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ORIGINAL RESEARCH

Outcomes of Minimally Invasive versus Traditional Open Cholecystectomy in Elderly Patients: A Comparative Analysis

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ABSTRACT

Background: Cholecystectomy is one of the most common surgical procedures worldwide, with the choice between minimally invasive (laparoscopic) and traditional open techniques significantly impacting postoperative outcomes, especially in elderly patients who may have additional comorbidities.**Methods**: This comparative analysis studied a total of 120 elderly patients who underwent either minimally invasive cholecystectomy (MIC) or traditional open cholecystectomy (OC) at a tertiary care center. We retrospectively analyzed the length of hospital stay, intraoperative blood loss, postoperative pain, complication rates, patient satisfaction, and quality of life.**Results**: Patients undergoing MIC had a significantly shorter hospital stay (mean 2.3 days, SD=0.8) compared to those undergoing OC (mean 4.1 days, SD=1.2) with a p-value <0.001. Intraoperative blood loss was also lower in the MIC group (mean 50 ml, SD=20) than in the OC group (mean 150 ml, SD=50), p-value <0.001. Additionally, MIC was associated with lower postoperative pain scores and fewer complications such as wound infections and respiratory issues. Notably, patient satisfaction and quality of life scores were higher in the MIC group.**Conclusion**: Minimally invasive cholecystectomy offers significant advantages over traditional open cholecystectomy for elderly patients, including reduced hospital stays, lesser intraoperative blood loss, decreased pain levels, fewer complications, and improved patient satisfaction and quality of life. These findings support the preference for MIC in elderly patients where clinically appropriate.

Keywords: Minimally Invasive Cholecystectomy, Open Cholecystectomy, Elderly Patients.

INTRODUCTION

Cholecystectomy, the surgical removal of the gallbladder, is a common procedure often performed to address gallstones and other gallbladder-related diseases. The choice of surgical technique—minimally invasive or traditional open surgery—can significantly influence patient outcomes, especially in elderly populations who may have differing risk profiles due to comorbidities and decreased physiological reserves.[1][2]

Minimally invasive cholecystectomy, commonly referred to as laparoscopic cholecystectomy, has been increasingly favored since its introduction in the 1980s due to its association with reduced postoperative pain, shorter hospital stay, and faster recovery. However, despite these advantages, the decision to opt for a laparoscopic approach in elderly patients must be carefully considered, given the potential risks such as cardiovascular stress and complications related to pneumoperitoneum.[3][4]

On the other hand, traditional open cholecystectomy, though more invasive and associated with longer recovery times, provides direct access to the surgical site, which can be beneficial in complex cases or where anatomical anomalies are present. This method may sometimes be preferred in cases where laparoscopic surgery is deemed unsafe or technically unfeasible.[5][6]

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Recent studies have shown varying outcomes in elderly patients undergoing these procedures, with some research suggesting that laparoscopic cholecystectomy leads to better short-term outcomes but requires careful patient selection to minimize operative risks. Conversely, open cholecystectomy remains a viable option in patients with contraindications to the laparoscopic approach or in emergent situations where rapid intervention is necessary.[7][8]

AIM

To compare the postoperative outcomes of minimally invasive versus traditional open cholecystectomy in elderly patients.

OBJECTIVES

1. To assess the short-term recovery outcomes (e.g., hospital stay, postoperative pain) in elderly patients undergoing both surgical techniques.
2. To evaluate the complication rates associated with minimally invasive and traditional open cholecystectomy in this demographic.
3. To analyze the overall patient satisfaction and quality of life post-surgery for both techniques.

MATERIAL AND METHODOLOGY

Source of Data

Data was retrospectively collected from patient medical records who underwent cholecystectomy at our institution.

Study Design

The study was a retrospective cohort analysis comparing outcomes of minimally invasive versus traditional open cholecystectomy in elderly patients.

Study Location

This study was conducted at the Department of General Surgery, at tertiary care center.

Study Duration

The duration of the study spanned from January 2024 to December 2024.

Sample Size

A total of 120 elderly patients were included in the study, with 60 patients undergoing minimally invasive cholecystectomy and 60 undergoing traditional open cholecystectomy.

Inclusion Criteria

Elderly patients aged 65 years and above who underwent a cholecystectomy during the study period were included.

Exclusion Criteria

Patients were excluded if they were under 65 years of age, had previous abdominal surgeries that could influence the choice of surgical approach, or if they had converted from laparoscopic to open cholecystectomy.

Procedure and Methodology

Patients undergoing minimally invasive surgery received laparoscopic cholecystectomy under general anesthesia with standard four-port technique. For open cholecystectomy, a right subcostal incision was made under general anesthesia. All procedures were performed by a team of experienced surgeons.

Sample Processing

No specific sample processing was required as this study involved clinical outcomes based on patient records and follow-up data.

Statistical Methods

Data were analyzed using SPSS Version 25.0. Descriptive statistics were used to summarize patient demographics and surgical outcomes. Comparative analysis was performed using the Chi-square test for categorical variables and the T-test for continuous variables. A p-value of less than 0.05 was considered statistically significant.

Data Collection

Data were collected from electronic health records, including demographic information, surgical details, postoperative recovery markers (such as length of hospital stay and pain scores), complications, and follow-up notes regarding patient satisfaction and quality of life assessments.

OBSERVATION AND RESULTS

Table 1: To compare the postoperative outcomes of minimally invasive versus traditional open cholecystectomy in elderly patients

Variable	Minimally Invasive Mean (SD)	Open Surgery Mean (SD)	95% CI for Difference	P-value
Length of Hospital Stay (days)	2.3 (0.8)	4.1 (1.2)	(-2.1, -1.5)	<0.001
Intraoperative Blood Loss (ml)	50 (20)	150 (50)	(-110, -90)	<0.001

This table compares the postoperative outcomes between minimally invasive and traditional open cholecystectomy in elderly patients. Specifically, the length of hospital stay was significantly shorter for patients undergoing minimally invasive surgery, averaging 2.3 days with a standard deviation of 0.8, compared to 4.1 days (SD=1.2) for open surgery. The difference in hospital stays between the two methods was statistically significant with a p-value of less than 0.001. Similarly, intraoperative blood loss was

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considerably less in the minimally invasive group, with an average loss of 50 ml (SD=20), as opposed to 150 ml (SD=50) in the open surgery group. The reduced blood loss in minimally invasive surgery also showed statistical significance, with a p-value of less than 0.001. These results indicate a clear advantage of minimally invasive cholecystectomy over traditional methods in terms of recovery metrics.

Table 2: To assess the short-term recovery outcomes (e.g., hospital stay, postoperative pain) in elderly patients undergoing both surgical techniques

Variable	Minimally Invasive Mean (SD)	Open Surgery Mean (SD)	95% CI for Difference	P-value
Hospital Stay (days)	2.3 (0.8)	4.1 (1.2)	(-2.1, -1.5)	<0.001
Postoperative Pain Score (0-10)	3 (1.2)	5 (1.5)	(-2.5, -1.5)	0.001

This table assesses short-term recovery outcomes including hospital stay and postoperative pain. The results mirror the advantages seen in minimally invasive surgery from Table 1, with patients experiencing shorter hospital stays and lower pain scores post-operation. The mean hospital stay for minimally invasive surgery was 2.3 days (SD=0.8) versus 4.1 days (SD=1.2) for open surgery, with a significant p-value of less than 0.001. Postoperative pain scores were also lower for minimally invasive surgery, averaging 3 (SD=1.2) compared to 5 (SD=1.5) for open surgery, with a p-value of 0.001. These findings support the benefits of minimally invasive techniques in promoting faster recovery and less discomfort post-surgery.

Table 3: To evaluate the complication rates associated with minimally invasive and traditional open cholecystectomy in this demographic

Variable	Minimally Invasive n (%)	Open Surgery n (%)	95% CI for Difference	P-value
Wound Infection	3 (5%)	12 (20%)	(10%, 25%)	0.004
Respiratory Complications	2 (3.3%)	10 (16.7%)	(5%, 20%)	0.02

This table evaluates the complication rates associated with both surgical techniques in elderly patients. The incidence of wound infection and respiratory complications was significantly lower in the minimally invasive group. Specifically, wound infections occurred in 5% of patients undergoing minimally invasive surgery compared to 20% in the open surgery group, with a p-value of 0.004. Respiratory complications were present in 3.3% of the minimally invasive group versus 16.7% of the open surgery group, with a p-value of 0.02. These results demonstrate a lower risk of complications with minimally invasive cholecystectomy, suggesting a safer profile for elderly patients.

Table 4: To analyze the overall patient satisfaction and quality of life post-surgery for both techniques

Variable	Minimally Invasive Mean (SD)	Open Surgery Mean (SD)	95% CI for Difference	P-value
Patient Satisfaction (1-10)	8 (1)	6 (1.5)	(1.5, 2.5)	0.001
Quality of Life Score (1-10)	7.5 (1.2)	5 (1.3)	(1.8, 2.7)	<0.001

Table focuses on overall patient satisfaction and quality of life post-surgery. Patients who underwent minimally invasive surgery reported higher satisfaction, with an average score of 8 (SD=1) compared to 6 (SD=1.5) for those who underwent open surgery, and a p-value of 0.001. Similarly, the quality of life scores were higher in the minimally invasive group, averaging 7.5 (SD=1.2) versus 5 (SD=1.3) in the open surgery group, with a p-value of less than 0.001. These findings highlight that, in addition to reduced pain and complications, minimally invasive surgery also leads to higher patient satisfaction and improved quality of life postoperatively.

DISCUSSION

The results in table 1 showing shorter hospital stays and less intraoperative blood loss with MIC align with numerous studies that have documented the benefits of laparoscopic approaches. For instance, a meta-analysis by Rubert CP et al.(2016)[9] confirms that elderly patients undergoing MIC experience significantly shorter hospitalizations and fewer complications, which parallels our findings of reduced length of stay and blood loss. Additionally, Loozen CSet al.(2017)[10]highlighted that the minimally invasive approach reduces systemic stress and surgical trauma, which can be particularly advantageous for the elderly.

For table 2, Our findings on the shorter hospital stays and lower postoperative pain scores with MIC are consistent with the study by Li Let al.(2024)[11], which found that laparoscopic surgery not only minimizes hospital stay lengths but also significantly reduces postoperative discomfort. This reduction in pain is critical in enhancing patient recovery, as

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indicated by the rapid mobilization and reduced need for analgesics post-surgery reported by Bingener J,et al.(2015)[12].

In table 3, The lower rates of wound infection and respiratory complications observed with MIC compared to OC resonate with findings fromGhanem AM et al.(2023)[13], which concluded that the minimally invasive technique, due to smaller incisions, leads to decreased exposure and lower infection rates. Furthermore, respiratory complications are reduced due to less postoperative pain and quicker return to baseline respiratory function, as discussed in the research by Wu X et al.(2019)[14].

Table 4, the superior patient satisfaction and quality of life scores associated with MIC observed in our study are supported by research from Atay Aet al.(2022)[15], which associates these outcomes with less invasive surgical stress and quicker returns to normal activities. Quality of life improvements post-MIC have been substantiated by a systematic review by Chan KSet al.(2021)[16], emphasizing better overall health perceptions postoperatively.

CONCLUSION

The comparative analysis of minimally invasive cholecystectomy (MIC) versus traditional open cholecystectomy (OC) in elderly patients reveals significant advantages of the minimally invasive approach. The findings from this study align with the broader surgical and clinical literature, underscoring the efficacy and safety of MIC over OC, particularly within the elderly demographic, who are often at higher risk for surgical complications and longer recovery periods.

Firstly, the results demonstrated that MIC is associated with shorter hospital stays and significantly reduced intraoperative blood loss compared to OC. These outcomes not only enhance the immediate postoperative recovery process but also contribute to a lower burden on healthcare resources, including reduced hospitalization costs and minimized risk of hospital-acquired infections.

Secondly, the analysis of short-term recovery outcomes revealed that MIC leads to lower postoperative pain scores, facilitating a quicker return to normal activities and less reliance on pain management medications, which is particularly beneficial for the elderly to avoid the side effects associated with prolonged medication use.

Moreover, the lower complication rates observed in the MIC group, particularly regarding wound infections and respiratory complications, highlight the safety benefits of less invasive techniques. These advantages are critical in reducing the overall postoperative morbidity, thus supporting faster and safer recovery for elderly patients.

Finally, the study found that patient satisfaction and quality of life post-surgery were significantly higher in the MIC group compared to those who underwent OC. This is indicative of the less invasive nature of MIC, which impacts patients' perceptions of their surgical experience and outcomes positively.

In conclusion, the findings from this study advocate for the preferential use of minimally invasive cholecystectomy over traditional open cholecystectomy in elderly patients, given its numerous benefits including reduced surgical trauma, quicker recovery, lower complication rates, and improved patient satisfaction. Future surgical guidelines and practices, particularly those involving elderly populations, should consider these results to optimize patient outcomes and enhance the quality of surgical care.

Limitations of Study

1. **Retrospective Design**: The retrospective nature of this study limits the ability to control for potential confounding variables that could influence the outcomes. Prospective studies are needed to establish a more definitive causal relationship between the type of surgical procedure and the observed outcomes.
2. **Selection Bias**: There may be inherent selection bias in determining which patients undergo minimally invasive versus open cholecystectomy. Factors such as the patient's medical history, the severity of the condition, and surgeon preference could influence this choice, potentially skewing the results.
3. **Sample Size**: Although the total sample size of 120 patients provides initial insights, it may still be too small to detect smaller differences in outcomes between the groups. Larger studies are necessary to validate these findings further and ensure they are statistically robust.
4. **Generalizability**: The study was conducted at a single tertiary care center, which might limit the generalizability of the results to other settings or populations. Multi-center studies would help confirm whether these findings can be applied broadly across different geographic and clinical environments.
5. **Subjective Measures**: Measures of patient satisfaction and quality of life are subjective and can be influenced by individual patient expectations and experiences beyond the surgery itself. Standardizing these measurements and incorporating more objective quality-of-life assessments could provide a clearer picture of the true benefits.
6. **Operative Details**: The study did not account for variations in surgical technique or surgeon experience, which can significantly affect outcomes. Differences in operative time, the expertise of the surgical team, and the use of technology like robotic assistance might influence the results but were not controlled for in this analysis.

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7. **Follow-up Duration**: The follow-up period was not specified, which is crucial for assessing long-term complications and recurrences. Longer follow-up would provide more comprehensive information on the durability of the surgical benefits and patient outcomes.

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