

Prospective Study on the Factors Influencing the Clinical Outcome of Various Laparoscopic Surgeries in Elderly Patients

Vignaradj Kirouchenaradj¹, N Premanand², V Srinivasan³

¹Assistant Professor, Department of General Surgery, Saveetha Medical College and Hospital, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, India, ²Southern Railway Headquarters Hospital, Perambur, Chennai, Tamil Nadu, India, ³Associate Professor, Department of General Surgery, Saveetha Medical College and Hospital, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, India

Abstract

Background: Laparoscopic techniques with its advantages of decreased wound complications, post-operative ileus, intraoperative blood loss, and reduced need for post-operative rehabilitation are gradually replacing many common surgical procedures that are performed in an increasingly aging population. The proportion of elderly people (age 60 years and above) is on the rise in India over the past few decades. However, elderly population has decreased cardiopulmonary reserve, carries a long list of medical comorbidities and prior surgical history. The safety and efficacy of laparoscopic surgeries in elderly population have been from studies conducted in Western population where the average life expectancy at present exceeds India.

Materials and Methods: Elderly patients at the Department of General Surgery at Saveetha Medical College and Hospital, Chennai, and Southern Railway Headquarters Hospital, Chennai, who are undergoing various laparoscopic surgeries are recruited and prospectively operated by the hospital protocol and perioperative pulmonary rehabilitation given and followed up till 1 month period postoperatively. The data are collected and the relevant statistical analysis done.

Results: There are 25 patients with Grade 2 and above complications. There are 18% surgical complications (Grade 2 and above); 19% medical complications (Grade 2 and above); and 10% combined (Grade 2 and above); in the total study population ($n = 100$). The overall mortality rate was 2% in this study population. In patients with Grade 2 and above, post-operative complications, using multivariate logistic regression ($r^2 = 0.65$, significance $F = 0.011$) Charlson comorbidity score >2 ($P = 0.02$); the type of surgery ($P = 0.02$); and polypharmacy ($P = 0.03$), are found to have a statistically significant linear relationship. Whereas the chronological age ($P = 0.09$); sex ($P = 0.10$); the duration of surgery ($P = 0.18$); and the operating surgeon ($P = 0.23$) are statistically insignificant. The length of hospital stay was linearly associated with the type of surgery performed and high Charlson comorbidity score. Modified Barthel Index deterioration was associated with the type of surgery. The average pain score was 2. There was a reduction in the occurrence of post-operative pulmonary complications by about 84.37% in the population "at high risk" (PPC prediction score >3) with the routine use of perioperative pulmonary rehabilitation using incentive spirometry.

Conclusion: Laparoscopic surgery is safe in carefully selected subset of elderly population. Pre-operative stabilization of the comorbid condition should be done when feasible. Psychological counseling for the patient and the caretaker with emphasis on perioperative pulmonary rehabilitation and post-operative lifestyle modification should be done at the time of first consult. Further large-scale studies are needed to support these findings.

Key words: Laparoscopic surgery, Post-operative complications, Length of hospital stay

Access this article online



www.surgeryijss.com

Month of Submission : 06-2021
Month of Peer Review: 07-2021
Month of Acceptance : 08-2021
Month of Publishing : 10-2021

INTRODUCTION

Laparoscopic techniques are gradually replacing many common surgical procedures that are performed in an increasingly aging population. The word "Laparoscopic" comes from two Greek words. The first is lapara, which means the "flank or loin." The other Greek root is skopein,

Corresponding Author: Vignaradj Kirouchenaradj, Department of General Surgery, Saveetha Medical College and Hospital, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, India. E-mail: vignaradj@yahoo.co.uk

which means “to see or view or examine.”^[1] Elderly patients represent a large cohort of surgical patients, therefore profoundly affected by this shift in care. The proportion of elderly people (age 60 year and above) is on the rise in India over the past few decades. The average life expectancy in India had grown by 5 years in the past decade. However, elderly patients clearly show higher rates of surgical morbidity and mortality overall. Therefore, Indian surgeons are confronted with a patient population that is older, have decreased cardiopulmonary reserve, and carry a long list of medical comorbidities and prior surgical history.^[2]

The advantage of laparoscopic surgery over the conventional approaches in terms of decreased wound complications, post-operative ileus, intraoperative blood loss, and reduced need for post-operative rehabilitation had been well documented in literature.^[3] A huge amount of data about laparoscopic surgeries in elderly population has been from studies conducted in Western population where the average life expectancy at present exceeds India. Hence, this study with focus on the clinical outcomes of various laparoscopic surgeries (excluding gynecological procedures) done in elderly population may throw light on the factors influencing the outcome and the same shall likely be applicable to Indian adult population in the near future in view of early age at onset and early diagnosis of comorbid condition.^[4]

The aim of the study is to demonstrate that laparoscopic surgery is a safe alternative to conventional surgery in the elderly subset of the Indian population. The objective of this study is to analyze the influence of chronological age, comorbid conditions (stratified with Charlson comorbidity score),^[5] and the type of surgery performed on the clinical outcome in terms of post-operative complications (which is classified using the Clavien Dindo scale) and on the functional outcome which was assessed using Modified Barthel Index deterioration scores. To study the role of perioperative pulmonary rehabilitation including incentive spirometry in reducing the post-operative pulmonary complications in population at risk.

The surgical requirements for laparoscopic surgery place unique physiological demands on the patient and present a distinct challenge in elderly patient. The insufflation of carbon dioxide gas can create acid-base disturbances, changes in blood gas balance, and alterations of cardiovascular and pulmonary physiology.^[6] While most of these changes do not result in clinical significance, they can become more of a factor in patients with comorbid conditions, especially those that result in decreased cardiopulmonary reserve, as are common in elderly patients.

MATERIALS AND METHODS

This prospective descriptive study was conducted in the Department of General Surgery at Saveetha Medical

College and Hospital, Chennai, and Southern Railway Headquarters Hospital, Chennai. All patients admitted in the hospital during the period from October 2013 to October 2015 were included in the study. Complete clinical history case records were including with detailed physical examination, radiological and pathological investigation reports were analyzed. The study was performed after the approval of the Institutional Ethics Committee. The procedure was performed in accordance with the ethical standard and photographs are taken with patients' and their relatives' full consent. All patients are enrolled into the study after getting written informed consent. The essence of consent comprised the following: (1) Consent explaining the risks and benefits of the laparoscopic approach, (2) the possibility of conversion of laparoscopy to open surgery, and (3) need for perioperative pulmonary rehabilitation. All patients of age 60 years and above in both the sexes undergoing laparoscopic surgeries were included in the study. The patients undergoing laparoscopic gynecological procedures and converted laparoscopic surgeries were excluded from the study. All elderly patients undergoing various laparoscopic surgeries during the study period who met the inclusion criteria are selected for the study. The sample size was 100.

All the data (history/examination findings and all investigations) in pre-operative period were recorded carefully. Patients are optimized (made medically stable) except in emergency settings review of previous films/imaging and available surgery reports. Bladder catheterization in lower abdominal surgeries bowel decompression was done in appropriate surgeries.

The main aim of early intervention is to operate during the edema phase when the tissues are easily separable and the tissue planes are better visualized. Increased vascularity, necrosis, abscess formation, and dense adhesion and fibrosis are encountered following a delayed/interval surgery, which increase the morbidity and the conversion rate.

In this study, one case of acute cholecystitis with peritonitis, one case of empyema gallbladder, and one case of carcinoma gallbladder masquerading as Mirizzi syndrome were operated as emergency on the same day of admission. The rest of the cases are operated after 4–6 weeks of non-operative management of acute episodes (Interval cholecystectomy).

The patient was followed up in post-operative period daily till discharge and reviewed 1 week and 1 month later. Pain score with Wong Baker's pain score chart was done on POD-3 and the data were recorded. All patients had perioperative pulmonary rehabilitation in the form of incentive spirometry, deep inspiration, active coughing, and sputum expectoration. Early mobilization was practiced. Appropriate deep vein

thrombosis prophylaxis given. The duration of post-operative antibiotics was at the discretion of treating surgeon. Modified Barthel Index of activity was assessed preoperatively, immediate, and delayed postoperative period, that is, 1 month later. Patients are advised to review immediately in case of any adverse effects such as pain, infection, swelling, vomiting, and abdominal distension.

Statistical Data Analysis

For this study, historical, clinical, operative data, and pain score charts and Modified Barthel Index charts are documented for all the 100 subjects under study, in the form of a pro forma and computed into Microsoft Excel spreadsheets and coded.

All results are analyzed using Statistical software SPSS 2.0. Descriptive and inferential statistical analysis had been carried out in the present study. Results of continuous measurements are presented as mean with range and results on categorical measurements are presented in number (%). Significance was assessed at 5% level of significance. Multivariate logistic regression was run to analyze the factors influencing the post-operative complications (Grade 2 and above).

RESULTS

A total of 100 (n = 100) elderly patients are operated. The mean age of the patient undergoing surgery was 65.87 years (range 60–83 years). The total no. of 67 males and 33 female patients is operated [Table 1]. The most common surgeries in decreasing order of frequency are laparoscopic cholecystectomy (n = 56), laparoscopic hernia repair (n = 18)-ventral hernia (n = 12), inguinal hernia (n = 6), laparoscopic colorectal surgeries, including appendectomies (n = 11), laparoscopic urological procedures (n = 9) and combined (n = 3), and other laparoscopic surgeries such as excision of gastrointestinal stromal tumors stomach, continuous ambulatory peritoneal dialysis (CAPD) repositioning, and diagnostic laparoscopy and feeding jejunostomy for carcinoma stomach [Table 2].

The septuagenarian population is associated with high grade (>Grade 2) complications. The overall all-cause complications seem to increase with age.

A total of 13 patients had Grade 1 and above post-operative complications. The death in carcinoma gallbladder occurred due to cancer recurrence at 1 year follow-up, hence death not included in postsurgical complication at 30-day follow-up. Here, it is mentioned to highlight the role of indication on the outcome [Table 3].

The most common cause for subtotal cholecystectomy was densely adherent and thickened GB (Cholecystitis sequelae) and inability to define Calot’s triangle.

From the above table, Charlson comorbidity score >3 and type of surgery had a direct influence on the length of stay [Table 4].

Total no. of patients with post-operative pulmonary complications n = 8 including pneumonia, pulmonary edema, and ventilator dependence [Table 5].

In a study for the development of a prediction rule for estimating post-operative pulmonary complications in

Table 1: Age and sex distribution

Age group	No. of patients	Male	Female
60–64	51	35	16
65–69	24	14	10
70–74	13	8	5
75–79	10	8	2
80–84	2	2	0
Total	100	67	33

Table 2: Type of surgery and number of patients

Type of surgery	Number of patients
Laparoscopic cholecystectomy	56
Laparoscopic hernia repair	18
Laparoscopic urological surgery	9
Laparoscopic colorectal (including appendectomy)	11
Combined procedures	3
Others (GIST stomach, CAPD repositioning, diagnostic lap, and feeding jejunostomy)	3
Total	100

CAPD: continuous ambulatory peritoneal dialysis

Table 3: Table grade of complications and frequency

Age group	Grade 1	Grade2	Grade 3	Grade 4	Grade 5
60–64	4	7	1	0	0
65–69	3	7	1	0	0
70–74	2	3	1	1	1
>75	4	2	0	0	1
Total	13	19	3	1	2

Table 4: Mean duration of surgery and length of hospital stay

Type of surgery	Mean duration of surgery (in min)	Mean duration of hospital stay (in days)
Lap cholecystectomy	72	4 (2–22)
Lap hernia repair	72	2.8 (2–7)
Lap urological	210	8.7 (4–22)
Lap colorectal-malignant	205	12 (11–14)
Lap appendectomy (abscess/perforation)	86	4.44 (2–11)
Combined	176	4

Table 5: Complications of lap cholecystectomy

S. No.	Complications	No. of patients	Management
1	Urinary retention	5	Catheterization
2	Urinary tract infection	2	Antibiotics
3	Paralytic ileus	3	Conservative
4	Biloma	1	Ultrasound-guided Percutaneous aspiration
5	Retained CBD calculus	2 (1 with pancreatitis)	ERCP after 1 week
5	Bile leak	2	Conservative
6	Port site bleed	2	1 conservative 1 bedside evacuation of hematoma
7	Cholangitis	2	Conservative
8	Sub-diaphragmatic collection	1	Conservative
9	Sub-diaphragmatic abscess	1	Conservative (due to small size)
10	Significant intraoperative blood loss	1	Blood transfusion (due to liver bed resection)
11	Cancer recurrence	1	Second-line chemotherapy
12	Bleeding per rectum	1	Colonoscopy-polypectomy

2014,^[7] the following are found to be significant: Age >70 years (2 points), current smoker (1 point), the presence of airflow limitation (1 point),

the American Society of Anesthesiologists class ≥ 2 (1 point), serum albumin <4 g/dL (1 point), emergency surgery (2 points), and non-laparoscopic abdominal/cardiac/aortic aneurysm repair surgery (4 points). The presence of airflow limitation was defined as the ratio of forced expiratory volume in 1 s to forced vital capacity (FEV1/FVC) <0.7 and FEV1 <80% of predicted value. The area under the curve was 0.79 (95% CI, 0.75–0.83) with the newly developed model. Applying this predictive model to our study population.

Interestingly, no patients had a score of 0 in our study population. The maximum score was 5. The patients are divided into low risk, that is, PPC score 1–2 ($n = 59$) and high risk, that is, PPC score >3 ($n = 41$).

This means that in our study population, the odds of developing post-operative pulmonary complications are 2.59 higher given patients in high-risk group (with PPC score >3) compared to low-risk group (with PPC score 1–2).

The aforementioned predictive model was 79% successful in predicting the pulmonary complications in its study population ($n = 2059$). When this concept is applied to our high-risk patients ($n = 41$), the expected number of patients to develop pulmonary complications is 32. But the observed number $n = 5$. Hence, there is about 84.37% reduction in the occurrence of post-operative pulmonary complications which can be brought about by perioperative pulmonary rehabilitation by incentive spirometry.

About 63% of patients consume >5 medications per day (excluding vitamin supplementation and analgesics) which indicates polypharmacy.

This is similar to the findings in the American geriatric population undergoing various open surgeries, in which a total of 86% had one or more pre-operative risk factors, the most common being hypertension (50%), coronary artery disease (30%), pre-existing neurological disease (29%), and pulmonary disease (23%). Fully 30% had a history of smoking. Only 14% had no pre-operative conditions; 41% had three or more conditions.^[8]

DISCUSSION

In our study, 100 patients met the inclusion criteria. There are 67 male patients and 33 female patients. About 63% of the patients consume >5 group of medications (excluding vitamin supplementation and analgesics). About 90% of patients had at least one associated comorbid condition for which they are on treatment. The common comorbid conditions of decreasing frequency: Systemic hypertension ($n = 63$), diabetes mellitus ($n = 43$), coronary artery disease ($n = 23$), chronic obstructive pulmonary disease ($n = 15$), followed by others ($n < 10$) for chronic kidney disease ($n = 7$), chronic liver disease ($n = 5$), cancer ($n = 9$), benign prostatic hyperplasia ($n = 7$), and hypothyroidism ($n = 4$) [Table 6].

About 59% of patients are aware about laparoscopic surgery before reaching the hospital. The most common surgery performed was laparoscopic cholecystectomy ($n = 56$); laparoscopic hernia repair ($n = 18$)-ventral hernia ($n = 12$), inguinal hernia ($n = 6$); laparoscopic urological procedures ($n = 9$); and laparoscopic colorectal surgeries ($n = 11$) and combined ($n = 3$).

A total of 31 patients developed post-operative complications. In these patients, Grade 1 was 38.7% ($n = 12$); Grade 2 was 61.2% ($n = 19$); Grade 3 was 9.6% ($n = 3$); Grade 4 was 3.2% ($n = 1$), and Grade 5, that is, death was in 6.4% ($n = 2$) patients. Thus, overall mortality rate was 2% in this study population. There are 25 patients with Grade 2 and above complications. There

Table 6: The frequency of the associated medical condition

Sl. No.	Name of condition	No. of patients
1	Diabetes mellitus	43
2	Systemic hypertension	63
3	Coronary artery disease	23
4	Chronic kidney disease	7
5	Chronic liver disease	5
6	Chronic obstructive pulmonary disease	15
7	Benign prostatic hyperplasia	7
8	Anemia (hemoglobin <10 g/dl)	8
9	Hypothyroidism	4
10	Rheumatic heart disease	2
11	Seizures	2
12	Parkinsonism	4
13	Cancer	1 cancer cervix 1 cancer breast 7 (surgical indication)
14	Deep vein thrombosis	1
15	Poliomyelitis	1
16	Hearing disability	1
17	Without any comorbid condition	10

are 18% surgical complications (Grade 2 and above); 19% medical complications (Grade 2 and above); and 10% combined (Grade 2 and above) in the total study population.

Type of Surgery

In patients who underwent laparoscopic cholecystectomy, the most common indications are as follows: Biliary colic 41% (*n* = 23); acute cholecystitis 0.03% (*n* = 2); chronic cholecystitis 21.4% (*n* = 12); choledocholithiasis with extrahepatic biliary stasis 21.4% (*n* = 12); and carcinoma gallbladder 0.05% (*n* = 3). Male: female ratio is 1.8:1. Total no. of male *n* = 36 and total no. of female *n* = 20. Among these three patients are operated on an emergency basis (one empyema gallbladder; one acute cholecystitis with peritonitis; and one malignancy presenting with cholangitis) [Table 7]. The mean duration of surgery was 72 min (range 40–180 min for liver bed resection). The procedure was done by three different laparoscopic surgeons. The intra-abdominal drain was placed in 25 patients (44.6%). The need of placing drain was at the discretion of the operating surgeon.

Laparoscopic subtotal cholecystectomy was done in 16% (*n* = 9) patients. The most common reason for subtotal cholecystectomy was dense inflammatory adhesions and inability to define the Calot’s triangle. The mean duration of intravenous antibiotics was 2.8 days (1–8 days) and the need for analgesics was 1.6 days (1–7 days in case of carcinoma gallbladder). Among 12 patients diagnosed to have common bile duct calculus, 100%

Table 7: Indication for laparoscopic cholecystectomy

Indication	No. of cases
Biliary colic	23
Acute cholecystitis	2
Chronic cholecystitis	12
CBD calculus	12
Chronic pancreatitis	2
Empyema	1
Mirizzi syndrome	1
Carcinoma gallbladder	3
Total	56

(*n* = 12) underwent pre-operative ERCP. One patient had to undergo ERCP twice for ductal clearance. During the post-operative period, 0.03% (*n* = 2), two retained common bile duct stones were found which was missed preoperatively. One presented with acute pancreatitis in the post-operative period. Both of them underwent ERCP after 1 week. 0.03% (*n* = 2) two patients had a bile leak which was managed conservatively. One patient was discharged postoperatively and was readmitted after 3 weeks with biloma (0.01%) which was managed by percutaneous aspiration.

One patient had bleeding per rectum postoperatively needing blood transfusion hence colonoscopy was warranted and the bleeding colonic polyp was found and resected. Carcinoma gallbladder was suspected intraoperatively in two patients and underwent laparoscopic extended cholecystectomy with liver bed resection and recovered with Grade 2 complications. One patient was diagnosed postoperatively to have carcinoma gallbladder and died on a follow-up of 1 year due to metastatic disease.

In patients who underwent laparoscopic hernia repair (*n* = 18); 33.33% (*n* = 6) had umbilical hernia; 27.7% (*n* = 5) had incisional hernia; 0.05% (*n* = 1) had spigelian hernia with defect size 6cm 2; 33.33% (*n* = 6) underwent inguinal hernia repair of which 83.33% (*n* = 5) underwent TEP; and 16.66% (*n* = 1) underwent TAPP for the right inguinal hernia. The procedure was done by two different surgeons. The mean defect size was 2.9 cm². Two patients had a Swiss cheese type of defect. The mean duration of surgery was 72 min (45–135 min). The mean duration of stay was 2 days (1–7 days in a patient with pneumonia). The mean duration of analgesic was 1.5 days. Only one patient had minimal retro pubic collection, which was managed conservatively.

In patients undergoing urological laparoscopic procedures (*n* = 9); 44.44% (*n* = 4) had malignancy (three renal cell carcinoma and one midureteric urothelial carcinoma); 33.33% (*n* = 3) had non-functioning

kidney (<10% differential function from undiagnosed pelviureteric junction obstruction); and 22.22% (n = 2) (one had impacted mid ureteric calculus; one had bilateral ureteric calculus with azotemia underwent emergency bilateral percutaneous nephrostomy followed by bilateral laparoscopic ureterolithotomy. They are operated by single surgeon. The mean duration of surgery was 210 min (165–285 min). One (0.11%) patient who had radical nephrectomy for renal cell carcinoma had iatrogenic diaphragmatic injury and was managed by intracorporeal suturing and intercostal tube drainage of hemithorax. The patient recovered well but died on post-operative day 22 after acute left ventricular failure following myocardial infarction. One (0.11%) patient needed blood transfusion. The mean duration of stay was 8.7 days (4–22 days) and the mean duration of analgesics was 2.8 days.

In other laparoscopic surgeries n = 17; 23.5% (n = 4) are operated for carcinoma colon among which two patients underwent laparoscopic low anterior resection and one patient underwent laparoscopy-assisted abdominoperineal resection and one patient underwent right hemicolectomy for ascending colon carcinoma. The mean duration of surgery was 217 min. The mean duration of stay was 12 days and mean duration of analgesic need was 3 days. No Grade 2 surgical complication was observed. This could be because of small sample size. About 41.17% (n = 7) underwent laparoscopic appendectomy. About 71.8% (n = 5) was done as an emergency (two patients had appendicular abscess; one patient had generalized peritonitis; and one patient underwent diagnostic laparoscopy and appendectomy). The mean duration of surgery was 86 min. In the post-operative period, about 40% of emergency appendectomy patients had medical complications. There was one death from pneumonia on post-operative day 4. There was one case of accelerated hypertension managed medically. Thus, emergency surgery had an impact on post-operative complications.

One patient underwent resection of GIST stomach; one patient underwent diagnostic laparoscopy and feeding jejunostomy for inoperable carcinoma stomach both recovered uneventfully; one patient underwent laparoscopic CAPD catheter repositioning and he developed catheter site abscess warranting catheter removal. Three patients underwent combined procedures laparoscopic hernia repair and laparoscopic cholecystectomy and recovered uneventfully.

When the type of surgery was stratified for the number of cases, there was statistically significant influence on the occurrence of post-operative complications (P = 0.02).

Charlson Comorbidity Score

The Charlson comorbidity score was used to assess the influence of comorbid conditions on post-operative complications. The age factor was not scored. Hence, the maximum score is 33 (adding the highest scores for all the

comorbid conditions) and the minimum score is zero (no known comorbid condition). Systemic hypertension is not a component of the Charlson comorbidity score. Among 100 elderly patients, about 32% had score 1; 33% had scores 2–3; 9% had score 4–5; and 29% had zero score. In patients with the Charlson comorbidity score 4–5, 83.33% (n = 5) had post-operative complications and in patients with a Charlson comorbidity score 2–3, 42.4% (n = 14) had post-operative complications, whereas only 29.5% (n = 81) of patients with the score 0–1 had complications.

Higher Charlson comorbidity score (>2) had an influence on the occurrence of post-operative complications (mainly Grade 2 and above complications) (P = 0.002). This is in contrast to the study conducted by Ibis et al. (49) in elderly patients undergoing appendectomy where the comorbidities had no role in postoperative outcome. However, the sample size was low (n = 27) to draw further conclusions from the study [Table 8].

Polypharmacy

The number of groups of drugs taken by the patient, in turn, reflected by the number of comorbid conditions they suffer from had a statistically significant influence on post-operative complications. Patients taking >5 group of drugs had poor outcome (P = 0.03). The more the number of groups of medications the patient is consuming preoperatively, the higher the chance of post-operative complication. This reflects either poor pre-operative control or the resistance of the comorbid condition for pharmacological control. The compliance of patients is a confounding factor.

Chronological Age

The patients are classified into age groups: 60–64 years 51 patients, 65–69 years 24 patients, 70–74 years 10 patients, 75–79 years 10 patients, and 2 patients in age 80–84 years. The percentage of complications Grade 2 and above varies with age; 15.6% (n = 8) in 60–64 years; 33.33% (n = 8) in 65–69 years; 38.46% (n = 5) in 70–74 years; and 16.66% (n = 2) in >75 years.

In a study conducted by Otake et al.^[9] which is a retrospective analysis of 55 elderly patients treated by laparoscopic salpingo-oophorectomy. The patients are divided into three groups: “Young-elderly” (aged 65–74),

Table 8: Table Charlson comorbidity score and number of patients

Age	Score 1	Score 2	Score 3	Score 4	Score 5	Score 0	Total
60–64	20	6	6	1	0	18	51
65–69	7	7	5	1	0	4	24
70–74	2	2	1	0	2	6	13
>75	3	2	4	1	1	1	12
Total	32	17	16	3	3	29	100

“old-elderly” (aged 75–84), and “super-elderly” (aged 85–105) and assessed clinical characteristics, surgical results and post-operative course are analyzed. Although patients in the old-elderly group had a significantly higher risk for surgery, they had equivalent surgical results to the young-elderly group for laparoscopic salpingo-oophorectomy.

In a study conducted by Saber *et al.*^[10], on laparoscopic ventral hernia repair, younger patients are found to have a significantly increased BMI, while the older group had an increased number of comorbidities. No difference was found in the complication or recurrence rates between the two groups. The decision to perform or not to perform an elective hernia repair should depend on the patient’s condition and comorbidities regardless of the chronological age of the patient. In our study, the influence of chronological age was statistically insignificant ($P = 0.09$).

Duration of Surgery and Surgeon Factor

The mean duration of surgery, in turn, reflecting the duration of carbon dioxide pneumoperitoneum was statistically insignificant ($P = 0.18$). The surgeon factor was assessed, but was statistically insignificant ($P = 0.23$). This is in accordance with the study by Waters *et al.*^[11] in which during the learning curve in the first 100 cases of laparoscopic colorectal surgery, there was no difference between minor and major complications but the operative time decreased with experience. In our study, all the surgeries are performed by senior consultant laparoscopic surgeons with experience of more than 10 years.

Role of Incentive Spirometry

The total no. of patients with post-operative pulmonary complications $n = 8$ including pneumonia, pulmonary edema, and ventilator dependence. In patients with high risk (PPC score >3) $n = 32$, only $n = 5$ had post-operative pulmonary complications with risk reduction about 84.37%, which can be brought about by perioperative pulmonary rehabilitation including incentive spirometry.

Modified Barthel Index Deterioration

Deterioration by two points was observed in 3% of patients undergoing laparoscopic cholecystectomy on day 3–1.2% by day 7 whereas the same was observed in 2.4% of laparoscopic hernia repair on day 3 with all of them regaining pre-operative activities by day 7. Deterioration by four points was observed in 22.22% of patients undergoing laparoscopic urological procedure on day 7 to 11.11% by day 30 whereas the same was observed in 17.64% of other laparoscopic surgeries including colorectal surgeries on day 7 to 5.8% by day 30.

Medical Complications

A total of 19% of medical complications encountered of which 42.15% are cardiovascular ($n = 8$); 42.15%

Table 9: The frequency of medical complications

Complication	No. of patients	Management
Accelerated hypertension	4	Intravenous nitroglycerine
Acute kidney injury	2	Adequate hydration
Acute left ventricular failure	1	Died POD-22 (underwent lap nephrectomy for renal cell carcinoma)
Pneumonia	5	2-Antibiotics and bronchial lavage (recovered) 1-Death on POD -4 (underwent diagnostic lap and lap appendectomy)
Atrial fibrillation	1	Antiarrhythmics
Bradycardia	1	Temporary pacemaker insertion
Respiratory failure	1	Ventilatory support recovered
Lower respiratory tract Infection	1	Antibiotics and chest physiotherapy
Pulmonary edema	1	Diuretics
Angina pectoris	1	Cardiac evaluation needed PTCA later
Malaria	1	Antimalarials

of pulmonary complications (including 27.7% of pneumonia); and 22.22% of acute kidney injury [Table 9]. This is less when compared to 43% medical complication rate in the study on laparoscopic cholecystectomy in geriatric population conducted by Nenner *et al.*^[12] Although the number of patients in various subgroups is not proportionate, the results obtained are comparable to other individual studies. Further large-scale studies are needed to confirm the above findings.

CONCLUSION

Due to increased longevity, the number of the elderly patients undergoing laparoscopic surgeries is increasing. Elderly population is quite unique in their varied physiological reserve, long list of comorbid conditions, higher incidence of malignant pathology, and reduced immunocompetence for localizing infection, depending on others for activities of daily living and lack of socioeconomic independence, especially in women. With the advent of safe anesthesia techniques and newer medications for pre-operative control of the comorbid condition and advanced techniques and equipment’s for laparoscopy, the laparoscopic surgical interventions can be safely done in elderly population. The chronological age did not have significant influence on the post-operative complications in our study population. Higher the Charlson comorbidity score >2 and polypharmacy, that is, the greater number of medications the patient is taking preoperatively, higher the chances of post-operative complications. This indicates either poor pre-operative control or resistance of the comorbid condition to pharmacological therapy alone. Further studies on polypharmacy including the

use nonsteroidal anti-inflammatory agents are warranted especially in the Institutions providing free medical care. Although the presence or absence of risk factors dictates the occurrence of post-operative pulmonary complications, it can be drastically reduced with routine use of incentive spirometry in the perioperative period. The type of surgery performed influences the outcome. Further, it is to be noted that these factors are statistically significant in a multivariate logistic regression indicating that the combination of the aforementioned factors play additive role in union than individually in influencing post-operative outcome in the elderly subset of patients undergoing various laparoscopic surgeries.

REFERENCES

1. Kaiser AM, Corman ML. History of laparoscopy. *Surg Oncol Clin N Am* 2001;10:483-92.
2. Borle FR, Mehra B, Singh AR. Comparison of cosmetic outcome between single-incision laparoscopic cholecystectomy and conventional laparoscopic cholecystectomy in rural Indian population: A randomized clinical trial. *Indian J Surg* 2015;77:877-80.
3. Fuchs KH. Minimally invasive surgery. *Endoscopy* 2002;34:154-9.
4. Bittner R. Laparoscopic surgery-15 years after clinical introduction. *World J Surg* 2006;30:1190-203.
5. Huang Y, Zhang Y, Li J, Liu G. Charlson comorbidity index for evaluation of the outcomes of elderly patients undergoing laparoscopic surgery for colon cancer. *J BUON* 2017;22:686-91.
6. Safran DB, Orlando R 3rd. Physiologic effects of pneumoperitoneum. *Am J Surg* 1994;167:281-6.
7. Jeong BH, Shin B, Eom JS, Yoo H, Song W, Han S, *et al.* Development of a prediction rule for estimating postoperative pulmonary complications. *PLoS One* 2014;9:e113656.
8. Liu LL, Leung JM. Predicting adverse postoperative outcomes in patients aged 80 years or older. *J Am Geriatr Soc* 2000;48:405-12.
9. Saber AA, Elgamal MH, Mancl TB, Norman E, Boros MJ. Advanced age: Is it an indication or contraindication for laparoscopic ventral hernia repair? *JLS* 2008;12:46-50.
10. Khanna SK. Efficacy of incentive spirometer in improving pulmonary functions after upper abdominal surgery. *Indian J Basic Appl Med Res* 2013;3:328-4.
11. Waters JA, Chihara R, Moreno J, Robb BW, Wiebke EA, George VV. Laparoscopic colectomy: Does the learning curve extend beyond colorectal surgery fellowship? *JLS* 2010;14:325-31.
12. Nenner RP, Imperato PJ, Alcorn CM. Complications of laparoscopic cholecystectomy in a geriatric population group. *N Y State J Med* 1992;92:518-20.

How to cite this article: Kirouchenaradj V, Premanand N, Srinivasan V. Prospective Study on the Factors Influencing the Clinical Outcome of Various Laparoscopic Surgeries in Elderly Patients. *IJSS Journal of Surgery* 2021;7(5):55-62.

Source of Support: Nil, **Conflict of Interest:** None declared.