

A Retrospective Observational Study to Compare the Effect of Low-Pressure Versus Standard-Pressure pneumoperitoneum in Laparoscopic Cholecystectomies Performed at BMC Sagar

Akhilesh Ratnakar¹, Sunil Kumar Saxena², Jitendra Singh Dangi³, Lav Gupta⁴, Aditi Kumari⁵, Hemal Vithani⁶

¹Associate Professor, Department of Surgery, Bundelkhand Medical College, Sagar (M.P.)

²Professor and Head of Department, Department of Surgery, Bundelkhand Medical College, Sagar (M.P.)

³Assistant Professor, Department of Surgery, Bundelkhand Medical College, Sagar (M.P.)

⁴Assistant Professor, Department of Surgery, Bundelkhand Medical College, Sagar (M.P.)

⁵PG Resident, Department of Surgery, Bundelkhand Medical College, Sagar (M.P.)

⁶PG Resident, Department of Surgery, Bundelkhand Medical College, Sagar (M.P.)

Received: 18-10-2023 / Revised: 21-11-2023 / Accepted: 26-12-2023

Corresponding author: Dr. Aditi Kumari

Conflict of interest: Nil

Abstract:

Introduction: Laparoscopy, owing to its minimally invasive nature, has become the standard of treatment for cholelithiasis. It decreases post-operative pain, morbidity and length of hospital stay.

Objective: Our aim in this study is to assess whether low pressure in laparoscopic surgeries (7 mm Hg instead of 12 mm Hg) would have added benefit of reduced post-operative use of analgesia and morbidity, subsequently, shorter hospital stay.

Methods: A total of 80 patients who underwent laparoscopic cholecystectomy were studied and divided into low-pressure group (7 mm Hg) and standard-pressure (12 mm Hg) group. The outcomes were measured as primary and secondary. Primary included length of hospital stay whereas secondary compared post-operative pain, amount of analgesia required, day on which bowel sounds heard and time to ambulation.

Results: Out of 80 subjects enrolled, 36 were males and 44 females. Laparoscopic cholecystectomy using low pressure for pneumoperitoneum yielded no mortality and no significant difference in surgical complication or conversion to open surgery. On the other hand, it resulted in better outcome in terms of need for analgesia, reduced period of ileus and early ambulation.

Conclusion: Low pressure pneumoperitoneum in laparoscopic cholecystectomies has an edge over standard pressure since cardiovascular and respiratory physiology is comparatively less affected. Thus, it may emerge as a better alternative to improve patient outcome.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

The first laparoscopic cholecystectomy was carried out by E Muhe of Boblingen, Germany in 1985. Cephaloid traction to the gall bladder in laparoscopic cholecystectomy was advocated by P. Mouret of Lyon, France.

Subsequent improvement in the same was suggested by Reddick and Oslen. The pioneer to Laparoscopic cholecystectomy in India was Dr Tehemton ErachUdwadia in May 1990. Since then, there has been no looking back in this field and laparoscopic surgery, owing to its minimally invasive nature, has emerged as the new “gold standard” for symptomatic cholelithiasis.

Creation of pneumoperitoneum is an essential step in laparoscopy. This allows good access to visualization of interior of the abdominal cavity and good room for the surgeon to operate. Standard pressure of carbon dioxide insufflation is 12-14 mm Hg pressure.

Despite all the advantages of laparoscopic surgery (less pain, less cutting of skin and tissue, fewer wound complications, quicker post-operative recovery, and shorter duration of hospital stay), the creation of pneumoperitoneum adversely affects cardiovascular and respiratory physiology. It also irritates phrenic surface, leading to post-operative shoulder pain.

Residual gas and abdominal wall stretching are other issues to be addressed. From a respiratory standpoint, it reduces lung volume, increases pulmonary resistance, decreases pulmonary compliance, and increases the risk of barotrauma. There is also a possible alteration of renal function. Owing to the absorption of CO₂, the hypercapnia thus induced can lead to a stimulation of the sympathetic nervous system and increase the plasmatic catecholamines. Owing to these potential effects, insufflation with the minimum pressure is undertaken which allows maintenance of sufficient exposure.

The aim of this study was to assess whether low pressure in laparoscopic surgeries (7 mm Hg instead of 12 mm Hg) would have added benefit of reduced post-operative use of analgesia and morbidity, subsequently, shorter hospital stay.

Materials and Methods

In this retrospective, observational, single-centers study undertaken at General Surgery Department of Bundelkhand Medical College, Sagar, a total of 80 patients who underwent laparoscopic cholecystectomy were included, out of which 44 were females and 36 males. This study was performed in Bundelkhand Medical College, Sagar, from June 2022 to May 2023. Ethical approval was obtained from the hospital review committee before conducting the study.

Inclusion criteria was patients who underwent planned laparoscopic procedure, and age of 18 years or older. Following counselling with a member of the research team and provision of written patient information relating to the study prospective, signed informed consent was obtained from each patient before inclusion.

Exclusion criteria included: non-laparoscopic procedure, any patient incapable of providing informed consent, and those unable to commit to the medical follow-up of the study for geographical, social, or psychological reasons.

The patients were divided into low-pressure group and standard-pressure group, each group consisting of 40 patients. Group A: insufflation at low pressure (5–7 mm Hg) and group B : insufflation at standard pressure (12–15 mm Hg).

The outcomes were measured as primary and secondary.

- Primary included length of hospital stay.
- Secondary compared post-operative pain, amount of analgesia required, day on which bowel sounds heard and time to ambulation.

Data was entered in password-protected Microsoft Excel software and the outcome in terms of visual analogue scale (for post-operative pain), amount of analgesia required, day on which bowel sounds appeared, time to ambulation and duration of hospital stay was calculated and compared.

Results and Discussion

Study to compare the efficacy of low pressure pneumoperitoneum over standard pressure pneumoperitoneum was carried out for 80 subjects. There were 36 men and 44 women. Laparoscopic cholecystectomy using low pressure for pneumoperitoneum yielded no mortality and no significant difference from standard pressure pneumoperitoneum in surgical complication or conversion to open surgery.

Table 1: Visual Analogue Scale Scoring for Post-Operative Pain in Study Subjects

VAS	Standard Pressure Pneumoperitoneum (SPP)			Low Pressure Peritoneum (LPP)		
	Males	Females		Males	Females	
0	8 (10%)	10 (12.5%)	18 (22.5%)	11 (13.75%)	9 (11.25%)	20 (25%)
1-3	5 (6.25%)	5 (6.25%)	10 (12.5%)	7 (8.75%)	9 (11.25%)	16 (20%)
4-6	3 (3.75%)	4 (5%)	7 (8.75%)	0 (0%)	3 (3.75%)	3 (3.75%)
7-9	2 (2.5%)	3 (3.75%)	5 (6.25%)	0 (0%)	1 (1.25%)	1 (1.25%)
10	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	18 (22.5%)	22 (27.5%)	40 (50%)	18 (22.5%)	22 (27.5%)	40 (50%)

Post-operative pain in Low pressure pneumoperitoneum was less in comparison to Standard pressure pneumoperitoneum as assessed by Visual Analogue Scale. Amount of analgesia required in cases of Low pressure pneumoperitoneum was on an average of 15 infusions of 100 mL Paracetamol as compared to

average 18 infusions in Standard pressure pneumoperitoneum.

The average post-operative day for return of bowel sounds in Low pressure pneumoperitoneum was 1.5 days. It was 2 days in Standard pressure cases. Average time to ambulation in Low pressure pneumoperitoneum was 1 day whereas it was 1.5 days in Standard Pressure cases.

Table 2: Comparison of Duration of Hospital Stay in Study Subjects

Duration of Hospital Stay	Standard Pressure Pneumoperitoneum (SPP)			Low Pressure Peritoneum (LPP)		
	Males	Females		Males	Females	
1-3	5 (6.25%)	5 (6.25%)	10(12.5%)	7 (8.75%)	9 (11.25%)	16 (20%)
4-6	11 (13.75%)	14 (17.5%)	25(31.25%)	11 (13.75%)	12 (15%)	23(28.75%)
7-9	2 (2.5%)	3 (3.75%)	5 (6.25%)	0 (0%)	1 (1.25%)	1 (1.25%)
	18 (22.5%)	22 (27.5%)	40 (50%)	18 (22.5%)	22 (27.5%)	40 (50%)

Average duration of Hospital Stay was maximum during 4-6 days period in both cases. The percentage of patients being discharged within 3 days was higher in low pressure pneumoperitoneum (20%) than in standard pressure ones (31.25%). Thus, in terms of outcome, low pressure pneumoperitoneum creation seems to be a promising alternative in laparoscopic cholecystectomies.

Conclusion

Low pressure pneumoperitoneum appears effective in decreasing pain after laparoscopic cholecystectomy. Particularly, it is beneficial in patients with compromised cardiovascular and respiratory physiology. Thus, low pressure pneumoperitoneum may be deemed safe and a better alternative in laparoscopic procedures. Efficacy of the same for other laparoscopic procedures, other than laparoscopic cholecystectomy remains an area of further research.

References

1. Neudecker J, Sauerland S, Neugebauer E, Bergamaschi R, Bonjer HJ, Cuschieri A, et al. The European Association for Endoscopic Surgery clinical practice guideline on the pneumoperitoneum for laparoscopic surgery. *SurgEndosc.* 2002; 16(7):1121–43.
2. Hua J, Gong J, Yao L, Zhou B, Song Z. Low-pressure versus standard pressure pneumoperitoneum for laparoscopic cholecystectomy: a systematic review and meta-analysis. *Am J Surg.* 2014; 208(1):143–50.
3. de ' Angelis N, Abdalla S, Carra MC, Lizzi V, Martínez-Pérez A, Habibi A, et al. Low-impact laparoscopic cholecystectomy is associated with decreased postoperative morbidity in patients with sickle cell disease. *SurgEndosc.* 2018; 32(5):2300–11.
4. Bucur P, Hofmann M, Menhadji A, Abedi G, Okhunov Z, Rinehart J, et al. Comparison of Pneumoperitoneum Stability between a valveless trocar system and conventional insufflation: A prospective Randomized Trial. *Urology.* 2016; 94:274–80.
5. Covotta M, Claroni C, Torregiani G, Naccarato A, Tribuzi S, Zinilli A. A Prospective, Randomized, Clinical Trial on the effects of a Valveless Trocar on Respiratory Mechanics during Robotic Radical Cystectomy: A Pilot Study. *AnesthAnalg.* 2017; 124(6):1794–801.
6. Gustafsson UO, Scott MJ, Schwenk W, Demartines N, Roulin D, Francis N, et al. Enhanced Recovery After Surgery Society. Guidelines for perioperative care in elective colonic surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations. *ClinNutr.* 2012; 31(6):783–800.