Original Research Article

**Compare the clinical and postoperative outcomes: laparoscopic versus open surgery**

Vinod Bhandari*, Mahak Bhandari

Department of General Surgery, Sri Aurobindo Medical college and P.G. Institute, Indore, Madhya Pradesh, India

**Abstract**

**Background:** To assess the several postoperative complications and clinical outcomes, a retrospective comparison between laparoscopic or open surgery was performed.

**Methods:** We evaluated patients baseline characteristics clinical characteristics, perioperative, intraoperative, inflammatory stress markers and postoperative outcomes between the two groups by univariate analysis.

**Results:** Total 73 patients' data were included and divided into two groups, 38 patients in first group (laparoscopic surgery) and 35 patients in second group (open surgery). There were no statistically significance differences between gender, age, weight, body mass index and type of surgery of the patients (p>0.05). There was no significant difference between groups in history of infliximab, history of steroid usage, history of appendectomy and perianal disease (p>0.05). There was no significant difference between groups in total protein, albumin, hemoglobin, skeletal muscle mass and soft lean mass. Operative time, length of incision and blood loss was significantly (p<0.001) different in both groups, respectively. Total number of complications was less in the laparoscopic surgery; however, there was no statistically significant difference. Laparoscopic surgery can shorten the hospital stay by around one day. Patients had better postoperative outcomes after laparoscopic surgery than after open surgery. No significant difference was present in edema grades between groups preoperatively. More patients developed slight edema and edema in open surgery than in laparoscopic surgery on postoperative day (POD-3), but not on POD-5.

**Conclusions:** Laparoscopic surgery has more benefits, safe and high-quality care and better postoperative clinical outcomes for all patients compared to open surgery.

**Keywords:** Clinical outcomes, Laparoscopic surgery, Open surgery, Postoperative complications

**Introduction**

Open surgery is the traditional type of surgery in which an incision is made using a scalpel. While this can be done safely and effectively, the larger incision can cause longer hospital stays, longer recovery, more pain, larger scars, higher risks of complications such as bleeding and infections. Laparoscopic, or endoscopic, surgery is a minimally invasive procedure that uses several small cuts in the skin to access the surgical area. The doctor uses a tiny camera to view the area and small tools to perform the surgery. Currently, laparoscopic surgery has been widely applied in patients with Crohn’s disease because its safety and feasibility were confirmed, and many studies have exhibited its advantages more than open surgery. The laparoscopic approach to conventional surgery is a burgeoning area of surgical practice, with new techniques and procedures introduced on a yearly if not monthly basis. This revolution has been fueled by the belief among surgeons, referring physicians, and the general public that laparoscopic procedures are minimally invasive. Laparoscopic surgery brings many short-term
and long-term benefits over open surgery, such as reducing postoperative complications, promoting postoperative recovery, and reducing hospital stay and lead to a faster recovery, entail less pain compared to traditional open surgery.\(^6\)\(^7\) Although there is a large figure of literature concerning the technical success of completing these procedures.\(^8\)\(^9\)

The procedure has become the gold standard for many organ systems, with some of the most common being digestive (as for cholecystectomy), and reproductive (particularly gynecological). Significant improvements in surgical training, as well as developments of instruments, imaging, and surgical techniques, have made laparoscopic surgery safe and feasible across different medical fields. However, laparoscopic surgery also has the advantage of less trauma, less pain postoperatively and a reduced hospital stay for patients. Crohn’s disease is a chronic inflammatory gastrointestinal disorder, characterized by phases of remission and frequent relapses that often need surgical intervention.\(^10\)

Surgery is often necessary to treat complications such as abscess, fistula, stricture, bleeding, or failed responses to medical therapy.\(^10\)\(^11\) In previous years, laparoscopy took longer time than open section surgery but now laparoscopy can be completed in about the same time as open section, mainly due to the accumulation of practical surgical experience using this technique; one additional benefit is the reduced occurrence of complications.\(^12\)

Some data have been published on pain medication requirements and the relative number of days for hospital stay or return to work, little research has been done on quality of life using standardized, validated measures of health status. In this study we compared the clinical outcomes and postoperative complications undergoing the same procedures in laparoscopic surgery versus open surgery.

**METHODS**

It is an observational retrospective data was collected from department of General Surgery at Sri Aurobindo Medical College and PG Institute, Indore between June 2018 to July 2019.

Total of 73 patient’s data were enrolled in this study and divided into two groups as first group (laparoscopic surgery) 38 patients and second group (open surgery) 35 patients.

All data of patient’s baseline characteristics, perioperative, inflammatory stress markers and complications outcomes were collected on following selection criteria from prospectively maintained data sheet. Baseline characteristics includes age (year), gender, body mass index (BMI) (kg/m\(^2\)), duration of disease (months), history of appendectomy and perianal disease.

Clinical parameter includes total protein (g/l), albumin (g/l), hemoglobin (g/l), skeletal muscle mass(kg) and soft lean mass (kg)

Type of surgery includes colonic resection, small bowel resection and ileocolic resection. Intraoperative outcome include operation duration (min), length of incision (cm) and blood loss (ml)

Surgical indication includes internal fistula/.mass, inflammation, hemorrhage and stricture. Postoperative outcome includes dehiscence of incision, infection of incision, abscess/mass, anastomotic leakage, postoperative hospital stays (days) and others

Postoperative recovery includes time to bowel movement (hours), time to flatus (hours) and time to tolerate EN (days)

Edema grades was considered before surgery (pre-operative) and on postoperative day 1 (POD1), postoperative day 3 (POD3), and postoperative day 5 (POD5).

**Inclusion criteria**

Only those data were included in study who has a complete information as per our selection criteria.

**Exclusion criteria**

Vaginal fistula, enterocutaneous fistula, abscess, extensive abdominal adhesions, and any diseases that could influence water distribution, such as hypertension, liver dysfunction, renal disease, endocrine disorder, or other systemic diseases data were not included in this study.

**Statistical analysis**

The collected data were numerically coded and entered in Microsoft Excel 2007 and statistical analysis was done in SPSS version 21.0. Socio-demographic variables data were analyzed using descriptive statistics like frequencies, mean and standard deviation. Chi-square test of association or Fishers exact probability test was used as applicable to assess the association between associated variables. A \(p\) value less than 0.05 was considered statistically significant.

**RESULTS**

A total of 73 patients data included in this observational cohort study. Thirty-five patients in laparoscopic surgery and 38 patients in open surgery. The mean age was 33.21±11.05 in laparoscopic surgery and 34.41±12.25 in open surgery, mean BMI 18.72±2.95 vs 18.59±2.61, respectively. Duration of disease (months) was 36.73±32.56 in laparoscopic surgery and 37.48±30.22 in open surgery. There was no significant difference
between groups in history of infliximab, history of steroid usage, history of appendectomy and perianal disease (Table 1). Preoperative nutritional status nutritional, support, was improved, and no patient had severe hypoalbuminemia or anemia. Total protein, albumin, hemoglobin, skeletal muscle mass and soft lean mass were seen in Table 2.

Table 1: The demographic and baseline characteristics of patients.

| Variable                        | Laparoscopic surgery (n=35) | Open surgery (n=38) | P value |
|---------------------------------|----------------------------|---------------------|---------|
| Age (in years)                  | N (%)                      | N (%)               |         |
| ≤16                             | 33.21±11.05                | 34.41±12.25         | 0.662   |
| 17–40                           | 4 (11.5%)                  | 3 (7.9%)            | 0.608   |
| >40                             | 23 (65.7%)                 | 24 (63.2%)          | 0.819   |
| Sex (male/female)               | 8 (22.8%)                  | 11 (28.9%)          | 0.553   |
| BMI (kg/m²)                     | 11/24                      | 13/25               | 0.847   |
| Duration of disease (months)    | 36.73±32.56                | 37.48±30.22         | 0.919   |
| History of infliximab           | 6 (17.1%)                  | 5 (14.2%)           | 0.634   |
| History of steroid usage        | 18 (51.4%)                 | 20 (52.6%)          | 0.918   |
| History of appendectomy         | 9 (25.7%)                  | 17 (27.87)          | 0.089   |
| Perianal disease                | 8 (22.8%)                  | 11 (28.9%)          | 0.553   |

Table 2: Clinical parameter of patients.

| Clinical parameter              | Laparoscopic surgery (n=35) | Open surgery (n=38) | P value |
|---------------------------------|----------------------------|---------------------|---------|
| Total protein (g/l)             | 63.36±7.70                 | 62.38±7.83          | 0.591   |
| Albumin (g/l)                   | 37.38±4.03                 | 37.57±4.06          | 0.841   |
| Hemoglobin (g/l)                | 114.28±15.94               | 113.78±17.46        | 0.899   |
| Skeletal muscle mass (kg)       | 25.13±5.85                 | 24.12±5.77          | 0.460   |
| Soft lean mass (kg)             | 40.87±8.68                 | 40.81±9.37          | 0.977   |

Table 3: Comparison of intraoperative data between groups.

| Variable                        | Laparoscopic surgery (n=35) | Open surgery (n=38) | P value |
|---------------------------------|----------------------------|---------------------|---------|
| Type of surgery                 | N (%)                      | N (%)               |         |
| Colonic resection               | 4 (11.5%)                  | 8 (21.0%)           | 0.267   |
| Small bowel resection           | 9 (25.7%)                  | 10 (26.4%)          | 0.953   |
| Ileocolic resection             | 22 (62.8%)                 | 20 (52.6%)          | 0.377   |
| Hand-assisted anastomosis       | 10 (28.5%)                 | -                   | -       |
| Operation duration (min)        | 122.54±34.63               | 87.86±25.32         | <0.001  |
| Length of incision (cm)         | 5.01±1.24                  | 10.31±1.78          | <0.001  |
| Blood loss (ml)                 | 55.11±22.34                | 123.26±53.72        | <0.001  |
| Surgical indication             | N (%)                      | N (%)               |         |
| Internal fistula/mass           | 9 (25.8%)                  | 10 (26.4%)          | 0.953   |
| Inflammation                    | 3 (8.5%)                   | 3 (7.8%)            | 0.916   |
| Hemorrhage                      | 3 (8.5%)                   | 2 (5.3%)            | 0.576   |
| Stricture                       | 20 (57.2%)                 | 23 (60.5%)          | 0.769   |

There was no difference in types of surgery between groups. Operation duration (min) was 122.54±34.63 in laparoscopic surgery and 87.86±25.32 in open surgery. The length of incision of open surgery was much longer than that of laparoscopic surgery 10.31±1.78 vs 5.01±1.24, respectively. Blood loss (ml) was less in laparoscopic surgery as compare to open surgery, there were the significant difference occur. There was no significant difference in surgical indication in both groups (Table 3). A surgery-associated complication included dehiscence of incision, infection of incision, abscess/mass, anastomotic leakage and others complication was show in Table 4. Postoperative hospital stays (days) was 7.62±2.86 in laparoscopic surgery and 8.64±3.52 in open surgery. Laparoscopic surgery can shorten the hospital stay by around one day. Patients had better postoperative outcomes after laparoscopic surgery than after open surgery (Table 4).
Table 4: Comparison of complication and postoperative recovery.

| Complications                      | Laparoscopic surgery (n=35) | Open surgery (n=38) | P value |
|-----------------------------------|-----------------------------|---------------------|---------|
| Dehiscence of incision            | N (%)                       | N (%)               |         |
| Infection of incision             | 1 (2.8)                     | 1 (2.6)             | 0.952   |
| Abscess/mass                      | 3 (8.5)                     | 6 (15.7)            | 0.348   |
| Anastomotic leakage               | 1 (2.8)                     | 2 (5.2)             | 0.604   |
| Others                            | 2 (5.7)                     | 2 (5.2)             | 0.932   |
| Postoperative hospital stay (days)| 7.62±2.86                   | 8.64±3.52           | 0.180   |
| Postoperative recovery            |                             |                     |         |
| Time to bowel movement (hours)    | 65.85±19.46                 | 76.15±23.96         | 0.048   |
| Time to flatus (hours)            | 41.50±12.98                 | 52.83±15.96         | 0.001   |
| Time to tolerate EN (days)        | 4.42±1.27                   | 5.01±1.44           | 0.068   |

Table 5: Comparison of evolution of edema grades between groups.

| Pre-operative                  | Laparoscopic surgery (n=35) | Open surgery (n=38) | P value |
|--------------------------------|-----------------------------|---------------------|---------|
|                               | N (%)                       | N (%)               |         |
| Normal                        | 26 (74.2)                   | 28 (73.6)           | 0.953   |
| Slight edema                  | 5 (14.2)                    | 8 (21.1)            | 0.450   |
| Edema                         | 6 (11.4)                    | 2 (5.3)             | 0.104   |
| POD3                          |                             |                     |         |
| Normal                        | 15 (42.8)                   | 6 (15.8)            | 0.010*  |
| Slight edema                  | 7 (20.0)                    | 12 (31.5)           | 0.260   |
| Edema                         | 13 (37.2)                   | 20 (52.7)           | 0.184   |
| POD5                          |                             |                     |         |
| Normal                        | 16 (45.7)                   | 13 (34.2)           | 0.315   |
| Slight edema                  | 13 (37.1)                   | 12 (31.6)           | 0.616   |
| Edema                         | 6 (17.2)                    | 13 (34.2)           | 0.096   |

Pre-operative slight edema and edema was in laparoscopic surgery 5 (14.2%), 6 (11.4%) and 8 (21.1%), 2 (5.3%) in open surgery. On POD3 slight edema and edema was in laparoscopic surgery 7 (20.0%), 13(37.2%) and in open surgery 12 (31.5%), 20 (52.7%). And on POD5 developed slight edema and developed edema 13 (37.1%), 6 (17.2%) vs 12 (31.6%), 13 (34.2%). No significant difference was present in edema grades between groups preoperatively. More patients developed slight edema and edema in open surgery than in laparoscopic surgery on POD3, but not on POD5 (Table 5).

DISCUSSION

This is study to determine if the laparoscopic approach to these surgical problems leads to better clinical outcomes than open surgery. In present study there was no difference in types of surgery between groups. Operation duration (min) was 122.5±34.63 in laparoscopic surgery and 87.86±25.32 in open surgery. When compared with conventional open surgery, the benefits of laparoscopic surgery have been widely investigated and confirmed in Crohn’s disease. In this study the length of incision of open surgery was much longer than that of laparoscopic surgery 10.31±1.78 vs 5.01±1.24, blood loss (ml) was less in laparoscopic surgery as compare to open surgery. Laparoscopic surgery can shorten the hospital stay by around one day. Patients had better postoperative outcomes after laparoscopic surgery than after open surgery. Unlike local edema caused by local surgery, such as thyroidectomy or hand surgery, all five segmental edema indexes increased after surgery, indicating that abdominal surgery resulted in generalized edema. The generalized edema is associated with a systemic response to surgery. Postoperative edema is associated with poor clinical outcomes, such as delayed healing, more complications, slow bowel function recovery, and longer hospital stay. Itohi et al reported that postoperative edema could independently predict gastrointestinal recovery, and measurement of edema can be used to identify those patients at risk of poor clinical outcomes. In current study no significant difference was present in edema grades between groups preoperatively. More patients developed slight edema and edema in open surgery than in laparoscopic surgery on POD3, but not on POD5. A smaller number of patients with postoperative edema and lower value and increment of the edema index were found in the laparoscopic surgery group than the
open surgery group. In an animal study, when compared with open surgery, the laparoscopic surgery groups had faster intestinal transit recovery was associated with less edematous changes, and the faster intestinal transit recovery.25

In this study on POD5 developed slight edema and developed edema 13 (37.1%), 6 (17.2%) vs 12 (31.6%), 13 (34.2%). Similarly, previous study was reported that about 53% (20/38) of patients develop edema after major abdominal surgery and Vaughan-Shaw et al reported that approximately 35% (19/55) of patients develop edema after emergency abdominal surgery.19,20 Less surgical trauma and stress of laparoscopic surgery, less postoperative edema indicated. In the perioperative period, the levels of inflammatory and edema index increased and decreased, on POD3, indicating the natural course of stress responses and body recovery after surgery. The benefits of laparoscopic surgery are associated with less postoperative edema, surgical trauma, and stress to surgery consequently.22-25 The present study suggested that laparoscopic surgery can reduce postoperative edema and response to surgical trauma and stress, as well as speed postoperative recovery compared with open surgery. Reduction of postoperative edema may explain the association of laparoscopic surgery with better clinical outcomes. All patients come by routine enterectomy, and no deaths were observed. All patients were discharged without any complications that required surgical interventions.

CONCLUSION

The laparoscopic surgery and open surgery was compared. Laparoscopic surgery has more benefits due to short hospital stay, less blood loss, reduced operation duration, faster recovery, reduce postoperative edema and speed, reduce surgical indication levels like inflammatory and stress responses to surgery for patients with Crohn’s disease. The length of incision of open surgery was much longer than that of laparoscopic surgery. Laparoscopic surgery has more benefits, safe and high-quality care and better postoperative clinical outcomes for all patients compared to open surgery.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Wilhelmson M, Møller MH, Rosenstock S. Surgical complications after open and laparoscopic surgery for perforated peptic ulcer in a nationwide cohort. Br J Surg. 2015;102(4):382-7.
2. Velanovich V. Laparoscopic vs open surgery. Surg Endosc. 2000;14(1):16-21.
3. Patel SV, Patel SV, Ramagopalan SV, Ott MC. Laparoscopic surgery for Crohn’s disease: a meta-analysis of perioperative complications and long term outcomes compared with open surgery. BMC Surg. 2013;13(1):14.
4. Maggiori L, Panis Y. Laparoscopy in Crohn’s disease. Best Practice & Research. Clin Gastroenterol. 2014;28(1):183-94.
5. Eshuis EJ, Slors JF, Stokkers PC, Sprangers MA, Ubbink DT, Cuesta MA, et al. Long-term outcomes following laparoscopically assisted versus open ileocolic resection for Crohn’s disease. Brit J Surg. 2010;97(4):563-8.
6. Schwenk W, Haase O, Neudecker JJ, Müller JM. Short term benefits for laparoscopic colorectal resection. Cochrane Database System Rev. 2005(2).
7. Moloo H, Haggar F, Coyle D, Hutton B, Duhaime S, Mamazza J, et al. Hand assisted laparoscopic surgery versus conventional laparoscopy for colorectal surgery. Cochrane Database Syst Rev. 2010;(10):CD006585.
8. Arregui ME, Robert J, Katkhouda N, McKernan JB, Reich H (eds). Principles of laparoscopic surgery: basic and advanced techniques. Springer Science & Business Media; 2012.
9. Haasler GB. Video-assisted thoracic surgery. In: Frantzides CT (ed.) Laparoscopic and thorascoscopic surgery, Mosby, St. Louis; 1995: 253-284.
10. Zuo L, Li Y, Wang H, Zhu W, Zhang W, Gong J, et al. A practical predictive index for intra-abdominal septic complications after primary anastomosis for Crohn’s disease: change in C-reactive protein level before surgery. Dis Colon Rectum. 2015;58(8):775-81.
11. Li Y, Zhu W, Zuo L, Zhang W, Gong J, Gu L, et al. Frequency and risk factors of postoperative recurrence of Crohn’s disease after intestinal resection in the Chinese population. J Gastrointest Surg. 2012;16(8):1539-47.
12. Lezoche E, Feliciotti F, Paganini AM, Guerrieri M, De Sanctis A, Minervini S, et al. Laparoscopic vs open hemicolecotomy for colon cancer. Surg Endosc. 2002;16(4):596-602.
13. Maartense S, Dunker MS, Slors JF, Cuesta MA, Pierik EG, Gouma DJ, et al. Laparoscopic-assisted versus open ileocolic resection for Crohn’s disease; a randomized trial. Ann Surg. 2006;243(2):143-53.
14. Neumann PA, Rijcken EJ, Bruewer M. Current status of laparoscopic surgery for patients with Crohn’s disease. Inter J Colorectal Dis. 2013;28(5):599-610.
15. Dasari BV, McKay D, Gardiner K. Laparoscopic versus open surgery for small bowel Crohn’s disease. Cochrane Database Systema Rev. 2011: 1.
16. Zoccali M, Fichera A. Minimally invasive approaches for the treatment of inflammatory bowel disease. World J Gastroenterol. 2012;46(18):6756-63.
17. Itoji E, Stroud M, Elia M. Impact of oedema on recovery after major abdominal surgery and potential value of multifrequency bioimpedance measurements. Brit J Surg. 2006;93(9):354-61.
18. Vaughan-Shaw PG, Saunders J, Smith T, King AT, Stroud MA. Oedema is associated with clinical outcome following emergency abdominal surgery. Ann Royal Coll Surg Engl. 2013;95(6):390-6.

19. Villeco JP. Edema: a silent but important factor. J Hand Therap. 2012;25(2):153-62.

20. Veenhof AA, Vlug MS, van der Pas MH, Sietses C, van der Peet DL, De Lange-De Klerk ES, et al. Surgical stress response and postoperative immune function after laparoscopy or open surgery with fast track or standard perioperative care: a randomized trial. Ann Surg. 2012;255(2):216-21.

21. Veenhof AA, Sietses C, Von Blomberg BM, Van Hoogstraten IM, Vd Pas MH, Meijerink WJ, et al. The surgical stress response and postoperative immune function after laparoscopic or conventional total mesorectal excision in rectal cancer: a randomized trial. Inter J Colorectal Dis. 2011;26(1):53-9.

22. Finnerty CC, Malvure NT, Ali A, Kozar RA, Herndon DN. The surgically induced stress response. J Parenteral Enteral Nutr. 2013;37:21-9.

23. Takada M, Fukumoto S, Ichihara T, Ku Y, Kuroda Y. Comparison of intestinal transit recovery between laparoscopic and open surgery using a ratmodel. Surg Endosc. 2003;17(8):1237-40.

24. Silveira FP, Nicoluzzi JE, Saucedo Jr NS, Silveira F, Nicollelli GM, Maranhão BDA. Evaluation of serum levels of interleukin-6 and interleukin-10 in patients undergoing laparoscopic versus conventional cholecystectomy. Revista do Colêgio Brasileiro de Cirurgiões. 2012;39(1):33-40.

25. Nguyen NT, Goldman CD, Ho HS, Gosselin RC, Singh A, Wolfe BM. Systemic stress response after laparoscopic and open gastric bypass. J Am Coll Surg. 2002;194(5):557-67.

Cite this article as: Bhandari V, Bhandari M. Compare the clinical and postoperative outcomes: laparoscopic versus open surgery. Int Surg J 2020;7:861-6.