e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2023; 15(12); 498-503

Original Research Article

A Hospital Base Study to Assess the Laparoscopic Cholecystectomy in Patients with Moderate to Severe Left Ventricular Dysfunction: An Observational Study

Anshuman[1], Sushant Satya Priya[2], Narendra Kumar[3]

[1]Senior Resident, Department of Anesthesiology, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India

[2]Senior Resident, Department of Anesthesiology, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India

[3]Associate Professor, Department of Anesthesiology, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India, India

Received: 13-09-2023 Revised: 15-10-2023 / Accepted: 28-11-2023
Corresponding author: Dr. Sushant Satya Priya
Conflict of interest: Nil

Abstract

Aim: The aim of the present study was to assess the laparoscopic cholecystectomy in patients with moderate to severe left ventricular dysfunction at a tertiary hospital.

Material & Methods: The present study was single-center, open label, prospective, observational controlled study, conducted in Department of Anaesthesiology, Study period was of 1 year. 20 patients with moderate to severe LV dysfunction undergoing laparoscopic cholecystectomy were enrolled in the study.

Results: In present study, mean age was 58.52 ± 8.42 years. Gender wise male (25%) were less than female (75%) patients. Medical comorbidities were Hypertension (80%), Diabetes mellitus 5 (25%) and Previous history of cardiac intervention (25%). 70% patients had moderate Left ventricular dysfunction (LVEF 36–40%) while 30% had severe Left ventricular dysfunction (LVEF<36%). No significant change in mean HR and mean MAP was seen at T2, T3, T4 or T5 from T1 was noted. From T1 to T2, there was increase in mean CVP and mean CVP values decrease from T4 to T5 and reach values approximately similar to the T1 levels. On intragroup statistical analysis, significant increase in mean CVP was seen at T3, T4 from T1. From T1 to T2, no change in mean SVR was seen, while from T2 to T3 and T4, there was an increase in the mean SVR, mean SVR values at T5 return to the approximately the T1 levels after CO2 exsufflation. From T1 to T2, there was fall in mean CO while at T3 there was fall in CO was noticed again and the CO does return to similar pre-induction T1 values at T5. The mean EtCO2 values were statistically significant when compared from P1 values. The PaCO2 values were comparable between predefined time points in the study.

Conclusion: Cholecystectomy may be safely done in cardiac patients with moderate to severe left ventricular systolic dysfunction patients under the supervision of an experienced consultant anaesthesiologist. Optimization of cardiac status, administered of balanced anaesthesia and 10-12 mmHg pressure pneumoperitoneum are essential steps for patients' safety. Life threatening complications are low and can be easily managed in hospital with adequate cardiology support.

Keywords: Laparoscopic Cholecystectomy, Left Ventricular Systolic Dysfunction, Balanced Anaesthesia, Pneumoperitoneum

Introduction

Laparoscopic cholecystectomy stays the standard treatment for cholelithiasis. Since the introduction of laparoscopic cholecystectomy by Philip Mouret in 1987, the technique was rapidly accepted by the surgical community. [1] Laparoscopic cholecystectomy procedure results cosmetically more acceptable, decreased hospital duration, less postoperative pain and lesser disability from daily work as compared to open cholecystectomy. [2] Consistently expanding number of patients with heap of clinical disease is being treated by this strategy. [3] The appeal of diminished pain and fatigue, early return to normal activities and superior cosmesis has made it a popular surgery. [4] Previous abdominal surgery, acute cholecystitis, morbid obesity, old age and pregnancy were traditional contraindications for laparoscopic cholecystectomy. [5,6,7,8]

During laparoscopy, positive pressing factor pneumoperitoneum utilizing carbon dioxide could affect the cardiovascular framework. [8] But in patients with moderate to severe left ventricular dysfunction whether the laparoscopic cholecystectomy is beneficial as it will cause less physiological stress or there will be cardiovascular disadvantage of pneumoperitoneum, is a matter of concern for both laparoscopic surgeon and anesthetist.

Comparable anxiety likewise among the surgeon and anesthetist team and laparoscopic cholecystectomy is frequently debilitate in patients with critical cardiovascular illnesses. Despite what might be expected, the physiological pressure following negligibly obtrusive medical procedure is lesser when contrasted with patients going through open cholecystectomy. [9] This makes one wonder whether the indicated hazard of pneumoperitoneum could be counterbalanced by the decreased pressure following negligibly intrusive medical procedure, accordingly bringing the patients with cardiovascular co-morbidity inside the ambit of laparoscopic cholecystectomy. [10,11]

Intensive intraoperative monitoring and vigilance in the anesthetic management is of utmost importance for a smooth perioperative course in patients with cardiac dysfunction. [12,13] This requires a thorough knowledge into the effect of pneumoperitoneum and reverse Trendelenburg positioning on the cardiac physiology especially with respect to patients with a diseased myocardium. [14,15]

Therefore in the present study, we studied laparoscopic cholecystectomy in patients with moderate to severe left ventricular dysfunction at a tertiary hospital.

Material & Methods

The present study was single-center, open label, prospective, observational controlled study, conducted in Department of Anaesthesiology, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India. Study period was of 1 year. 20 patients with moderate to severe LV dysfunction undergoing laparoscopic cholecystectomy were enrolled in the study.

Inclusion Criteria:

- Patients 18-65 years, either gender, with presence of moderate to severe left ventricular systolic dysfunction, planned for laparoscopic cholecystectomy, willing to participate in present study.

Exclusion Criteria:

- BMI > 35 kg/m2 . Coexisting stenotic valve lesions or right ventricular dysfunction. Presence of electrocardiographic findings of arrhythmia. NYHA IV physical status. End stage hepatic/renal/pulmonary disease.

Methodology

Demographic variables, history of cardiac medications and prior history of admission to the ER or cardiac adverse events was noted. Patients were evaluated as per standard operative procedures for laparoscopic surgery.

The formal echocardiography was done by an experienced cardiologist and LV systolic dysfunction was graded as mild (LVEF 41–45%), moderate (LVEF 36– 40%), or severe (LVEF < 36%).

In operation theatre, standard ASA monitors including 5 lead ECG, pulse oximeter and NIBP were attached and baseline echocardiography was done. A broad gauge intravenous cannula was placed in the right internal jugular vein and connected to the pressure transducing system (Edward Life Science) for central venous pressure(CVP) measurement. Under aseptic conditions and local anaesthetic, a 20G arterial cannula was inserted in the radial artery and connected to the FloTrac system for continuous cardiac output, SVV monitoring. CVP measured from the venous cannula was also transduced for calculation of SVR. A baseline ABG sample was taken at T1 for measurement of baseline PaCO2.

Under general anaesthesia, after creation of pneumoperitoneum, once IAP of 12mm Hg was achieved, 2D echocardiography was done (T2). Intraoperatively IAP was maintained to <12mmHg. Following this reverse Trendelenburg positioning was done. 10 min after the positioning the 2nd sample of ABG was taken. IBP, HR, MAP, SpO2, EtCO2, intra abdominal pressures were monitored continuously. CO (both from 2D echo, FloTrac system), IBP, NIBP, HR, SVV, CVP, SVR, SPV, PPV were noted at the predefined study time points. After 10 min after desufflation(T5), third ABG sample was taken. All study parameters were recorded at the following time points.

- T1 - Pre-induction
- T2 - 10 minute after induction
- T3 - when pneumoperitoneum with intraabdominal (IAP) pressure of 12mm Hg is achieved, • T4 - 10 minute after reverse Trendelenburg position,
- T5 - 10 minute after deflation of pneumoperitoneum.

The patient was shifted to PACU after fulfilling the criteria that patient was able to respond to verbal stimuli and ensuring that pain was adequately managed. Any post procedure nausea and vomiting were addressed and antiemetics were prescribed. All cardiac patients were followed till hospital discharge

and any in hospital morbidity were noted. Any patients with symptoms suggestive of failure or ischemic event in the postoperative period were subjected to quantitative analysis of cardiac biomarkers. 30-day morbidity and mortality were for telephonic communication with the patients.

Statistical Analysis

Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Difference of proportions between qualitative variables were tested using chi- square test or Fisher exact test as applicable. P value less than 0.5 was considered as statistically significant.

Results

Table 1: Demographic characteristics

Parameter	No. of cases (%)/ Mean ± SD
Age in years	58.52 ± 8.42
Gender	
Male	5 (25%)
Female	15 (75%)
Weight in kg	63.57±13.57
Height in cm	163.27±12.18
BMI in kg/m^2	23.57±2.68
BSA in m^2	1.8±0.27
Medical comorbidities	
Hypertension	16 (80 %)
Diabetes mellitus	5 (25%)
Previous history of cardiac intervention	5 (25%)
Left ventricular dysfunction	
Moderate (LVEF 36–40%)	14 (70%)
Severe (LVEF < 36%)	6 (30%)

In present study, mean age was 58.52 ± 8.42 years. Gender wise male (25%) were less than female (75%) patients. Medical comorbidities were Hypertension (80%), Diabetes mellitus 5 (25%) and Previous history of cardiac intervention (25%). 70% patients had moderate Left ventricular dysfunction (LVEF 36–40%) while 30% had severe Left ventricular dysfunction (LVEF<36%).

Table 2: Heart rate and mean arterial pressure at the defined time points

Heart rate (beats/min)	Mean ± SD	P value from T1
HR at T1	82±11.83	-
HR at T2	76.72±11.85	.420
HR at T3	75.28±13.17	.342
HR at T4	76.44±14.24	.432
HR at T5	73.87±12.32	.107
Mean arterial pressure (mm Hg)		
MAP at T1	93±11.82	-
MAP at T2	84±12.18	.320
MAP at T3	103.42±15.45	.084
MAP at T4	98.56±12.16	.372
MAP at T5	98.26±12.94	.480

No significant change in mean HR and mean MAP was seen at T2, T3, T4 or T5 from T1 was noted.

Table 3: Mean CVP and SVR at the defined time points

Central venous pressure (mm Hg)	Mean ± SD	P value from T1
CVP at T1	8.82±2.48	-
CVP at T2	11.15±5.72	.132
CVP at T3	12.78±3.27	.007
CVP at T4	12.48±3.22	.009
CVP at T5	8.52±3.24	.512
Systemic vascular resistance (Dynes.sec.cm-5)		
SVR at T1	1604.76±672.4	-
SVR at T2	1508±462.38	.950
SVR at T3	1960.80±752.98	.045
SVR at T4	1975.55±624.82	.065
SVR at T5	1708.82±848.42	.375

From T1 to T2, there was increase in mean CVP and mean CVP values decrease from T4 to T5 and reach values approximately similar to the T1 levels. On intragroup statistical analysis, significant increase in mean CVP was seen at T3, T4 from T1. From T1 to T2, no change in mean SVR was seen, while from T2 to T3 and T4, there was an increase in the mean SVR, mean SVR values at T5 return to the approximately the T1 levels after CO_2 exsufflation.

Table 4: Mean cardiac output, Mean EtCO2 and Mean $PaCO_2$ at the defined time points

Cardiac output (L/min)	Mean ± SD	P value from T1
CO at T1	4.86±1.42	-
CO at T2	4.12±1.28	.175
CO at T3	3.76±1.14	.085
CO at T4	3.70±1.11	.077
CO at T5	4.61±1.4	.490
EtCO2 (mm Hg)		
EtCO2 at T1	28.82±2.38	-
EtCO2 at T2	36.44±6.34	.023
EtCO2 at T3	35.70±5.85	.056
EtCO2 at T4	36.34±4.56	.007
EtCO2 at T5	37.53±5.85	.022
PaCO2 (mm Hg)		
PaCO2 at T1	35.18±5.75	-
PaCO2 at T4	38.82±4.96	.302
PaCO2 at T5	39.61±7.73	.412

From T1 to T2, there was fall in mean CO while at T3 there was fall in CO was noticed again and the CO does return to similar pre-induction T1 values at T5. The mean EtCO2 values were statistically significant when compared from P1 values. The PaCO2 values were comparable between predefined time points in the study.

Discussion

During laparoscopy, positive pressing factor pneumoperitoneum utilizing carbon dioxide could affect the cardiovascular framework. [8] In this manner, standard careful course readings frequently refer to patients with cardiovascular disturbance a relative contraindication to laparoscopic cholecystectomy. [16] During laparoscopy, positive pressure pneumoperitoneum using carbon dioxide could have deleterious effects on the cardiovascular system. [16] Therefore, standard surgical text books often cite patients with cardiac dysfunction a relative contraindication to laparoscopic cholecystectomy. [5]

In present study, mean age was 58.52 ± 8.42 years. Gender wise male (25%) were less than female (75%) patients. A population based study done in the north Indian population confirms a greater prevalence of cholecystitis in females as compared to males. [17] Medical comorbidities were Hypertension (80%), Diabetes mellitus 5 (25%) and Previous history of cardiac intervention (25%). 70% patients had moderate Left ventricular dysfunction (LVEF 36–40%) while 30% had severe Left ventricular dysfunction (LVEF<36%). No significant change in mean HR and mean MAP was seen at T2, T3, T4 or T5 from T1 was noted. Dhoste et al [18] in a similar study evaluated the hemodynamic and respiratory changes during laparoscopic cholecystectomy in patients aged >75 years, ASA III category and concluded that the main cardiovascular depression was noted after induction of anesthesia.

From T1 to T2, there was increase in mean CVP and mean CVP values decrease from T4 to T5 and reach values approximately similar to the T1 levels. On intragroup statistical analysis, significant increase in mean CVP was seen at T3, T4 from T1. From T1 to T2, no change in mean SVR was seen, while from T2 to T3 and T4, there was an increase in the mean SVR, mean SVR values at T5 return to the approximately the T1 levels after CO2 exsufflation. From T1 to T2, there was fall in mean CO while at T3 there was fall in CO was noticed again and the CO does return to similar pre-induction T1 values at T5. The mean EtCO2 values were statistically significant when compared from P1 values. The PaCO2 values were comparable between predefined time points in the study. Patients with ischemic coronary illness are inclined to create atrial fibrillation, a condition which could be encouraged by CO2 pneumoperitoneum. [19] The greater part of the investigations tending to cardiovascular impacts of CO2 pneumoperitoneum have been acted in solid subjects, who appear to endure pneumoperitoneum without untoward issue. [20,21] Careful history taking and abstract evaluation of patients going through laparoscopic cholecystectomy is a significant part of overseeing such patients. [22] It is intriguing to take note of that albeit the left

ventricular launch (LVEF) on resting transthoracic echocardiography is usually used to survey heart work, LVEF isn't a piece of any of these scoring frameworks. Thus there is little motivation to debilitate laparoscopic cholecystectomy based on single LVEF value. [23]

Conclusion

The present study showed that laparoscopic cholecystectomy may be safely done in cardiac patients with moderate to severe left ventricular systolic dysfunction patients under the supervision of an experienced consultant anaesthesiologist. Optimization of cardiac status, administered of balanced anaesthesia and 10-12 mmHg pressure pneumoperitoneum are essential steps for patients' safety. Life threatening complications are low and can be easily managed in hospital with adequate cardiology support.

References

1. GS L. Profiles in laparoscopy: Mouret, Dubois, and Perissat: the laparoscopic break-trough in Europe (1987-1988). JSLS. 1999;3:163-7.
2. Rubert CP, Farias FV, Higa RA. Comparison between open and laparoscopic elective cholecystectomy in elderly, in a teaching hospital. Rev Col Bras Cir 2016;43:2–5.
3. Rosenthal RJ, Szomstein S, Kennedy CI, Soto FC, Zundel N. Laparoscopic surgery for morbid obesity: 1, 001 consecutive bariatric operations performed at the Bariatric Institute, Cleveland Clinic Florida. Obes Surg. 2006;16 (2):119–124.
4. Barkun JS, Barkun AN, Sampalis JS et al (1992) Randomised controlled trial of laparoscopic versus mini cholecystectomy. The McGill Gallstone Treatment group. Lancet 340 (8828):1116–1119
5. Nagle AP, Soper NJ, Hines JR (2007) Cholecystectomy (Open and laparoscopic). In: Zinner MJ, Ashley SW (eds) Maingot's abdominal operations, 11th edn. McGraw-Hill Medical, New York, pp 847–863
6. Rosenthal RJ, Szomstein S, Kennedy CI, Soto FC, Zundel N (2006) Laparoscopic surgery for morbid obesity: 1, 001 consecutive bariatric operations performed at the Bariatric Institute, Cleveland Clinic Florida. Obes Surg 16(2):11 9–124
7. Doste K, Lacoste L, Lehuede KJ, MS TD, Fusciardi J (1996) Haemodynamic and ventricular changes during laparoscopic cholecystectomy in elderly ASA III patients. Can J Anaesthesia 43(8):783–788
8. Barone JE, Bears S, Chen S. Outcome study of cholecystectomy during pregnancy. Am J Surg .1999;177:232–236.
9. Sadhu S, Jahangir TA, Sarkar S, Dubey Sanjoy Kr, Roy Manas Kr. Open port placement through the umbilical cicatrix. Indian J Surgery . 2009;71(5):273–275
10. Dexter SP, Vucevic M, Gibson J, McMahan MJ. Haemodynamic consequences of high and low-pressure capnoperitoneum during laparo - scopic technique. Surg Endosc. 1999;13:376–381.
11. Joris JL, Noriot DP, Legrand MJ, Jacquet NJ, Lamy ML. Hemodynamic changes during laparoscopic cholecystectomy. Anesth Analg. 1993;76:1067–1071.
12. Silverstein A, Costas A, Gakwaya MR, Lule J, Meara JG, Shrime MG, et al. Laparoscopic versus open cholecystectomy: A Cost-Effectiveness Analysis at Rwanda Military Hospital. world J Surgery. 2017;41:1225–33.
13. Radunovic M, Lazovic R, Popovic N, Magdelinic M, Bulajic M, Radunovic L, et al. Complications of laparoscopic cholecystecto - my: Our experience from a retrospective analysis. Maced J Med Sci. 2016; 4:641- 646.
14. Atkinson TM, Giraud GD, Togioka BM, Jones DB, Cigarroa JE. Cardiovascular and ventilatory consequences of laparoscopic surgery. Circulation. 2017;135:700-710
15. Umar A, Mehta KS, Mehta N. Evaluation of hemodynamic changes using different intra-abdominal pressures for laparoscopic cholecystectomy. Indian J Surg. 2013 Aug;75 (4):284-9.
16. McLaughlin JG, Scheeres DE, Dean RJ, Bonnell BW. The adverse hemodynamic effects of laparoscopic cholecystectomy. Surgical endoscopy. 1995 Feb;9:121-4.
17. Raymond I, Pedersen F, Steensgaard-Hansen F, Green A, Busch-Sorensen M, Tuxen C, Appel J, Jacobsen J, Atar D, Hildebrandt P. Prevalence of impaired left ventricular systolic function and heart failure in a middle aged and elderly urban population segment of Copenhagen. Heart. 2003 Dec 1;89(12):1422-9
18. Dhoste K, Lacoste L, Karayan J, Lehuede MS, Thomas D, Fusciardi J. Haemodynamic and ventilatory changes during laparoscopic cholecystectomy in elderly ASA III patients. Canadian Journal of Anesthesia/Journal canadien d'anesthésie. 1996 Aug;43:783-8.
19. Kim J, Sun Z, Englum BR, Allori AC, Adibe OO, Rice HE, et al. Laparoscopy Is Safe in Infants and Neonates with Congenital Heart Disease: A National Study of 3684 Patients. J Laparoendosc Adv Surg Tech A. 2016 Oct; 26(10):836-39
20. Liu YY, Yeh CN, Lee HL, Chu PH, Jan YY, Chen MF. Laparoscopic cholecystectomy for gallbladder disease in patients with severe cardiovascular disease. World J Surg. 2009 Aug;33(8):1720-6.
21. Fried M, Krska Z, Danzig V. Does the laparoscopic approach significantly affect

cardiac functions in laparoscopic surgery? Pilot study in non-obese and morbidly obese patients. Obes Surg. 2001 Jun;11(3):293-6.
22. Vigneswaran Y, Wang V, Krezalek M, Prachand V, Wyers S, Juricek C, et al. Laparoscopic procedures in patients with cardiac ventricular assist devices. Surg Endosc. 2019 Jul;33(7):2181-86.
23. Struthers AD, Cuschieri A. Cardiovascular consequences of laparoscopic surgery. Lancet. 1998 Aug 15;352(9127):568-70.