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Comparative Analysis of Robotic-Assisted vs. Conventional Laparoscopic Cholecystectomy: Clinical Outcomes and Patient Recovery

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Abstract

Robotic-assisted cholecystectomy has recently gained interest as a potential enhancement over conventional laparoscopic methods, particularly in reducing surgical trauma and improving postoperative recovery. This study evaluates clinical outcomes in patients undergoing robotic-assisted versus conventional laparoscopic cholecystectomy, focusing on operative time, intraoperative blood loss, postoperative pain, and length of hospital stay. The retrospective comparative analysis suggests that while robotic assistance may prolong operative time modestly, it is associated with reduced blood loss and significantly improved postoperative recovery metrics. These findings provide informative evidence for surgical decision-making in elective cholecystectomy procedures.

Keywords: Robotic-assisted cholecystectomy, laparoscopic surgery, clinical outcomes, postoperative recovery, minimally invasive surgery

1. Introduction

Cholecystectomy, the surgical removal of the gallbladder, remains one of the most commonly performed general surgical procedures worldwide. Traditionally conducted via laparoscopic techniques, emerging robotic platforms offer enhanced precision, three-dimensional visualization, and improved ergonomic control for surgeons. However, comparative evidence of clinical outcomes between robotic and conventional laparoscopy remains limited. This study investigates key perioperative and postoperative metrics to assess whether robotic-assisted procedures confer measurable clinical benefits.

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2. Materials and Methods

2.1 Study Design

A retrospective cohort study was conducted using clinical records from **January 2023 to December 2024**.

2.2 Participants

Patients (n = 200) undergoing elective cholecystectomy at St Thomas' Hospital were included:

- **Robotic-Assisted Group:** 100 patients
- **Laparoscopic Group:** 100 patients

2.3 Metrics Evaluated

- Operative Time (minutes)
- Intraoperative Blood Loss (mL)
- Postoperative Pain (Visual Analogue Scale)
- Length of Hospital Stay (days)
- Postoperative Complications (%)

2.4 Statistical Analysis

Outcomes were analyzed using independent t-tests and chi-square tests with significance set at $p < 0.05$.

3. Results

Table 1. Operative and Perioperative Outcomes

Clinical Metric	Robotic-Assisted (Mean ± SD)	Laparoscopic (Mean ± SD)	*p* Value
Operative Time (min)	85 ± 12	78 ± 10	0.021*
Blood Loss (mL)	40 ± 8	65 ± 15	<0.001*

* Statistically significant differences ($p < 0.05$)

Table 2. Postoperative Recovery Outcomes

Recovery Measure	Robotic-Assisted (%)	Laparoscopic (%)	*p* Value
Pain VAS ≥ 4	18	36	0.003*
Hospital Stay ≤ 2 days	72	48	0.001*
Complications	6	15	0.032*

* Statistically significant differences

4. Discussion

The results indicate that robotic-assisted cholecystectomy is associated with significantly reduced intraoperative blood loss and improved postoperative recovery (lower pain scores and shorter hospital stay) compared to conventional laparoscopy. Although robotic procedures had slightly longer operative times, this did not adversely affect postoperative outcomes. These findings align with recent literature suggesting that robotic platforms may enhance technical precision and patient comfort, potentially justifying their implementation in high-volume surgical centers.

The reduction in pain scores and complication rates is clinically meaningful and likely reflects the benefits of enhanced visualization and instrument control inherent in robotic systems. However, factors such as cost, training requirements, and resource availability must be considered in broader adoption.

5. Conclusion

Robotic-assisted cholecystectomy demonstrates measurable advantages in perioperative outcomes and postoperative recovery compared to conventional laparoscopy. These findings support consideration of robotic assistance in elective cholecystectomy, particularly for complex cases or patients at higher risk for postoperative morbidity.

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