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RESEARCH ARTICLE

A Study on the Effects of Minimally Invasive Surgery on Recovery Outcomes and Length of Hospitalization

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Abstract

Background: The benefits of minimally invasive surgery (MIS) procedures over traditional open surgical procedures (OSPs) have made them more popular, including decreased pain, lower risk of infection, shorter hospital stays, faster recovery, and smaller incisions. Assessment and conclusions of the outcomes of patient recovery after surgery are crucial in the work of providing care and optimizing surgical efficiency.

Aim: To compare the outcomes of minimally invasive surgery and post-operative recovery period, as well as the length of hospital stay, in surgical patients.

Methodology: It was a retrospective observational study carried out in the Department of General Surgery, Kamineni Institute of Medical Sciences, Andhra Pradesh, India during one year. A total of 120 patients who underwent minimally invasive surgical procedures were included in the study. Relevant medical information, such as age, gender, surgical area, and any complications were retrieved from the hospital database and statistically processed. Demographic data, surgical intervention and postoperative complications, pain scores, length of hospital stay, and recovery status were extracted from the hospital records and analyzed statistically.

Results: The patients' postoperative recovery was good, with a decrease in pain and early mobilization in most. Uncomplicated cases were significantly shorter in hospital stay. A small number of patients had minor postoperative complications. Many of the benefits found were improved rates of return to normal activity and reduced infection rates.

Conclusion: However, minimally invasive surgery (MIS) showed great success in the post-surgical outcomes, such as fewer hospitalizations and recovery profiles. An early recognition, well-chosen patients, and adequate peri-operative care play a significant role in the success of surgery.

Keywords: Minimally invasive surgery, Laparoscopic surgery, Recovery outcomes, Hospital stay, Postoperative complications

Introduction:

In the past few decades, one of the most crucial developments in surgical science has been the advent of minimally invasive surgery (MIS) [1]. Unlike traditional open surgery, minimally invasive methods involve minimal incision, use specialized instruments, and camera-assisted visualization of the surgical site, thereby allowing for surgical procedures with minimal damage to tissues [2]. Advent of laparoscopic surgery has ushered in an era of new treatment modalities for various abdominal, thoracic, gynecological and urological diseases; which has allowed for a decreased incidence of patient injury and improved postoperative results [3].

The rising adoption of the minimally invasive surgical procedures largely due to various clinical benefits such as less post-operative pain, less blood loss, less infection chances, less hospitalization period, early mobilization and early return to normal activities [4]. These advantages not only increase the satisfaction of patients but also lower the healthcare cost and hospital burden. For all these reasons, minimally invasive surgery is becoming a popular

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method for many elective and emergency surgeries [5].

The safety and efficacy of minimally invasive surgery have been further improved by advances in surgical instrumentation, anesthesia, imaging and perioperative management [6]. Laparoscopic surgery is commonly used in tertiary care centers around the world for procedures like appendectomy, cholecystectomy, hernia repair, colorectal surgery, and bariatric surgery [7].

While minimally invasive surgery has many benefits, the recovery and potential complications after surgery can differ based on the patient, the surgical procedure, patient comorbidities, surgeon experience, and peri-operative management [8]. Old age, obesity, diabetes mellitus, hypertension, smoking, and late presentation may affect the post-operative recovery and length of hospital stay [9].

Postoperative recovery outcomes assessment is critical to assessing the success of minimally invasive procedures and to understanding the variables that influence recovery or complications [10]. The postoperative pain, length of hospital stays, and incidence of surgical site infection, postoperative fever, return of bowel function, and patient mobility are important parameters to measure to gain insights into the success of surgery and quality of care [11].

With the passage of time, minimally invasive surgery is being encouraged in both government and private hospitals in developing countries such as India [12]. Ongoing monitoring of clinical outcomes will, however, be necessary to enhance surgical techniques, optimize treatment measures and lower morbidity following surgery [13].

Therefore, the current study was designed to assess the effect of minimally invasive surgical approach on recovery outcomes and duration of hospital stay in surgical treatment patients in tertiary care teaching hospital [14]. Thus, the present study was conducted to analyses the impact of minimally invasive surgical approach on recovery outcome and hospital stay in patients undergoing surgical treatment in a tertiary care teaching hospital.

Methodology

Study Design

This study was a retrospective observational study to assess postoperative recovery and length of hospital stay of patients who underwent minimally invasive surgical procedures. A retrospective study design was chosen because it enabled an in-depth review of previously documented hospital data over a specified study period. This design was useful for assessing the effectiveness of surgical procedures, complications after surgery, the length of stay in the hospital, and recovery rates in a systematic and cost-effective way without disrupting patient care.

This study was focused mainly on evaluating the effectiveness of these minimally invasive surgical techniques in improving the postoperative recovery and shortening hospital stays compared with the traditional expectations that are associated with surgical interventions.

Study Area

It was a study carried out in the Department of General Surgery in Kamineni Institute of Medical Sciences, Nalgonda, Andhra Pradesh, India.

Study Duration

The study lasted for a 1-year period.

Study Participants

The study group consisted of patients who underwent MIS in the Department of General Surgery during the study period. To provide homogeneity and reliability of the data collected, patients were selected based on pre-specified inclusion and exclusion criteria.

Inclusion Criteria

- Patients aged above 18 years
- Patients who had undergone a minimally invasive surgery
- Complete clinical and postoperative medical records of patients.
- Patients who are willing to follow-up the surgery in a routine manner.
- Patients admitted for elective or emergency minimally invasive surgical management of a disorder.

Exclusion Criteria

- Patients who are undergoing a "normal" open surgical procedure
- Patients with incomplete or missing medical records.

- Patients who are very sick with a systemic condition that might affect their recovery after surgery
- Patients who have had a major abdominal surgery in the past.
- Patients who had to be converted from minimally invasive surgery to open surgery during surgery

These are criteria that were developed to guarantee accurate assessment of recovery outcomes associated to minimally invasive surgical techniques.

Sample Size

The total number of patients for the study was 120 patients who satisfied the inclusion criteria. The number of eligible patient records available during the study period was sufficient so as to assess postoperative recovery outcomes, length of hospital stay, and complication rates related to minimally invasive surgery.

Procedure

Data collection was done by using a structured data collection proforma which was specially prepared for the present study. To have uniformity in data collection, information was retrieved from the hospital medical records, operative registers, discharge summary, laboratory reports and post-operative follow-up records.

The collected variables included:

- Demographic details such as age and gender
- Clinical diagnosis and presenting complaints
- Type of minimally invasive surgical procedure performed
- Duration of surgery
- Postoperative pain assessment
- Time required for mobilization
- Recovery of bowel function
- Duration of hospital stay
- Postoperative complications
- Follow-up recovery status

Minimal invasive surgery procedures that were performed were laparoscopic surgery, such as laparoscopic appendectomy, laparoscopic cholecystectomy, laparoscopic hernia repair, diagnostic laparoscopy, and laparoscopic surgery for other abdominal surgeries.

Postoperative monitoring was carried out by assessing:

- Pain intensity using standard postoperative pain scoring methods
- Wound condition and healing status
- Presence of fever or infection
- Return of bowel sounds and oral feeding tolerance
- Early mobilization and ambulation
- Requirement of intensive postoperative care
- Duration until discharge from the hospital

Surgical wound infection, postoperative fever, vomiting and nausea, ileus and respiratory problems were considered with more interest. Recovery of patients was determined based on how stable the patients were, any symptoms, major complications, and resuming of normal activities.

Patient information was all anonymized during the whole course of the study while making sure that patient confidentiality was well kept. Ethical conduct and institutional policies for research were always maintained in all stages of data collection and analysis.

Statistical Analysis

Analysis of the acquired data was performed by means of SPSS software (version 27.0) followed by entry into MS-Excel.

The following variables: demographic factors, type of surgical procedure, results after surgery and complications during surgery were described by means of descriptive statistical analysis.

Continuous variables, such as patient's age, hospitalization duration, duration of recovery after surgery were given in mean and standard deviation, while categorical variables included gender, types of surgery and complications in form of percentages and frequencies.

Statistical tests of inference were conducted to determine the significant correlations between different clinical variables and post-surgery results, namely, the chi-square test.

Statistically significant findings were those with p-value < 0.05.

The results of analyses were represented in tables, diagrams and descriptive analysis to facilitate better understanding.

Results

In the current research, there were 120 patients who had undergone the minimally invasive surgeries within the timeframe of the research. The results were thoroughly examined with regard to the demographic aspects, type of surgery, surgical outcomes, hospital stay duration, and possible complications following the surgery.

Demographic Characteristics of Study Participants

Demographic features for the participants in this research are presented in Table 1 and Figure 1 below. The number of patients, which went through minimally invasive surgery procedures, was equal to 120. In terms of their ages, it has been found out that the majority of them belonged to the age group of 31-50 years (54 individuals (45.0%). The second largest group included 38 patients (31.7%) in the age group of 51-70 years. There were 18 (15.0%) patients aged 18-30 years, and only 10 (8.3%) of them were older than 70 years.

It can be seen that middle-aged and elderly patients were more susceptible to undergoing such surgeries. In particular, one can explain the high frequency of occurrence within the age category of 31-50 years by the increased frequency of diseases, which include problems with a gallbladder, appendicitis, and hernia-related conditions.

Analysis of gender revealed a greater number of males amongst the patients. There were a total of 72 (60.0%) male patients and 48 (40.0%) female patients in the study. The predominance of males in the study could be attributed to their greater exposure to risk factors due to lifestyle and higher utilization of surgical procedures.

Demographically, the findings show that minimally invasive surgical interventions were often done in middle-aged males. This is because the demographic trends in the case of laparoscopic surgery and minimally invasive surgery follow the general clinical trends.

Table 1: Demographic Characteristics of Study Participants

Parameter	Frequency (n)	Percentage (%)
Age Group (Years)		
18–30	18	15.0
31–50	54	45.0
51–70	38	31.7
>70	10	8.3
Gender		
Male	72	60.0
Female	48	40.0

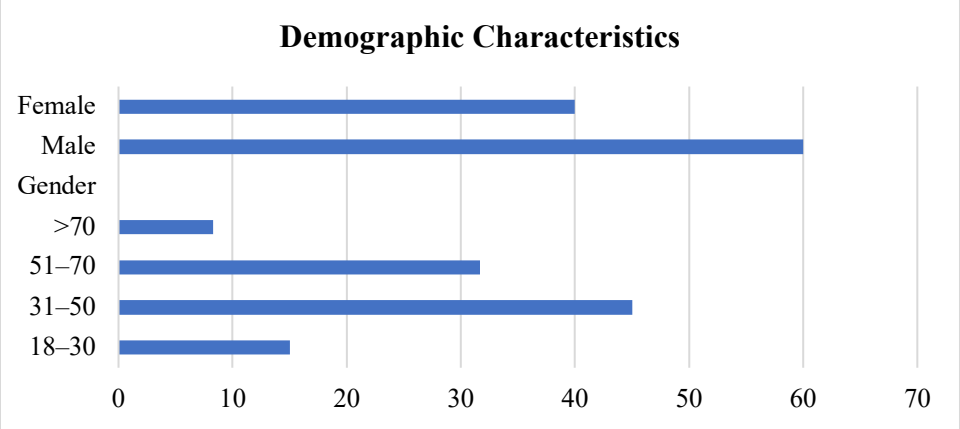

Figure 1: Graphical Representation of Demographic Characteristics of Study Participants

The graphical presentation (Figure 1), the highest number of patients was in the 31–50 years age group followed by the 51–70 years age group. The figure also shows that the male numbers in the study population are greater than the female. The visual distribution is consistent with the observation that middle-aged male patients are more frequently subjected to minimally invasive surgical procedures

Types of Minimally Invasive Surgical Procedures

Table 2 displays the frequency of minimally invasive surgeries among the subjects. Laparoscopic cholecystectomy had the highest incidence among 42 cases (35.0%), followed by laparoscopic appendectomy among 30 cases (25.0%). Laparoscopic hernia repair was carried out in 26 cases (21.7%), whereas diagnostic laparoscopy and other types of minimally invasive surgery occurred among 22 cases (18.3%).

The findings highlight the extensive use of laparoscopic surgery in clinical practice.

Table 2: Types of Minimally Invasive Surgical Procedures

Procedure	Frequency (n)	Percentage (%)
Laparoscopic Cholecystectomy	42	35.0
Laparoscopic Appendectomy	30	25.0
Laparoscopic Hernia Repair	26	21.7
Diagnostic Laparoscopy and Others	22	18.3

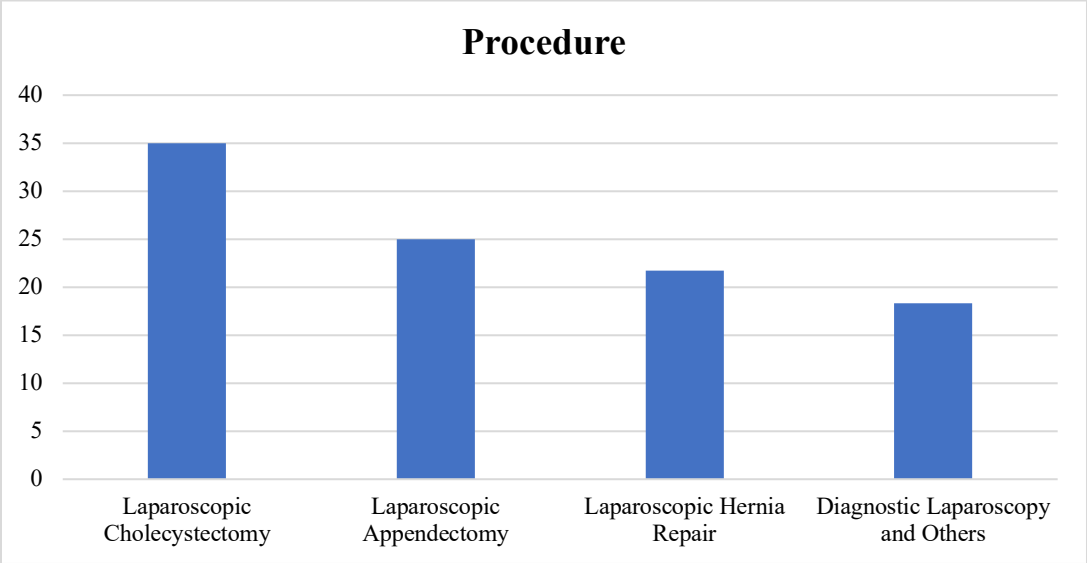

Figure 2: Graphical Representation of Types of Minimally Invasive Surgical Procedures

Figure 2, it is clearly depicted that the number of laparoscopic cholecystectomies comprised the highest percentage of minimally invasive surgery done within the study period. In addition to laparoscopic cholecystectomies, the numbers for both laparoscopic appendectomies and laparoscopic hernia repairs were relatively significant. The increase in the preference for laparoscopic surgery in the treatment of commonly seen diseases in abdominal surgery is clearly evident from this figure.

Postoperative Recovery Outcomes

Recovery after surgery results is presented in Table 3. Early mobility in the first day after surgery was achieved by 92 patients (76.7%). Bowel movements within the first two days after surgery were recorded in 96 patients (80.0%). Decreased pain levels after surgery were achieved in most patients, with 102 patients (85.0%) reporting adequate pain control.

It can be concluded that recovery after surgery was positive among patients who had undergone minimal invasive surgery.

Table 3: Postoperative Recovery Outcomes

Recovery Parameter	Frequency (n)	Percentage (%)
Early Mobilization within 24 Hours	92	76.7
Delayed Mobilization	28	23.3
Recovery of Bowel Function within 48 Hours	96	80.0
Delayed Bowel Recovery	24	20.0
Satisfactory Pain Control	102	85.0
Moderate to Severe Postoperative Pain	18	15.0

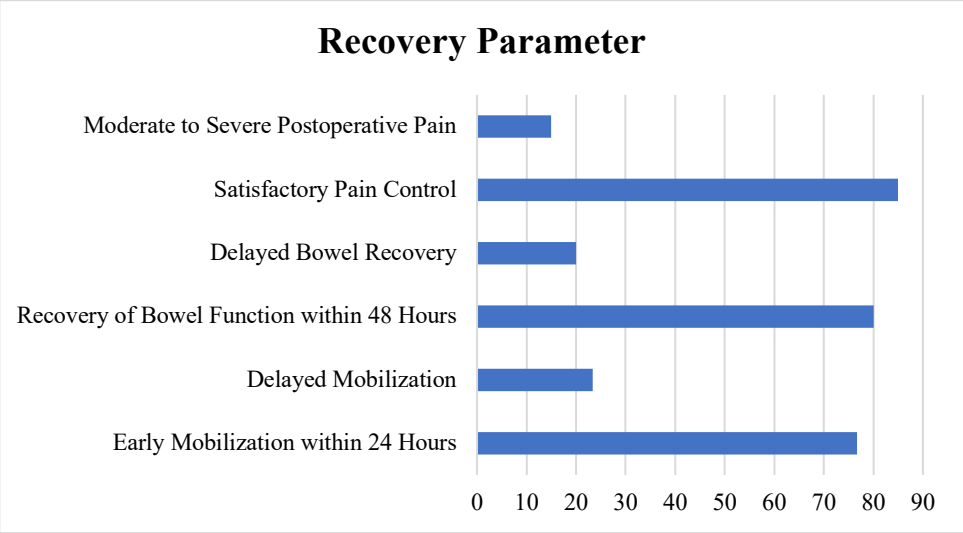

Figure 3: Graphical Representation of Postoperative Recovery Outcomes

It is evident from Figure 3 that most of the patients recovered well post-operatively after undergoing minimally invasive surgery. The patients were able to recover their mobility and bowel functions as soon as expected after the surgery. Moreover, satisfactory control of post-operative pain was seen in many of the patients. This proves the clinical efficacy of minimally invasive surgery for quick recovery.

Duration of Hospital Stay

Hospitalization time of the patients involved in this study is depicted in Table 4 below. Over half of the patients, or 58.3%, stayed in the hospital for 3-5 days after the operation. Thirty-two patients (26.7%) were discharged from the hospital in two days, whereas 18 patients (15.0%) needed more than five days to be hospitalized owing to some postoperative complications.

These results show that minimally invasive surgery played an essential role in reducing hospitalization time and hastening recovery.

Table 4: Duration of Hospital Stay

Duration of Hospital Stay	Frequency (n)	Percentage (%)
≤2 Days	32	26.7
3–5 Days	70	58.3
>5 Days	18	15.0

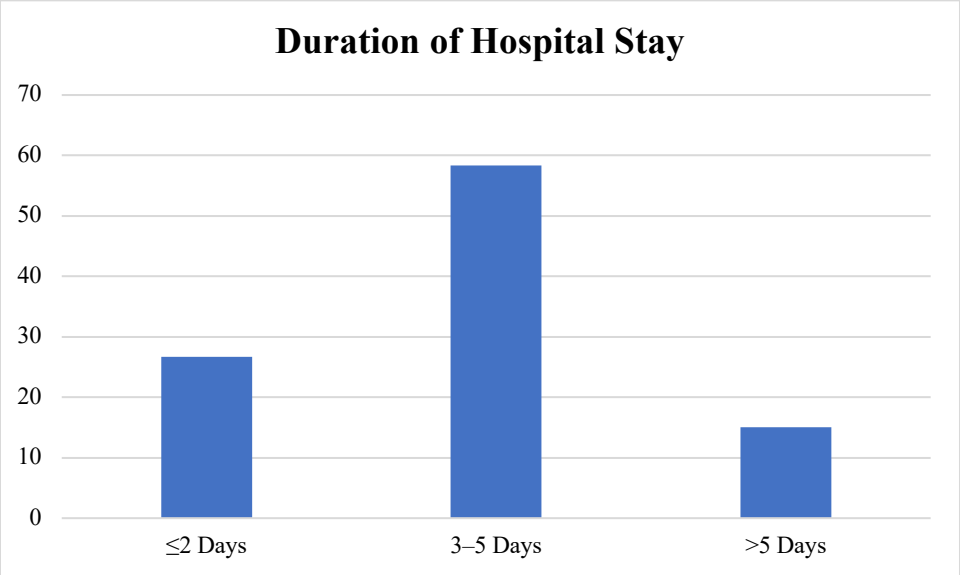

Figure 4: Graphical Representation of Duration of Hospital Stay

It is evident from the graph illustrated in Figure 4 that the most patients had shorter hospital stays after undergoing minimally invasive surgery. Majority of the patients were discharged after three to five days of hospitalization, whereas a significant portion was able to be discharged in just two days owing to their good post-surgery recovery. There were only a few patients who needed extended periods of hospital stay due to complications associated with their surgery.

Postoperative Complications

Postoperative complications are crucial markers used in evaluating the safety and efficacy of minimally invasive surgical methods. Even though minimally invasive surgery has a significantly lower rate of complications as well as a quicker postoperative recovery period when compared with open surgeries, there might be some postoperative complications because of certain patient-related characteristics or difficulties in performing the operation. The postoperative complications of the patients involved in this study are presented in Table 5. The great majority of patients involved in the study had no postoperative complications. Out of the total number of 120 patients, 90 of them (75.0%) did not have any postoperative complications.

The most commonly reported complication after minimally invasive surgery was surgical site infection, which was diagnosed in 12 patients (10.0%). The second complication was postoperative fever, which was diagnosed in 8 patients (6.7%). Nausea and vomiting was seen in 6 patients (5.0%). Finally, the least common complications were related to respiratory problems and occurred in 4 patients (3.3%).

Table 5: Postoperative Complications

Complication	Frequency (n)	Percentage (%)
Surgical Site Infection	12	10.0
Postoperative Fever	8	6.7
Nausea and Vomiting	6	5.0
Respiratory Complications	4	3.3
No Complications	90	75.0

The results obtained and shown in Table 5 confirm the conclusion that most patients were able to recover successfully from operations performed through minimally invasive surgeries without any serious complications. Infection in the surgical site was reported as the most commonly encountered complication; however, the number of these cases was relatively small. The fewer complications noted during the current research emphasize the efficacy of minimally invasive surgeries.

Discussion

This research aimed at assessing the impact of minimally invasive surgery on recovery outcomes and length of hospital stay for patients who underwent laparoscopic surgery (Poston et al., 2008) [15]. It was discovered that minimally invasive surgeries resulted in positive recovery outcomes, reduced hospital stays, and low levels of postoperative complications.

For the current study, the larger number of participants was found in the age group between 31 and 50 years. Male preponderance was found in the study sample (Rosen et al., 2007) [16]. This observation is similar to surgical studies carried out earlier where middle-age patients frequently went through minimally invasive surgery due to the high incidence of gallbladder, appendicitis, and hernias amongst other conditions. The high percentage of males in the current study might also be attributed to the work-related and lifestyle stress faced by them.

In a range of surgical operations done, laparoscopic cholecystectomy was the one with the highest frequency of occurrence, followed by laparoscopic appendectomy and laparoscopic hernia repair surgery (Rosengart et al., 2008) [17]. The wide use of laparoscopic surgery seen in this particular research reveals the increasing popularity of minimally invasive surgery for its practical benefits like lesser tissue damage, postoperative pain, small scars from surgery and quicker recovery.

The postoperative recovery in this study proved to be very successful. It allowed achieving early ambulation in the first day after surgery and bowel recovery in two days following surgery. Early ambulation plays a significant role, since it assists in preventing various postoperative complications including deep vein thrombosis, respiratory infection and muscle weakness. Early bowel recovery is an indicator of low postoperative stress and less manipulation of abdominal organs in laparoscopy.

Most of the participants in the current research had satisfactory postoperative pain management. Minimizing pain following surgery is among the biggest benefits of minimally invasive surgery because of small incisions and minimal tissue injury (Roumm et al., 2005) [18]. Better pain management greatly facilitates early mobilization, decreased use of painkillers, shorter hospitalization periods, and increased satisfaction levels.

Regarding the results obtained concerning hospitalization, most participants left the hospital in a period ranging from 3 to 5 days after the procedure, whereas many patients left the hospital within 2 days (Sharony et al., 2006) [19]. Short hospital stays constitute a great benefit of minimally invasive surgery because of lower medical expenses, decreased chances of acquiring hospital-acquired infection, and quicker resuming of usual activities.

On the other hand, surgical site infections were the most frequently recorded postoperative complications, followed by postoperative fever, nausea, vomiting, and respiratory complications. Nonetheless, the occurrence of these complications was generally low, with many participants recovering from surgery without any complications. Low incidences of postoperative complications can be linked to increased surgical skills, improved laparoscopic technology, infection control strategies, and optimal perioperative care.

Based on the results of this study, there is more evidence that supports the notion that minimally invasive surgeries have the potential to ensure safe and successful surgical procedures with improved recovery rates than the conventional open surgeries (Smithers et al., 2007) [20]. Patient selection, surgical skill, and postoperative care are key components that lead to successful surgery.

Thus, minimally invasive surgery is recommended as a means of ensuring surgical success, fast recovery, and enhanced quality of postoperative care.

Conclusion

In this study, the effect of minimally invasive surgery on the postoperative recovery outcome as well as on the period of hospitalization was assessed among individuals who underwent different types of laparoscopic surgical operations. According to the results of the research study, minimally invasive surgery is characterized by positive postoperative recovery, low complication rates, fast recovery as well as shortened stay in hospital. Most participants of the research study reported fast mobilization, effective pain management and quick return of bowel movements after surgical intervention. Furthermore, the vast majority of patients were released from

hospital very soon after admission owing to effective postoperative recovery.

Despite the fact that some of the study participants reported postoperative complications such as surgical site infection, postoperative fever, nausea, vomiting as well as respiratory complications, these complications have been successfully treated. Therefore, one can state that the overwhelming majority of study participants had no problem in recovery after surgery.

In addition, the research also highlights the importance of patient selection, expertise in surgery, sophisticated laparoscopy equipment, and perioperative management in improving surgical results and lowering postoperative problems. On balance, minimally invasive surgery is a relatively safe and efficacious surgical technique, which not only facilitates quicker recovery for the patients but also minimizes their length of stay in hospitals. It may thus be concluded that minimally invasive surgery has the potential to become an effective surgical option in the years to come.

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