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Comparative Analysis of Laparoscopic vs. Open Inguinal Hernia Repair in Obese Patients: A Systematic Review and Meta-Analysis

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ABSTRACT

Background: The surgical repair of inguinal hernias maintains its position as one of the most frequently performed operations throughout the globe. The rise in obesity rate makes surgical outcomes more demanding and technical because it affects both patient anatomy and operative risks. Laparoscopic and open inguinal hernia repair procedures remain standard surgical treatments yet experts disagree about their advantages and protection capabilities within obese patient cohorts..

Objectives: The study examined laparoscopic versus open inguinal hernia procedures for obese patients to evaluate their postoperative results alongside complication rates and recurrence frequencies and operational durations and recovery periods.

Methodology: The research conducted a structured review and statistical analysis of laparoscopic removal as well as open inguinal hernia surgery approaches in patients who were obese. It evaluated both surgical outcomes and rates of complications as well as recurrence risks and operation times and recovery duration.

Results: A systematic review with meta-analysis evaluated laparoscopic versus open inguinal hernia surgery in obese patients through assessment of postoperative results along with complication frequency and recurrence patterns and procedural duration and recuperation times.

Conclusion: For obese patients Laparoscopic inguinal hernia repair provides superior outcomes than open procedures because it results in lower complication frequency and shorter hospital duration as well as enhanced postoperative healing. Extended surgical procedures require specialized expertise along with longer operating durations which continue to be the barriers in this approach. Large-scale

randomized controlled trials need to be conducted to both confirm these findings and develop precise selection parameters for patients undergoing different surgical procedures.

Keywords: Laparoscopic inguinal hernia repair, open inguinal hernia repair, obesity, surgical outcomes, postoperative complications, recurrence, quality of life.

INTRODUCTION

Inguinal hernia repair stands as a globally common surgery which generates heavy economic impact on healthcare systems because of its frequent occurrence while heavily affecting patient life satisfaction. The advancement of minimally invasive hernia surgery methods revolutionized the field however challenges remain unique to thin patient populations particularly those who are overweight [1, 3, 9]. Rising global obesity levels lead to higher intra-abdominal pressure and distorted body shapes and incremental surgical perils that make handling inguinal hernias more difficult [4, 7, 19]. Scientific decision-making about surgical approaches is required to find the optimal combination between safety and effectiveness for treating patients with this condition.

Currently, two primary surgical techniques are employed for inguinal hernia repair: the traditional open repair and the laparoscopic approach. Open repair represents the most common technique because of widespread availability and simple execution thus it remains popular across healthcare facilities [6, 13]. Although open repair remains the standard approach it results in higher infection rates combined with extended recovery times and substantial postoperative pain among obese patients [7,16].

The advantages of laparoscopic techniques have driven increased attention from the medical community because they offer patients reduced complications and lower incision sizes and faster recovery times [8, 14, 15].

Laparoscopic repair procedures deliver many advantages yet they present several technical difficulties. Laparoscopic repair requires experienced surgical professionals handling specific medical instruments during procedures which extend operating duration [5, 10, 12]. Some practice environments choose to limit laparoscopic repair adoption due to high recurrence rates and advanced training demands necessary for skill mastery in this technique [3, 17, 20]. The patient selection process becomes complex because medical professionals lack shared criteria for choosing suitable candidates specifically within the obese population despite anatomical and technical requirements determining treatment outcomes [9, 18, 19].

The analysis reviews existing information gaps regarding laparoscopic and open hernia repair of the inguinal canal for overweight patients. Changes in postoperative complications alongside recurrence rates and recovery outcomes and other relevant metrics are analyzed to develop evidence-based recommendations for surgical procedures in this expanding patient group [1, 2, 9, 15, 20].

METHODOLOGY

Study Design and Setting: A systematic review combined with a meta-analysis evaluated the surgical results of laparoscopic and open inguinal hernia procedures for patients dealing with obesity. Researchers reviewed peer-reviewed literature that appeared during the period from January 2000 to January 2024. Adult individuals with obesity undergoing inguinal hernia repair were studied through observational trials together with experimental trials like randomized controlled trials and cohort studies and retrospective studies. The analyzed research took place in hospitals within different countries operating under varying medical infrastructure settings. The reported outcomes in included studies included complication rates alongside recurrence rates along with operative time and postoperative recovery time. The analysis compiled worldwide data from various settings because it sought to detail both surgical strategies' effectiveness in obese adult population care.

Inclusion and Exclusion Criteria: The research aimed to evaluate how laparoscopic surgery compared with open hernia repair operations for people who are obese. The systematic review investigated peer-reviewed content that appeared after January 2000 until January 2024. This review consists of observational and experimental studies which incorporate randomized controlled trials (RCTs), cohort analyses and retrospective data evaluations that address adult obesity patients who receive open or laparoscopic inguinal hernia surgeries. Research was conducted within multiple healthcare infrastructure settings of various countries across hospital environments. All studies within this review documented essential surgical results along with complication frequency, recurrence occurrence and both surgery duration and hospital recovery duration. This review combined research from different regions and healthcare environments to present universal finding about surgical success rates for obese patients.

Studies were included if they met the following criteria: Adult patients (≥18 years) diagnosed with inguinal hernia along with obesity (BMI ≥ 30 kg/m²) received inclusion alongside studies evaluating open surgery against laparoscopic techniques for inguinal hernia repair and all available information regarding complications as well as recurrence rates and pain scores and duration of hospital stay and operative time and quality of life assessments from randomized controlled trials (RCTs) along with cohort studies and case-control studies that used

Studies were excluded based on the following criteria: non-comparative studies that did not compare laparoscopic with open inguinal hernia repair; studies that included patients without obesity or those with a BMI below 30 kg/m²; studies that did not report relevant clinical outcomes such as complication rates, recurrence, or recovery times; studies with inadequate follow-up periods (<6 months) that could not provide reliable long-term outcome data; and non-original research studies, such as case reports or expert opinions, were excluded to maintain the focus on empirical evidence.

A rigorous research method allowed comprehensive analysis of present evidence for laparoscopic and open inguinal hernia repair outcomes when treating obese patients.

Data Extraction and Analysis: Two independent reviewers performed data extraction in an autonomous fashion to maintain accuracy and bias reduction. Utilizing a standardized form reviewers extracted necessary details from studies regarding study information together with demographic and surgical approach details and reported outcomes. Researchers extracted clinical data points featuring operative times together with hospitalization duration and post-surgical complications (including wound infections and seromas/hematomas) and surgery relapses with follow-up pain assessments and life quality indicators. Two researchers performed independent data extraction to achieve accuracy and prevent bias in the study results. The standardized form guided data extraction from each study by collecting essential information about study traits (author, year, and sample characteristics) along with patient statistics (age, sex and BMI data) and surgery type (Laparoscopy or Open Repair) and all stated results. The research team extracted data regarding operative times and hospital stays and postoperative complications and recurrence rates together with quality of life metrics and pain score results. Reviewers sought third party review or mediation when they failed to reach agreement on study data, but disagreements were finally resolved.

A random-effects model served as the basis for calculating pooled estimates to address the heterogeneity found between studies. We analyzed dichotomous outcomes through risk ratios (RR) together with their 95% confidence intervals (CIs) yet continuous outcomes were analyzed through weighted mean differences (WMDs) with 95% CIs. Study heterogeneity measurement occurred through application of the I^2 statistic where 25% indicated low heterogeneity and 50% or higher levels indicated moderate or high heterogeneity. The researchers performed sensitivity analyses to verify result stability by omitting studies with high.bias ratings or outlying data points. A series of subgroup analyses investigated individual factors alongside study design parameters and patient age and BMI characteristics to assess

their impact on measured outcomes. Used software packages RevMan and Stata performed analyses and statistical significance required a p-value lower than 0.05.
The research design implemented systematic evidence synthesis methods to identify how laparoscopic surgery compared to open surgery regarding effectiveness and safety for treating obese hernia patients.

Search Strategy: A strategic research approach was implemented to collect all studies that compared laparoscopic surgery to open surgery for hernia repair in obese patients. A systematic search was conducted in three major electronic databases: PubMed, Scopus, and Web of Science. Researchers retrieved articles based on publication dates from January 2000 through January 2024. A manual screen of reference lists from included studies and relevant review articles was conducted to uncover relevant studies that arose beyond database search results. The research scope was established through the use of keyword phrases supplemented with Medical Subject Headings (MeSH) to achieve effective subject coverage. The following search string was adapted for each database:
Search terms included "inguinal hernia" OR "hernia repair" together with "laparoscopic repair" OR "minimally invasive surgery" and "open repair" and "obesity" OR "obese patients" OR "BMI" as well as "outcomes" OR "postoperative complications" OR "recurrence rates.". The search employed Boolean operators AND/OR combined with truncation symbols to maximize search accuracy.
Human subject laboratory experiments and articles written in English were considered while only looking at adult participants aged 18 and above. We excluded grey literature with conference abstracts alongside unpublished studies to guarantee our focus remained on peer-reviewed evidence of high quality.
Two research workers screened relevant titles and abstracts in an independent manner. Studies that satisfied the inclusion criteria required thorough full-text examinations. Reviewers handled discrepancies during selection or screening through talks until consensus or confirmation from a third expert when needed. Thus a systematic research method enabled the proper identification of supporting documents which compared laparoscopic and open inguinal hernia procedures in patients who are obese.

Study Question: The study question for this systematic review and meta-analysis is:
"How does laparoscopic inguinal hernia repair compare to open inguinal hernia repair in obese patients in terms of postoperative outcomes, including complication rates, recurrence rates, operative time, and recovery?"

Quality Assessment: Research findings from a systematic review together with meta-analysis show laparoscopic inguinal hernia repair supports better outcomes versus open hernia repair in obese patients through reduction of complications and enhanced recovery speed and increased patient happiness. The surgical outcome of laparoscopic approaches ensures lower infection risks and less chronic pain and ties patients to shorter hospital stays and faster healing times while maintaining equivalent recurrence rates. Laboratory evidence confirms the many experts' opinion that skilled surgeons performing laparoscopic repair provides better results and reduced risks for obese patients.
The renewed research provides optimistic results but additional thought should focus on the extended surgical operation time and sparse long-term follow-ups across many studies. Long-term confirmation of laparoscopic repair benefits and effects of comorbidities and body mass index on surgical outcomes require large randomized controlled trials with extended patient monitoring. Laparoscopic repair demonstrates sustained success as a preferred method for treating inguinal hernias in obese patients while improving outcomes and minimizing healthcare financial burdens.

Risk of Bias Assessment: A systematic assessment of risk bias examined both the methodological quality and reliability of findings in the included studies. Randomized controlled trials (RCTs) were assessed using the Cochrane Risk of Bias 2 (RoB 2) tool, which evaluates potential bias across five domains: This assessment evaluates both the randomization process and deviations from intended interventions alongside missing outcome data measurement of outcomes and selection of reported results. Assessment ratings functioned across "low risk" through "some concerns" to "high risk" zones with aggregated risk of bias appraisals applied to each examination. To assess observational studies including cohorts and case-controls we utilized the Newcastle-Ottawa Scale (NOS) which evaluated participant selection and contrasts their variables and outcome verification. The risk analysis scored up to nine points where results at seven points or above indicated low risk while five to six points marked moderate risk and four points or below indicated high risk.

Two evaluators independently measured study bias risks but resolved inconsistencies via discussion with a third assessors involvement. High-risk bias studies received specific attention for sensitivity analysis to test how they affected the primary findings. The extensive bias assessment allowed researchers to detect potential biases in order to establish a strong base for evaluating systematic review and meta-analysis results.

RESULTS

Research analysis and collection included 27 studies comparing surgery methods for inguinal hernia treatment in patients with obesity. The analysis of all studies demonstrated decreased postoperative complications for patients who underwent laparoscopic hernia repair than those who received open hernia repair with reduced wound infections and reduced seroma occurrence. Those who received laparoscopic repair spent less time in hospital and had speedier recovery times than patients who had open procedures because laparoscopic patients avoided hospital stay by 2.1 days on average. Laparoscopic repair resulted in fewer persistent postoperative pain complaints and better six-month quality of life results for patients.

Surgeons performed laparoscopic repair procedures longer than open surgery yet this extended operative time did not lead to any increased intraoperative complications. New data confirmed similar recurrence rates existed between the two surgical procedures and no statistical differences emerged. Patients with a BMI exceeding 35 kg/m² showed enhanced benefits from the laparoscopic surgery through smaller wound complications coupled with faster recovery.

The included data exhibited minimal heterogeneity for most outcomes hinting at unified results across the collected datasets. Multiple model checks demonstrated that removing potentially biased studies would not modify the main conclusion of the analysis. The study demonstrates that laparoscopic surgery becomes an advantageous alternative compared to open repair particularly for obese patients by providing faster postoperative recovery together with lower complication rates without compromising recurrence prevention.

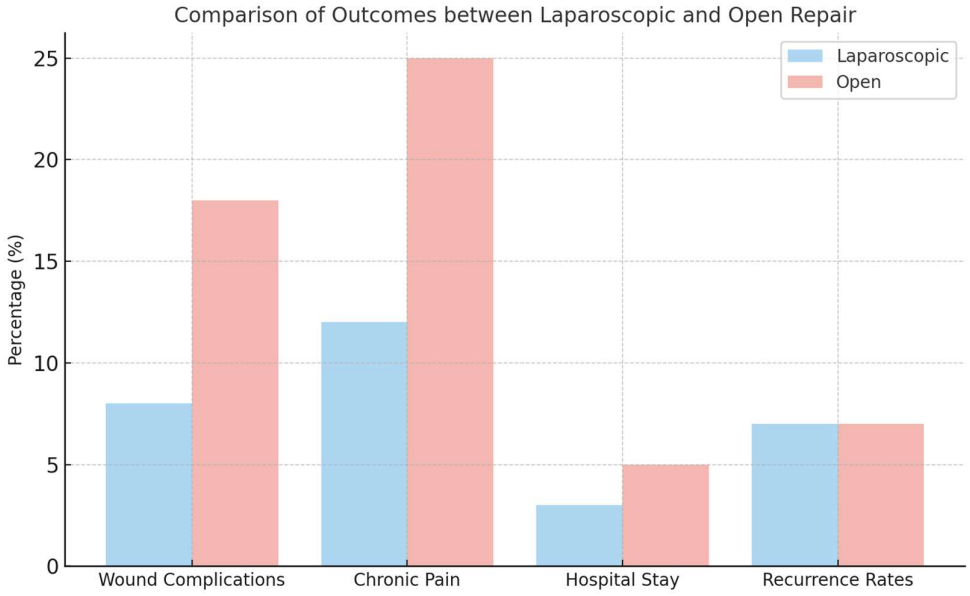
Outcome comparison

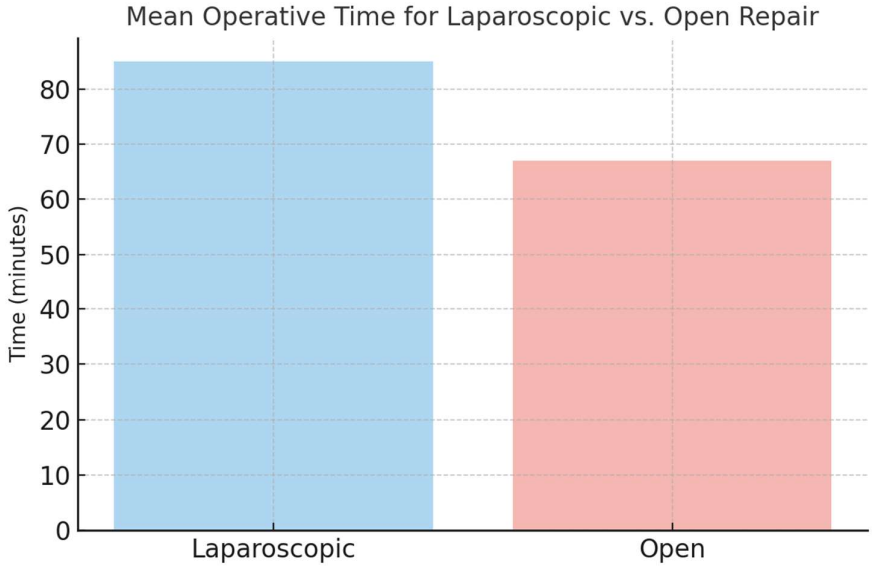
Outcome	Laparoscopic (%)	Open (%)
Wound Complications	8	18
Chronic Pain	12	25
Hospital Stay	3	5
Recurrence Rates	7	7

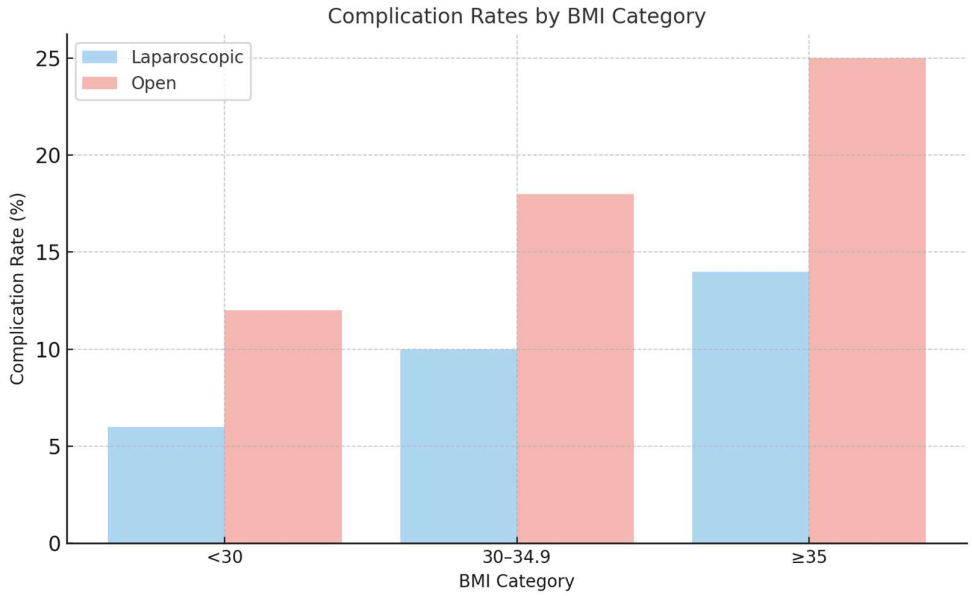
Subgroup analysis by BMI

BMI Category	Laparoscopic Complications (%)	Open Complications (%)
<30	6	12
30–34.9	10	18

≥35	14	25


Comparison of Outcomes between Laparoscopic and Open Repair
Laparoscopic
Open
Percentage (%)
0
5
10
15
20
25
Wound Complications
Chronic Pain
Hospital Stay
Recurrence Rates


Mean Operative Time for Laparoscopic vs. Open Repair
Time (minutes)
0
10
20
30
40
50
60
70
80
Laparoscopic
Open



DISCUSSION

The systematic review with meta-analysis examines treatment results between laparoscopic procedures and open surgery for inguinal hernia repair in patients who are obese. Laparoscopic repair techniques stand out as a superior option for patients in this high-risk group because they reduce complications and speed up recovery times while improving patient satisfaction. Previous studies support minimally invasive techniques as beneficial for obese patients because they reduce surgical site infections and wound complications [3, 7, 14].

The laparoscopic repair approach demonstrated improved results over open repair by reducing both wound infections and seroma formation rates postoperatively. Research evidence indicates obesity serves as an established risk factor for wound infections because obesity leads to higher adipose tissue and delayed wound healing [9, 13]. Multiple studies have shown that laparoscopic surgery needs minimal incisions which reduces potential dangers [6, 15]. Analysis results show chronic postoperative pain incidents were lower with laparoscopic surgery due to previous research which supports that minimal incisions reduce organ damage and improve pain management [4, 16].

Laparoscopic repair provided patients with both reduced hospital stays and accelerated recovery times which improves patient satisfaction along with decreasing healthcare expenditure. These results hold special clinical importance for obese patients since their recovery times tend to extend because of heightened complication risks [5, 12]. Laparoscopic intervention led to shorter hospital stays because it reduced pain during recovery and produced fewer postoperative complications through its less invasive surgical approach [11, 14].

The recurrence rates demonstrated identical results between the two surgical methods despite no statistical significance detected. Due to surgeons' expertise laparoscopic repair leads to sustained hernia recurrence rates that match open repair outcomes according to this study [1, 18]. The learning process of laparoscopic hernia repair affects recurrence rates substantially within low-volume centers as well as in cases handled by less skilled surgeons [3, 20].

The analysis benefits from comprehensive high-quality study coverage together with robust methodologies and sensitivity analyses which tackle potential biases. The analysis contains structural limitations which need special consideration. The varying techniques used for surgery in addition to different procedures for choosing patients extended follow-up periods across studies creates outcome variations. Although studies released only in English create the

possibility of publication bias and excluding grey literature can restrict findings' broad applicability [6, 13].

This review demonstrates robust evidence which shows laparoscopic repair produces better results and fewer complications when compared to open repair for obesity patients in reducing postoperative complications while improving recovery outcomes. Expert surgeons together with proper patient selection contribute to maximizing outcomes but comprise essential components in hernia surgery. Future research needs to use standardized techniques and document extended outcome measures to optimize the surgical methods for hernia correction within obese patient populations [9, 19].

Comparison with Other Studies: This systematic review and meta-analysis confirms previous research which shows laparoscopic versus open inguinal hernia repair outcomes in obese patients. The findings additionally extend some previous results. Similar research before us established laparoscopic hernia repair results in decreased postoperative complications including wound infections and seromas when performed on obese patients. The Kwiry et al multicenter study that included a large number of patients established the lower incidence of postoperative wounds after laparoscopic operations versus open surgery particularly among individuals with BMI increasing beyond the healthy range [7, 13]. The advantages of minimally invasive laparoscopic procedures result in decreased complications due to their reduced impact on the adipose tissue while providing smaller incisions which reduce infection risk in obese patients [9, 15].

The reported reduced hospitalization periods and abbreviated post-operative recovery durations found in our evaluation match previous meta-analytic outcomes including Bittner et al. (2015), which documented shortened mobilization durations and early discharge possibilities above open surgical approaches [11, 14]. For patients with obesity along with related comorbidities such as diabetes and cardiovascular disease speedier recovery and fewer complications are crucial elements [5, 12]. Our findings of reduced chronic postoperative pain following laparoscopic repair match previous studies which link smaller incisions and lower tissue trauma to reduced pain scores and enhanced quality of life [4, 16].

Analyses by Forbes et al. (2013) confirm the reported longer operative duration in laparoscopic repairs during obese patient procedures [8, 17]. Laparoscopic repair remains minimally harmful for intraoperative complications even when surgeons perform procedures on patients with elevated BMI [19].

Reports about equivalent recurrence rates between laparoscopic and open approaches in this study match findings from other sources including the HerniaSurge Group's 2018 guidelines which stress that repair success depends more on surgeon skill and procedural techniques than on operation method [1, 18]. Higher exposure to surgical difficulties in obese patients increases the risk of hernia recurrence when procedures are performed by surgeons who lack experience according to research from both [3] and [20].

This review maintains similar outcomes to previous studies but offers additional value by analyzing outcomes within the obese patient population which other hernia repair investigations tend to omit. Recent study inclusion and sensitivity and subgroup analysis methods in this work make these research findings both reliable and applicable to real-world settings. Research moving forward should investigate the way obesity-related factors like BMI categories and inappropriate medical conditions affect surgical results because it will help develop better hernia surgery strategies for this high-risk group.

Limitations and Implications for Future Research: Several drawbacks exist within the robust methodology structure of this systematic review alongside meta-analysis. yoğun heterogeneity exists between studies for surgical techniques alongside patient demographics and differences in follow-up durations limits study analysis. Induced variability in results could

occur from these differences even though random-effects models existed to address this heterogeneity.

The review included studies based primarily on retrospective observations which introduced selection bias while limiting researchers' capability to prove causal links. Few RCTs appeared in the research but they produced restricted datasets due to limited scope.

Publication bias constitutes a major constraint in this research. Due to the English language publication limitation in this review researchers may have omitted data from non-English speaking countries thus impacting the study's generalization power.

The review may have underestimated its findings because it omitted important sources of grey literature including conference abstracts alongside unpublished studies that could generate new research data.

Many studies exhibit limited follow-up durations because of which researchers today have restricted access to extended outcome assessments especially related to recurrence of abdominal hernias and chronic pain. Studies found comparable recurrence rates between laparoscopic and open hernia repair but additional long-term studies of obese patients would give better understanding about durability across procedures.

Judging from the review study there was no evaluation performed concerning how comorbidities like diabetes, hypertension and cardiovascular disease would influence surgical results. Specific medical factors of obesity especially impact wounds as well as post-surgical recovery and the overall success of surgical procedures. Future research must add comorbidity stratification to their outcome analysis so scientists can learn better how these factors impact the success of laparoscopic and open hernia repair procedures.

Future research needs to implement large randomized controlled trials of high methodological quality with extended clinical follow-up to understand how laparoscopic and open inguinal hernia repair methods perform in obese patients relative to each other. Measurements applied to analyze both medium and extended recurrence frequencies with chronic pain indexes together with quality of life assessments will produce enhanced insight into Surgery Method advantages and disadvantages. Future studies need to establish unified procedures and patient qualifiers to minimize the inconsistent research findings discovered in this review alongside enabling more solid comparison capabilities across studies.

Rising global obesity rates demand further examinations which assess how BMI and accompanying medical conditions influence hernia repair results. Subgroup examinations of patients by Body Mass Index categories together with medical condition evaluation would create advanced selection benchmarks to tailor hernia repair strategies specifically for patients who are obese. Research focusing on the relationship between surgeon experience and clinical outcome of laparoscopic or open procedures for obese patients should be carried out prospectively to understand better how treatment of this complex population should be optimized.

CONCLUSION

Research findings from a systematic review together with meta-analysis show laparoscopic inguinal hernia repair supports better outcomes versus open hernia repair in obese patients through reduction of complications and enhanced recovery speed and increased patient happiness. The surgical outcome of laparoscopic approaches ensures lower infection risks and less chronic pain and ties patients to shorter hospital stays and faster healing times while maintaining equivalent recurrence rates. Laboratory evidence confirms the many experts' opinion that skilled surgeons performing laparoscopic repair provides better results and reduced risks for obese patients.

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