.

### Advantages and Disadvantages

Each surgical approach has its own advantages and disadvantages. Open cholecystectomy provides ample exposure of the gallbladder and allows for precise dissection and removal. However, it involves a larger incision, greater postoperative pain, slower recovery, and longer hospital stay compared to laparoscopic approaches.

4-port laparoscopy has been widely adopted and has proven to be a safe and effective alternative to open cholecystectomy. It offers advantages such as smaller incisions, less postoperative pain, faster recovery and better aesthetic results. However, it involves making four incisions and can present technical and ergonomic challenges for the surgeon.

One-port laparoscopy is considered an even less invasive approach, which can result in even faster recovery and better cosmetic aesthetics due to making a single umbilical incision. However, this technique presents significant technical

challenges due to space limitation and instrument collision, which can increase the risk of intraoperative complications.

It is essential to consider individual patient characteristics, surgeon experience, and available resources when making surgical decisions. The surgical approach should be tailored to the patient's needs and preferences, taking into account the benefits and risks associated with each option.

### Factors to consider

When making decisions about the surgical approach to cholecystectomy, it is important to consider several factors. These may include the surgeon's experience in each technique, the presence of comorbidities or risk factors that may influence the choice of approach, and the patient's preferences in terms of recovery, aesthetics and perceived risks.

In addition, the cost and resources available may influence the choice of surgical approach. Laparoscopy of a port may require a specialized surgical team and may have a higher cost due to the need for specific instruments and devices. The availability of these resources and their economic viability may influence the adoption and applicability of this approach in different clinical settings.

## CONCLUSION

It is critical that surgeons are competent and well-trained in the surgical approach selected to ensure the best outcomes for patients. The learning curve and the experience of the surgeon are critical factors that must be taken into account when evaluating the clinical outcomes and safety of each approach. In summary, the choice of surgical approach for cholecystectomy should be based on a comprehensive assessment of clinical outcomes, safety, advantages and disadvantages, and individual patient factors. While laparoscopy, whether 4-port or single-port, has proven to be a safe and effective alternative to open cholecystectomy, single-port laparoscopic cholecystectomy poses additional technical and ergonomic challenges. Informed and personalized decision-making, considering these factors, is essential to ensure the best outcomes and safety for patients undergoing cholecystectomy.

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