Journal of Cardiovascular Disease Research

ISSN:0975-3583, 0976-2833 VOL 15, ISSUE 06, 2024

Original research article

Three-Port Versus Standard Four-Port Laparoscopic Cholecystectomy: A Clinical Trial

[1]Dr. Arun Manche Gowda, [2]Dr Praveen Gnanadev, [3]Dr. Madhupriya B, [4]Dr. Ullas Mahesh

[1]Assistant Professor, Department of General Surgery, BGS MCH Nagarur, Nelmangala, Bangalore, Karnataka, India

[2]Associate Professor, Department of General Surgery, Dr Chandramma Dayananda Sagar Institute of Medical Education and Research, Ramnagara, Karnataka, India

[3]Assistant Professor, Department of Pathology, Kempegowda Institute of Medical Sciences and Research Center, Bengaluru, Karnataka, India

[4]Professor & Former HOD, Tamil Nadu, India

Corresponding Author:
Dr. Ullas Mahesh

Abstract

Introduction: Laparoscopic cholecystectomy (LC) is first line treatment of symptomatic gall stone diseases. We have compared standard (four port) laparoscopic cholecystectomy with three port laparoscopic cholecystectomy.

Materials & Methods: Objective of this study was to compare the technical feasibility, safety and benefits of three port laparoscopic cholecystectomy over the conventional four port laparoscopic cholecystectomy. A comparative study conducted in our tertiary Hospital, Bangaluru, from January 2023 to December 2024, included a total of 50 patients (25 in each group) who underwent laparoscopic cholecystectomy.

Results: A total of 50 patients willing to participate in the study with valid consent were allocated into two groups by computer generated chit system. The first group, three-port LC group consisted of 25 cases and the second group, the standard four-port LC group consisted of 25 cases were analysed for the following outcome measures namely conversion rates, operating time, intra-operative complications, post-operative pain score, analgesic requirement and hospital stay. In both group intraoperative findings were similar. There was no post-operative mortality noted in our study. In 3 port group the time taken for operation was more compared to 4 port group. Intra op and post op complications were comparable in both groups. 3 port laparoscopic cholecystectomy reduces the post op analgesia requirement and gives better cosmetic outcome.

Conclusion: 3 port laparoscopic cholecystectomy is technically feasible, its safe, require less analgesics post operatively, due to less number of port it gives less post-operative scar so better cosmetic outcome. So, we recommend 3 port laparoscopic cholecystectomy as an alternative to conventional (4 port) laparoscopic cholecystectomy.

Keywords: Laparoscopic cholecystectomy (LC), 3 port, 4 port, cystic artery, cystic duct, VAS (Visual analogue scale) score, pneumoperitoneum

Introduction

Surgery has been the mainstay of treatment for cholelithiasis and in the past several decades research has been conducted to develop less invasive and less painful treatment for gallstone [1-3]. In 1882, Carl Langenbuch, a noted German surgeon, performed the first successful cholecystectomy which remained a gold standard for symptomatic cholelithiasis for over a century [4, 5]. However, the introduction of laparoscopic technique to perform cholecystectomy has revolutionized this procedure [6]. The first laparoscopic cholecystectomy was performed by Phillip Mouret in 1987 in France and later established by Dubois and Perissat in 1990 [7]. Laparoscopic cholecystectomy is a patient friendly surgery due to reduced incision related morbidity, reduced pain and length of hospital stay, early feeding, better cosmesis and early return to routine work. Laparoscopic cholecystectomy has been traditionally performed by the standard four port technique. With increasing experience, various modifications were

ISSN:0975-3583, 0976-2833 VOL 15, ISSUE 06, 2024

made to further enhance advantages of laparoscopic cholecystectomy. Laparoscopic cholecystectomy can be safely performed by using three ports and more recently two ports and even single port only [7, 8]. These newer techniques take similar time to perform operation and caused less postoperative pain reducing analgesic requirement and have better cosmetic benefits [7-11]. This study was designed to evaluate the safety and feasibility of three port laparoscopic cholecystectomy as compared to four port laparoscopic cholecystectomy. The aim of the study was to compare. Three-port and four-port laparoscopic cholecystectomy at single centre in with respect to various parameters particularly safety of the procedure, operative time, intra-operative complications, need for fourth port, conversion rate, Postoperative Pain score, post-operative analgesic requirement and cosmesis. The introduction of minimal access surgery for gallbladder surgery has revolutionized the treatment of gallstones. The advantages of laparoscopic procedure are lesser postoperative pain, lesser incidence of surgical site infection and shorter hospital stay [12]. Abdominal incision has been reduced to four (or more) small stab incisions. This approach significantly causes less postoperative pain, less bleeding, short hospital stay, and a good cosmetic outcome. The benefits were assessed very soon afterward: Less post-operative pain, shortened hospital stay, rapid recovery, and better cosmetic results. As the technique became a routine procedure, modifications were made in order to make it less invasive and more cosmetic [12]. Later, technical advances introduced the 5-mm laparoscope and the 5-mm clip appliers, thus decreasing the port size, and later, the newer 2-or 3-mm instruments allowed the surgeons to make smaller incisions. The use of a working channel laparoscope made it possible to use only two ports, along with transdermal sutures and needles, for an easier manipulation of the gall-bladder. Natural orifice transluminal endoscopic surgery (NOTES) has been shown to offer further improvements in advantages of laparoscopic cholecystectomy (LC), i.e., decreased pain, early ambulation, and better cosmesis [13]. Gallstone disease has been known since long as far as the 5th century when Greek physician Trallianus wrote about gallstones [14]. Nowadays, LC is the gold standard forthe treatment of symptomatic gallstones. Gallstones are remarkably common, especially in female population, and are a major expensive health problem. Its prevalence has become more apparent since the introduction of ultrasonography. The incidence of cholelithiasis in the United States is reported to be 10%. In addition to these 20,000,000 people with documented cholelithiasis, another 800,000 new cases are diagnosed annually [15] and 500,000 cholecystectomies are being performed annually [16]. The advantages of laparoscopy over conventional or classic surgery include decreased pain, improved cosmetic results, and a decreased duration of hospital stay. For this reason, LC is nowadays performed through fewer and smaller ports. In recent years, multiple studies of single-incision laparoscopic surgery (SILS) have been published. The only reported advantage of SILS over standard LC is an improved cosmetic result [17, 18]. Four-port LC is most commonly used, as this method provides better anatomic views and is easier to learn [19]. This study has been undertaken to assess the feasibility of three-port LC and compare its advantages and disadvantages over the standard four-port technique.

Materials & Methods

The present study was a hospital based clinical study carried out in a tertiary care teaching hospital for a two year period. Objective of this study was to compare the technical feasibility, safety and benefits of three port laparoscopic cholecystectomy over the conventional four port laparoscopic cholecystectomy. A comparative study conducted in our tertiary Hospital, Bangaluru, from January 2023 to December 2024, included a total of 50 patients (25 in each group) who underwent laparoscopic cholecystectomy. All patients presenting with symptomatic gall bladder disease, Cholelithiasis without Choledocholithiasis and with no contraindication for general anaesthesia were included in the study. Data recorded included demographic information, past medical history, indication for operation, duration of operation, reason for conversion and post-operative complications.

Using a pre-prepared proforma various demographic & clinico-radiological factors were recorded. Clinical examination and ultrasound was done for all patients. A routine pre-anesthetics check-up was done. A fully explained well informed consent was taken with explanation of risk of conversion to open cholecystectomy. Various Co-morbid conditions were classified as per the American society of anaesthesiology classification. Operating time, hospital stay, post-operative pain, analgesic requirement and complications were noted.

The patients recruited to the study underwent two types of surgical intervention. The patients were admitted to six surgical units. Of them, those admitted in one of the units where researcher was posted carried out 3 port laparoscopic cholecystectomy while all the other units did conventional laparoscopic cholecystectomy. All patients were operated under general anaesthesia with inhalation and intravenous agents and endotracheal intubation. Surgeons with grade of senior lecturer and above with fellowship in laparoscopy performed the laparoscopic cholecystectomy.

Inclusion criteria

- All patients with symptomatic gall stone disease (Cholelithiasis, acute & chronic cholecystitis).
- Patients presenting with acalculous cholecystitis.

ISSN:0975-3583, 0976-2833 VOL 15, ISSUE 06, 2024

- Age > 18 years.
- American Society for Anaesthesiology (ASA) class I and class II patients.

Exclusion criteria

- Choledocholithiasis.
- Carcinoma of gall bladder.
- Perforated gall bladder.
- Previous abdominal surgeries.
- Anaesthetically unfit for laparoscopic surgeries.

Results

50 patients were evaluated undergoing conventional laparoscopic and three port laparoscopic cholecystectomy. The patients belonged to various surgical units and full details of the patients were recorded in the proforma. Observations and analysis of all the parameters were studied. Out of the 50 patients, 25 underwent conventional laparoscopic surgery and 25 underwent three port laparoscopic cholecystectomy.

Most of the patients under our study to undergo laparoscopic cholecystectomy were between 3rd and 4th decade of life. Youngest patient was 19 years old and oldest one was of 73 years (Table 1).

Table 1: Showing Age distribution

Age (Years)	3 Port	4 Port	Number of Patients
11-20	1 (4%)	0(0%)	1
21-30	1(4%)	3(12%)	4
31-40	6(24%)	4(16%)	10
41-50	7(28%)	9(36%)	16
51-60	5(20%)	6(20%)	11
61-70	5(20%)	3(12%)	8
Total	**25**	**25**	50

Of the 50 patients who underwent laparoscopic cholecystectomy, ratio of male to female with Gall bladder disease was 1:2.57. The observed sex distribution shows that the gall bladder diseases have a higher frequency in female than in males. (Table 2)

Table 2: Showing Gender distribution

Sex	3 port	4 port	Total
Male	6	8	14
Female	17	19	36
Total	23	27	50

Table 3: Showing time duration of surgery

Time (mins)	3 Port	4 Port	Number of Patients
30-40	0	0	0
41-50	2(8%)	2(4%)	4
51-60	1(4%)	4(23.6%)	5
61-70	10(40%)	4(18.1%)	14
71-80	12(48%)	5(18.1%)	17
81-90	0	8(29.9%)	8
91-100	0	2(5.45%)	2
Total	**25**	**25**	50

Mean duration of surgery is more in Conventional laparoscopic cholecystectomy as compared with the three-port laparoscopic cholecystectomy as shown. (Table 3). Mean OT time for three port was 66.33 minutes & for four port it was 74.58 minutes. With P-value = 0.0006 obtained using t-test for independent samples.

Discussion

In the era of laparoscopic surgery, less postoperative pain and early recovery are major goals to achieve better patient care and cost effectiveness. Several studies demonstrated that less post-operative pain was associated with reduction in either size or number of ports. The use of fourth trocar is considered unnecessary by some surgeons while few of them used sutures to retract gallbladder fundus. Gallstone

ISSN:0975-3583, 0976-2833 VOL 15, ISSUE 06, 2024

disease is a global health problem. Laparoscopic cholecystectomy is considered to be the procedure of choice for elective cholecystectomy [20]. With the increasing experience in advanced laparoscopic techniques, LC is performed by

- Four ports of entry into the abdomen (standard procedure).
- Three ports of entry into the abdomen.
- Two ports of entry into the abdomen.
- Single port of entry into the abdomen (SILS).
- NOTES9.

Some surgeons observed that LC can be performed safely in the majority of cases by the three-port method.

It is safe and requires conversion to four-port method in the incidence is 10-20% of the whole adult population, making laparoscopic cholecystectomy one of the most frequently performed operations in the world. Most patients are asymptomatic and gallstones are generally detected with ultrasonography during the evaluation of unrelated medical conditions. Over the past two decades, Laparoscopic Cholecystectomy has become the gold standard for the surgical treatment of gallbladder disease. A shorter hospital stay and rapid return to normal activity and work, less postoperative pain, a faster recovery and lower cost and better cosmetics are some of the advantages of Laparoscopic Cholecystectomy. Looking at age incidence our study had the incidence ranging between 19-73 years with Mean of 48.61 years. Barbara *et al*., reported prevalence of Gall stones peaking in 50-60 years. Further study of Ranshoff and Gracie, concluded similar result. Leon Morgenstern showed maximum age incidence in 6th and 7th decades. This is accordance with observation of Malhotra, which suggest that as compared to western countries, Cholelithiasis is more prevalent in younger population in our region. In our study 14 patients were males and 36 were females. Females outnumbered males in each age group. The male female ratio in our study is 1: 2.57 which well compares with the study of Kimura K *et al*. This ratio also well compares with the studies by Ganey *et al*., and Leon Morgenstern *et al*., (1992). All studies indicate that incidence of cholelithiasis is more in females as compared to males. The reasons for increased incidence being presence of estrogen in females, which increases cholesterol secretion in bile and increased intestinal transit time of bile salts which further increases intestinal bile salt absorption Jeffrey *et al*., Considering the duration of surgery, our study 70% in the three port and 71% in the four port fell in the >70 minute time span. Three port had a mean time of 66.33 minutes and four port had a mean time of 74.58 minutes. It was also interesting that mean operative time was shorter for three-port technique, which does not correlate with previous studies. One explanation for the shorter operative time in the three -port group is that less time was spent on the establishment and subsequent closure of the additional port. One finding consistently noted in our study was that three port technique was slight difficult to perform with long gallbladder with a long peritoneal fold. This was because the fundus of gall bladder repeatedly fell toward the area of the dissection in calots triangle. This finding was consistent with the study conducted in Nepal by Trichak S. In our study, patients who underwent the three port technique had a mean duration of hospital stay of 4.58 days where as patients who underwent the conventional technique had a mean stay of 5.22 days. 42.75% of patients were discharged before the 4th post op day in the 3 port category whereas only 33.95% of patients were discharged in the 4 port category. These figures were comparable with the study published by Kumar *et al*., In our study postoperative pain was measured by VAS (visual analogue score). Patients who underwent the three port cholecystectomy, 77% of them had a VAS of <6 whereas only 61% of the four port patients had a VAS of <6. The results of three port technique were more favourable in that it reduced pain, so that fewer analgesic injections were needed for pain control. These figures were comparable with the study published by Kumar *et al*., 43.1% of the patients who underwent the three port technique had a VAS of <6 after 24 hours of surgery whereas 50.4% of the patients who had undergone the conventional technique had a VAS of <6 after 24 hours after the surgery. The results of three port technique were more favourable in that it reduced pain, so that fewer analgesic injections were needed for pain control. These figures were comparable with the study published by Kumar *et al*.,

In our study not a single patient required analgesics beyond 48 hours in the three port group whereas 4 patients required it longer than 48 hours in the four port group.

Considering the complications, 2 patients from the four port technique group had fever post operatively 48 hours of surgery.

We have experienced the almost same demographic profile as in other studies. The results of three port technique were more favourable in that it reduced pain, so that fewer analgesic injections were needed for pain control. In our study postoperative analgesia requirement was nil in the three port technique after 48 hours. The overall intraoperative complications in our study occurred with almost equal rate with both the techniques ($p>0.05$). The results show that the three port technique yields the same success rate as the four port one.

We did not had any bile duct injury in any of these groups. Some surgeons have expressed concerns about the safety of the 3-port technique, arguing that it may lead to a higher percentage of the bile duct

ISSN:0975-3583, 0976-2833 VOL 15, ISSUE 06, 2024

injuries.
However, bile duct injury can be avoided if the gallbladder is gripped at the infundibulum, retracted laterally, and dissected at the infundibulum-cystic duct junction rather than cystic duct common bile duct junction.
This study has shown comparable results to those of other studies done in the past and has confirmed the safety of the procedure.
Our findings thus suggest that the three port LC technique was not difficult to master and could be safely performed by trained personnel. Conversion to standard four port laparoscopic procedure should be undertaken wherever necessary. The most important aspect of any surgical procedure is its safety and complications.

Conclusion

It appears that the 3-port laparoscopic cholecystectomy technique is safe and has similar clinical outcomes to those of the conventional 4-port laparoscopic cholecystectomy technique. There appears to be a reduced need for analgesic injections with no obvious increase in bile duct injuries. 3-port laparoscopic cholecystectomy technique can be a viable alternative in the field of minimally invasive laparoscopic cholecystectomy. It is recommended that the surgeon should not hesitate to put fourth port to ensure safe completion of Surgery. The main advantages of the three-port technique are that it causes less pain, less expense and leaves fewer scars. We conclude that both three-port LC and four-port LC are equally good techniques in the hands of experienced laparoscopic surgeons, with comparable operative time, pre- and postoperative complications, analgesic requirement, hospital stay, cosmesis, and disability days. The four-port technique should be accepted and adopted only by surgeons experienced in laparoscopic surgery and familiar with the three-port technique as it is more difficult to perform, particularly in patients with adhesions. The operator who performs the three-port LC should be prepared for placement of an additional port conversion to open laparotomy whenever complication arises.

References

1. Shea JA, Berlin JA, Bachwich DR, Staroscik RN, Malet PF, McGuckin M, *et al*. Indications for and outcomes of cholecystectomy: a comparison of the pre and post laparoscopic eras. Ann Surg. 1998;227(3):343.
2. Krishnanand RC, Chanchlani M. three port laparoscopic cholecystectomy in tertiary care hospital of central India-an audit of 200 patients. J Evol Med Dental Sci. 2013;2(43):8290-6.
3. Beal JM. Historical perspective of gallstone disease. Surg. Gynecol. Obstet. 1984;158(2):181.
4. Hashimoto D, Hirota M, Yagi Y, Baba H. Umbilicus saving three-port laparoscopic cholecystectomy. Webmed Central laparoscopy, 2011, 2(10).
5. Tagaya N, Kita J, Takagi K, Imada T, Ishikawa K, Kogure H, *et al*. Experience with three-port laparoscopic cholecystectomy. J Hepato-Biliary-Pancreatic Surg. 1998;5(3):309-11.
6. Wills VL, Hunt DR. Pain after laparoscopic cholecystectomy. Brit J Surg. 2000;87(3):273-84.
7. Leggett PL, Bissell CD, Churchman-Winn R, Ahn C. Minimizing ports to improve laparoscopic cholecystectomy. Surg. Endosc. 2001;15(3):293-6.
8. Leggett PL, Bissell CD, Churchman-Winn R, Ahn C. Three-port micro-laparoscopic cholecystectomy in 159 patients. Surg. Endoscop. 2001;15(3):293-6.
9. Poon CM, Chan KW, Lee DW, Chan KC, Ko CW, Cheung HY, *et al*. Two-port versus four-port laparoscopic cholecystectomy. Surgical Endosc. Other Interventional Tech. 2003;17(10):1624-7.
10. Trichak S. Three-port vs standard four-port laparoscopic cholecystectomy. Surg. Endoscother Interventional Tech. 2003;17(9):1434-6.
11. Sun S, Yang K, Gao M, He X, Tian J, Ma B. Three-port versus four-port laparoscopic cholecystectomy: meta-analysis of randomized clinical trials. World J Surg. 2009;33(9):1904-8.
12. Gupta R, Singal R, Sharda VK, *et al*. Two port laparoscopic assisted appendicectomy versus three port laparoscopic appendicectomy: a prospective study of 50 cases. Trop J Med Res, 2015 Jan-Jun, 18(1).
13. Arroyo JP, Martín-Del-Campo LA, Torres-Villalobos G. Single-incision laparoscopic cholecystectomy: is it a plausible alternative to the traditional four-port laparoscopic approach? Minim Invasive Surg. 2012;2012:347607.
14. Nahrwold, David L. Biliary system. In: Sabiston DC, editor. Textbook of surgery. 13th ed. Philadelphia: WD Saunders Company; 2012. p. 0612.
15. Kimberley DS, Joe AC, Jeol JR. Pathogenesis of gallstones. Surg. Clin North Am. 2009;70:1197-1216.
16. Andrew KD. Epidemiology and natural history of gallstone disease. Gastroenterol Clin North Am. 2011;20:1-19.
17. Kim BS, Kim KC, Choi YB. A comparison between single-incision and conventional laparoscopic cholecystectomy. J Laparoendosc Adv Surg. Tech A. 2012 Jun;22(5):443-447.
18. Markar SR, Karthikesalingam A, Thrumurthy S, Muirhead L, Kinross J, Paraskeva P. Single-

ISSN:0975-3583, 0976-2833 VOL 15, ISSUE 06, 2024

incision laparoscopic surgery (SILS) vs conventional multiport cholecystectomy: systematic review and meta-analysis. Surg. Endosc. 2012 May;26(5):1205-1213.

19. Mayir B, Dogan U, Koc U, Aslaner A, Bılecık T, Ensarı CO, *et al*. Safety and effectiveness of three-port laparoscopic cholecystectomy. Int J Clin Exp Med. 2014 Aug;7(8):2339-2342.
20. Khan SA, Kalra D, Tanwar P, Kumar N, Singh J, Meena V, *et al*. Three ports versus four port (standard) laparoscopic cholecystectomy-comparative study of 60 cases of cholelithiasis. IOSR J Dent Med Sci. 2016;15:138-141.