Feasibility of Low-Pressure Laparoscopic Cholecystectomy: Surgeons' Perspective

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Laparoscopic Cholecystectomy performed at low pressure is demonstrated to have less postoperative pain and lower analgesic consumption, but is still not in practice widely. A prospective cross-sectional study was carried out to study the subjective feasibility from the surgeon's perspective. A preset questionnaire was filled out by the operating surgeon regarding the comfort and ease of manipulation of instruments during the surgery. A total of 30 cases were enrolled for low-pressure laparoscopic cholecystectomy (LPLC) at 8-10mmHg. Among them, 12 out of 30, i.e., 40% cases, were performed with a high level of comfort and 40% with minor physical tiredness. Also, 18 out of 30, i.e., 60% cases, had a high level of control in manipulating the instruments. Out of 30 cases, 8 were converted to normal pressure (12mmHg), and none were converted to open cholecystectomy. The surgeons' performance in undertaking LPLC successfully varied from 54%-100%. Low-Pressure Laparoscopic Cholecystectomy (LPLC) is feasible in our setup up though there was a surgeon's variability in performing laparoscopic cholecystectomy in low pressure.

Keywords: low-pressure laparoscopic cholecystectomy, normal-pressure laparoscopic cholecystectomy, pneumoperitoneum.

After the advent of laparoscopic surgery, laparoscopic cholecystectomy has been the gold standard for treating gall bladder disease since its introduction in 1987.[1] After establishing pneumoperitoneum, Intra-abdominal pressure is maintained at 12mmHg as the standard protocol. However, it is recommended to use the lowest intra-abdominal pressure, which allows adequate exposure of the operative field.[2] Numerous studies have been carried out, which recommend the use of intra-abdominal pressure at 7-8mmHg with regard to decreased postoperative pain, low analgesic consumption, and decreased frequency and intensity of shoulder tip pain.[3,4] Some studies have demonstrated that Low-Pressure Laparoscopic Cholecystectomy (LPLC) is even safe in patients of ASA III status when performed by experienced surgeons.[5] However, the surgeon's satisfaction in performing LPLC hasn't been validated yet, and we tend to assess the level of difficulty in manipulation of the instruments in LPLC, as well as the extent of fatigue and discomfort encountered by the experienced surgeons while performing LPLC.

Our specific aim will be to assess subjective variation in comfort/fatigue experienced by the surgeons while performing laparoscopic cholecystectomy in low pressure, the precision in manipulating the instruments during the surgery, and the rate of conversion to standard pressure laparoscopic cholecystectomy or open cholecystectomy.

Materials & Methods

This is a prospective cross-sectional study. Informed consent from all the patients was taken. Patients visiting our center (a tertiary level multidisciplinary center) who were undergoing laparoscopic cholecystectomy for the period of four months with ASA I or II were enrolled and were chosen in a consecutive sampling manner. Patients who had a BMI of more than 35, with previous abdominal surgery, and those who refused to participate in the research were excluded. Three consultant surgeons and one resident took part in the research. In all cases, pneumoperitoneum was established by Hasson's (open) technique, and four ports

Table 1. Comfort during operation

Grade 1	High level of comfort throughout the operation- feels fine at the end of the operation.
Grade 2	Minor physical tiredness after the operation, but no aches or discomfort
Grade 3	Moderate physical tiredness after the operation
Grade 4	Moderate mental and physical tiredness after the operation
Grade 5	Substantial mental and physical(aches) tiredness at the end of the operation

Table 2. Ease and precision of manipulation of the instruments in the operative field

Grade 1	High-level seamless control of manipulation in the operative field throughout the operation- no problems in execution
Grade 2	Minor difficulties in instrument manipulation during complex tasks such as suturing, dissection in anatomically crowded regions
Grade 3	Moderate difficulties in instrument manipulation during complex tasks with an increase in operating time≥30min minutes
Grade 4	Major difficulties in instrument manipulation during a complex task with an increase in operating time≥60min minutes
Grade 5	Substantial difficulties during instrument manipulation for any reason, including abnormal anatomy and dense adhesions, leading to conversion to open surgery.

were created. The pneumoperitoneum was maintained at 8mmHg at the start of surgery and later converted to standard pressure as per the surgeon's preference. At the end of surgery, the operating surgeon was asked to fill up the Performa.

The grading of comfort of the surgeon during the surgery as well as the grading of ease of manipulation of the instruments in the operative field is based on Sir Alfred Cuschieri's lecture on *Recent progresses and future trends in minimally invasive surgery*, held in Italy in 2012, which was originally used to assess similar difficulties while performing robotic surgery and shown in **Table 1** and **Table 2**.

Gall Bladder Dissection difficulty level was recorded and is based on the difficulty grading system (Nassar scale).[6] Complications, if any, were also mentioned, and the reason for conversion to normal or open cholecystectomy was also recorded. All the data was calculated manually.

Results

A total of 30 patients were enrolled in the study. Mean Age, sex, BMI, ASA status (I/II), and duration of operation time are shown in **Table 3**.

Table 3. Demographic data of the patients

Mean Age(years)	48.1(S.D.=±12.44)
Female: Male	5.6:1
BMI range (mean BMI)	20-34(26.3)
ASA I: ASAII	0.5:1
Mean operating time (in mins)	93±29.92

Out of all the 30 cases performed at Low Pressure, a total of 24 out of 30, i.e., around 80% were performed in Grade 1 and Grade 2 combined in terms of comfort of the surgeons, and none of the surgeons suffered from substantial mental and physical tiredness at the end of the operation. Details of the individual surgeons with the Grading are shown in **Figure 1**.

Similarly, in 60% of the cases, surgeons had a high level of control over manipulation of instruments in the operative field, and details against each surgeon are demonstrated in **Figure 2**.

A total of 8 cases were converted to standard pressure (12mmHg), and surgeons 1, 2, and 3 converted a total of 2, 1, and 5 cases, respectively, to normal pressure after starting in low pressure, i.e., 8mmHg. The surgeon's variability in successfully performing LPLC ranged from 54%-100% and is shown in **Figure 3**.

Among all the converted cases, only one was converted to standard pressure because of a lack of space on port insertion, whereas the other 7 cases were converted due to difficulty in visualization of Calot's triangle. Among these converted cases, only 2 cases had a BMI< 22kg/$m^{2,}$ while the rest had a BMI of >30kg/$m^{2.}$

A total of 28 cases that were performed were of Grade 1 in terms of Nassar's scale of GB dissection difficulty, 1 case was of Grade 2, which was performed in Low pressure, while 1 case was of Grade 3, which had to be converted to standard pressure. None of the cases were converted to open cholecystectomy.

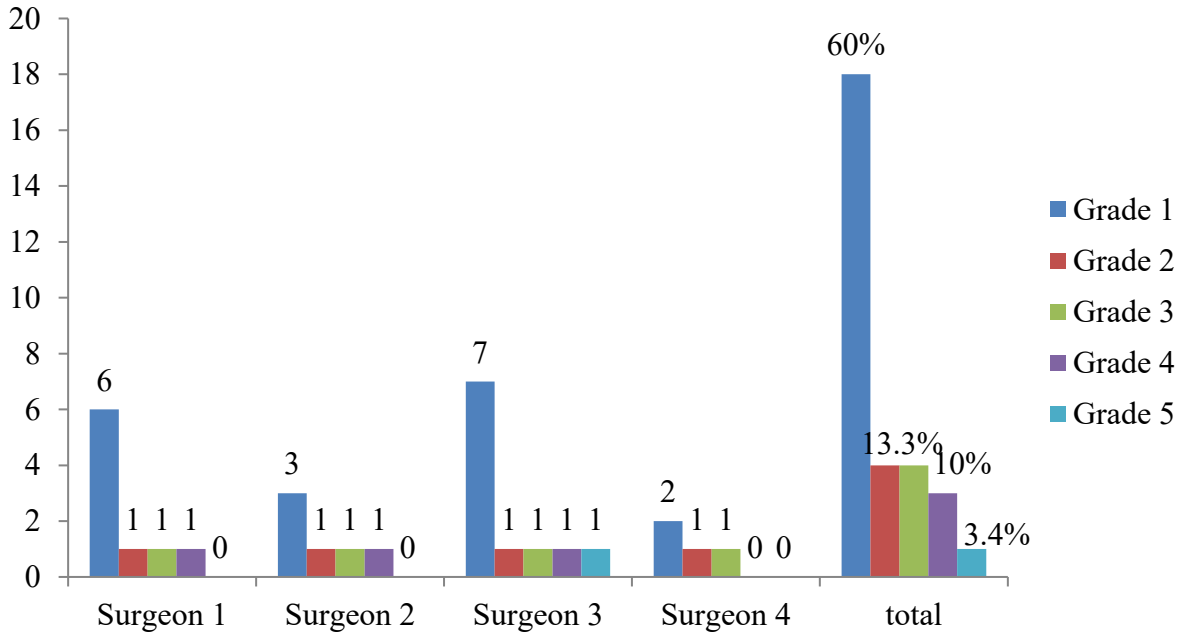

Figure 2. Results showing the different grades in manipulating the instruments in the operative field experienced by the surgeons while performing LPLC

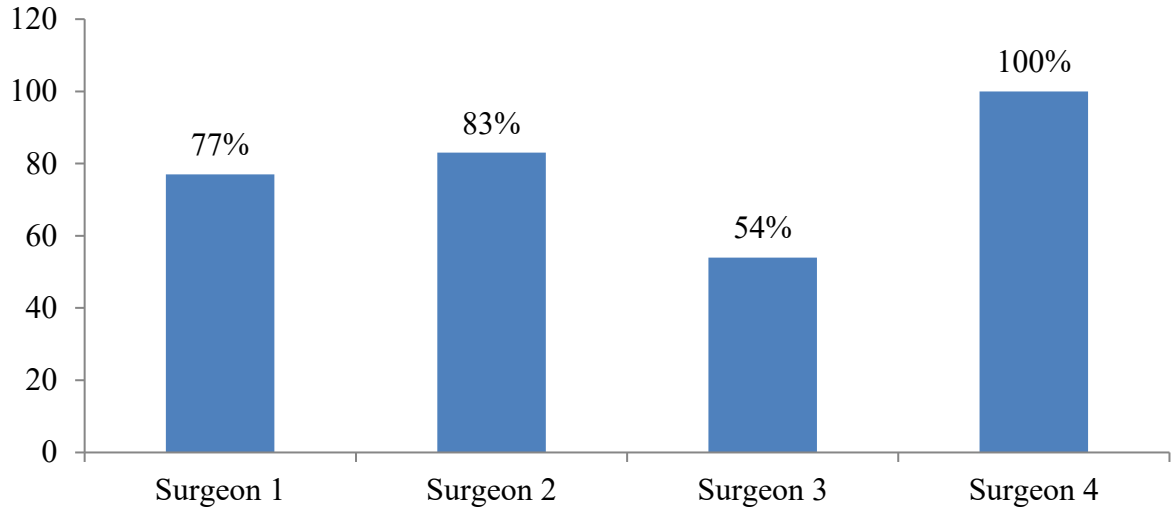

Figure 3. Surgeon's variability in successfully performing LPLC

Discussion

Establishing the pneumoperitoneum is an important element in laparoscopic surgery and is associated with various clinical problems, and likewise has led to modifications in the techniques as well.[2,7] In a study where the low-pressure and standard-pressure pneumoperitoneum were compared, the operation and anaesthesia duration were measured to be longer in low-pressure pneumoperitoneum laparoscopic surgery, explained by the harder exposure in the low-pressure pneumoperitoneum group.[8] However, with the experience of surgeons and the advanced techniques low pressure pneumoperitoneum is feasible and safe, and results in decreased postoperative pain and near-equal operation time compared to the standard pressure.[9–11] Also, a drop in the frequency of post-operative shoulder tip pain has been demonstrated.[12] There are even some indications that low-pressure pneumoperitoneum is associated with less liver and kidney injury as compared to the standard pressure pneumoperitoneum.[13] Additional studies claim that LPLC is safe in experienced hands and can be used routinely.[14]

Despite all these advantages demonstrated by various studies, in our part of the world, we still prefer standard pressure laparoscopic cholecystectomy.[15,16] In our study, the mean operation time was 93 minutes, and even though LPLC is beneficial in ASA III patients, we only enrolled ASA I and II patients for our study purposes.[5] Three experienced surgeons and one resident were part of the research, performing LPLC, and most of the cases were performed without major or substantial difficulty. None of the cases performed had any significant complications to date. Of the cases that were converted to standard pressure, 75%

had a BMI>30kg/$m^{2.}$ Even though there was a surgeon's variability in performing LPLC, it can be safely concluded that LPLC can be used routinely, even with surgeons who are still learning. Not many articles are published regarding the surgeon's perspective while undertaking an LPLC, so we don't have any study for comparison.

However, there were certain limitations. This is not a level I evidence study. Some surgeons were reluctant to perform LPLC, so those cases were excluded from the study, which decreased the total number of cases. More variables like fluctuation in heart rate and MAP, post-operative pain, analgesia consumption, and anesthetic complications could have been part of the study, but due to limited resources and time, they weren't included in the study. Thus, there is still more research that can be done with a larger number of cases, in more effective randomized controlled trials, and with the addition of more variables.

Conclusion

LPLC is feasible in our current settings and can be performed without major difficulty, even though there might be a surgeon's variability while performing LPLC. However, in patients with greater BMI, difficulty in visualization of Calot's triangle can be anticipated.

Conflict of interest: None

References

1. Litynski GS. Profiles in laparoscopy: Mouret, Dubois, and Perissat: the laparoscopic breakthrough in Europe (1987-1988). JSLS J Soc Laparoendosc Surg. 1999;3(2):163–7. PMID: 10444020
2. 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. Surg Endosc. 2002 Jul;16(7):1121–43.DOI: 10.1007/s00464-001-9166-7
3. Singla S, Mittal G, Raghav, Mittal RK. Pain management after laparoscopic cholecystectomy randomized prospective trial of low-pressure and standard pressure pneumoperitoneum. J Clin Diagn Res. 2014 Feb;8(2):92–4. DOI: 10.7860/JCDR/2014/7782.4017
4. Sarli L, Costi R, Sansebastiano G, Trivelli M, Roncoroni L. Prospective randomized trial of low-pressure pneumoperitoneum for reduction of shoulder-tip pain following laparoscopy. Br J Surg. 2000 Sep;87(9):1161–5. DOI:

10.1046/j.1365-2168.2000.01507.x

5. Ghosh BC, Gangopadhyay A. Prospective randomised trial of standard pressure versus low pressure laparoscopic cholecystectomy in a tertiary care hospital from Kolkata: Our experience. Asian J Med Sci [Internet]. 2018 Jul 2;9(4 SE-Original Articles):17–22. Available from: https://www.nepjol.info/index.php/AJMS/article/view/19780
6. Griffiths EA, Hodson J, Vohra RS, Marriott P, Katbeh T, Zino S, et al. Utilisation of an operative difficulty grading scale for laparoscopic cholecystectomy. Surg Endosc. 2019 Jan;33(1):110–21. DOI: 10.1007/s00464-018-6281-2
7. Gurusamy KS, Vaughan J, Davidson BR. Low pressure versus standard pressure pneumoperitoneum in laparoscopic cholecystectomy. Cochrane database Syst Rev. 2014 Mar;2014(3):CD006930. DOI: 10.1002/14651858.CD006930.pub3
8. Celik AS, Frat N, Celebi F, Guzey D, Kaplan R, Birol S, et al. Laparoscopic cholecystectomy and postoperative pain: is it affected by intra-abdominal pressure? Surg Laparosc Endosc Percutan Tech. 2010 Aug;20(4):220–2. DOI: 10.1097/SLE.0b013e3181e21bd1
9. 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 Jul;208(1):143–50. DOI: 10.1016/j.amjsurg.2013.09.027
10. Rashdan M, Daradkeh S, Al-Ghazawi M, Abuhmeidan JH, Mahafthah A, Odeh G, et al. Effect of low-pressure pneumoperitoneum on pain and inflammation in laparoscopic cholecystectomy: a randomized controlled clinical trial. BMC Res Notes [Internet]. 2023;16(1):235. Available from: https://doi.org/10.1186/s13104-023-06492-y
11. Sanjay T, Agarwal K, Rathod PA. Low-Pressure Versus Normal-Pressure Laparoscopic Cholecystectomy and its Effect on Intra-Operative Parameters and Post-Operative Pain: An Observational Study. Niger Med J. 2025;66(2):715–23. DOI: 10.71480/nmj.v66i2.768
12. Ali IS, Shah MF, Faraz A, Khan M. Effect of intra-abdominal pressure on post-laparoscopic cholecystectomy shoulder tip pain: A randomized control trial. J Pak

Med Assoc. 2016 Oct;66(Suppl 3)(10):S45–9. PMID: 27895352

13. Özdemir-van Brunschot DMD, van Laarhoven KCJHM, Scheffer GJ, Pouwels S, Wever KE, Warlé MC. What is the evidence for the use of low-pressure pneumoperitoneum? A systematic review. Surg Endosc. 2016 May;30(5):2049–65. DOI: 10.1007/s00464-015-4454-9
14. Nabi S, Nazima S, Bashir Y, Beigh A, Bashir N, Angmo D. Low-Pressure Pneumoperitoneum Versus Standard-Pressure Pneumoperitoneum in Laparoscopic Cholecystectomy: An Experience. Int J Adv Res. 2017;5(8):1771–8. DOI: 10.21474/IJAR01/5244
15. Tian F, Sun X, Yu Y, Zhang N, Hong T, Liang L, et al. Comparison of low-pressure and standard-pressure pneumoperitoneum laparoscopic cholecystectomy in patients with cardiopulmonary comorbidities: a double blinded randomized clinical trial. BMC Surg. 2024;24(1):348. https://doi.org/10.1186/s12893-024-02606-w
16. Ortenzi M, Montori G, Sartori A, Balla A, Botteri E, Piatto G, et al. Low-pressure versus standard-pressure pneumoperitoneum in laparoscopic cholecystectomy: a systematic review and meta-analysis of randomized controlled trials. Surg Endosc. 2022 Oct;36(10):7092–113.DOI: 10.1007/s00464-022-09201-1