World Journal of Laparoscopic Surgery

An Official Publication of the World Association of Laparoscopic Surgeons, UK

WJOLS

Also available online at
www.jaypeejournals.com
www.wjols.com

Access Online Resources

For more details, visit
www.wjols.com

Bibliographic Listings:
ProQuest, Scopus, Journals Factor,
EBSCO,Genamics JournalSeek, Emcare, HINARI, Embase,
J Gate, Google Scholar, Ulrich, CiteFactor, SIS,
OAJI, MIAR, SIF, COSMOS, ESJI, SJIF, SJR, IIJIF, ICI

JAYPEE Jaypee Journals

EDITORIAL

10.5005/wjols-16-3-iv

I am very happy to write the editorial of the *World Journal of Laparoscopic Surgery (WJOLS)*, Volume 16, Issue 3, which has many articles advancing laparoscopic surgery through technology and innovation.

The latest issue of the WJOLS presents a compelling collection of original articles and research studies, each underscoring the rapid advancements and innovative approaches in the field of laparoscopic surgery. This editorial aims to highlight the key themes and breakthroughs presented in these articles, emphasizing their significance in enhancing surgical outcomes and patient care.

Integrating Artificial Intelligence (AI) in Surgical Ergonomics: The study by Prem Kumar A et al. on the adaptation of computer vision and AI for assessing postural ergonomics in laparoscopic surgery marks a significant leap. This integration of technology promises to revolutionize surgical practices by ensuring better ergonomics, potentially reducing surgeon fatigue, and enhancing precision.

Predictive Analytics in Surgery: The work by Jyotirmaya Nayak and colleagues on predicting the difficulty of laparoscopic cholecystectomy using clinical and sonological data exemplifies the growing role of predictive analytics in surgery. Such approaches can lead to more informed surgical planning and patient counseling, ultimately improving surgical outcomes.

Validating Risk Assessment Models: The External Validation of a Preoperative Predictive Risk Scoring System for Laparoscopic Cholecystectomy, as researched by Mohd Riyaz Lattoo and his team, especially in a rural hospital setting, is crucial. It underscores the importance of context-specific validation of risk models, ensuring their applicability across diverse healthcare settings.

Innovations in Procedure and Technique: The article covering a range of procedures, from the laparoscopic insertion of CAPD catheters for end-stage renal disease to flank-free modified supine percutaneous nephrolithotomy, reflect the ongoing innovations in surgical techniques. These advancements not only enhance the scope of minimally invasive surgery but also promise better patient recovery and outcomes.

Exploring New Surgical Frontiers: The Paradigm Shift in the Management of Benign Pelvic Neurogenic Tumors and the Study on Omental Wrapping to Reduce Postoperative Pain after Laparoscopic Appendectomy highlights the exploration of new frontiers in laparoscopic surgery. These innovative approaches could redefine standard surgical practices.

Evidence-based Practices: The Comparative Studies on Laparoscopic vs Open Surgery for Colorectal Cancers, and the Investigation into Single-dose Preoperative Antibiotic Prophylaxis, provide evidence-based insights that are crucial for evolving and refining surgical protocols.

Cost-utility and Perioperative Outcomes: The Focus on Cost-utility, as Seen in the Study of Mesh Fixation vs Nonfixation in Hernioplasty, aligns with the growing need for cost-effective healthcare solutions without compromising patient care quality.

Future Directions and Challenges: The research article by Subbiah Shanmugam and Aravind Shivakumar on analyzing washings during laparoscopic surgeries for improved lymph node yield, and the minimally invasive approach for a large broad ligament fibroid detailed by Kavita Khoiwal, point towards future directions and challenges in laparoscopic surgery.

In conclusion, this collection of the WJOLS articles not only showcases the remarkable strides made in laparoscopic surgery but also sets the stage for future innovations and improvements. It reflects a multidimensional approach, integrating technology, refining techniques, and ensuring evidence-based practice, all aimed at enhancing patient care and surgical efficacy in the ever-evolving world of medicine.

I trust that you will find the articles in this issue both informative and engaging. Your feedback is highly valued and appreciated.

RK Mishra
Editor-in-Chief, WJOLS
Chairman
World Laparoscopy Hospital
Gurugram, Haryana, India

ORIGINAL ARTICLE

An Adaptation of Computer Vision of Artificial Intelligence for the Assessment of Postural Ergonomics in Laparoscopic Surgery

Prem Kumar A[1], Sindhu S[2], Mallikarjuna Manangi[3], Santhosh Shivashankar Chikkanayakanahalli[4], Sunil Kumar Venkatappa[5], Madhuri G Naik[6], Nischal Shivaprakash[7]

Received on: 15 June 2023; *Accepted on:* 12 July 2023; *Published on:* 11 January 2024

Abstract

Introduction: There is an increase in the prevalence of work-related musculoskeletal diseases among laparoscopic surgeons. Hence the assessment of ergonomics becomes important in identifying and preventing them. The use of artificial intelligence (AI) and computer vision in the assessment of ergonomics is easier and more accurate than conventional methods. Its adaptation into laparoscopic ergonomics is limited.

Methodology: This was a prospective observational study conducted at Victoria Hospital. Laparoscopic surgeons were observed while performing various laparoscopic surgeries. Postures held for more than 30s and repetitive movements were photographed and imported onto an AI posture evaluation software. The software detected various facial and neck landmarks and then calculated parameters such as the craniohorizontal angle (CHA), craniovertebral angle (CVA), straight sagittal posture (SSP), upper head posture (UHP), lower head posture (LHP), and vertical posture (VP). The reports obtained from the software from various postures across multiple surgeries were tabulated. Data analysis was done using SPSS 23 software and reported using descriptive statistics.

Results: The mean CHA, CVA, and SSP were 22.19 ± 7.02, 44.70 ± 18.90, and 58.90 ± 15.24, respectively. The corresponding medians were 21.75 (25.20–16.75), 44.00 (49.10–35.70), and 56.65 (68.55–44.92), respectively.

The mean UHP, LHP, and VP were 8.36 ± 5.71, 9.13 ± 8.24, and 14.80 ± 12.64, respectively. The corresponding medians were 7 (11.52–3.60), 6.25 (14.12–3.07), and 11.5 (17.25–7.12), respectively. Rounded shoulder posture (RSP) was present in 53.33% scenarios, and forward head posture (FHP) was present in 93.3% scenarios.

Conclusion: The technology of AI makes the assessment of ergonomics much easier and more accurate. Further developments in the software are needed for real-time assessment of postural ergonomics. The development of customized software catering to the specific needs of laparoscopic ergonomics would be ideal.

Clinical significance: Artificial intelligence can open up new horizons for the assessment of ergonomics, making the assessment much easier, quicker, and more accurate than the existing methods.

Keywords: Artificial intelligence, Computer vision, Postural ergonomics, Work-related musculoskeletal disorders.

World Journal of Laparoscopic Surgery (2023): 10.5005/jp-journals-10033-1561

Introduction

The Federation of European Ergonomics Societies defines ergonomics (or human factors) as the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and methods to design in order to optimize human well-being and overall system performance. Human anatomical, anthropometric, physiological, and biomechanical characteristics all together comprise physical ergonomics. This includes working postures, material handling, repetitive movements, work-related musculoskeletal disorders, workplace layout, safety, and health.[1]

The concept of postural ergonomics evolved as a topic of interest in laparoscopic surgery with the increase in the prevalence of work-related musculoskeletal disorders among laparoscopic surgeons, which has been reported to be as high as 74%.[2] The physical complaints reported by the surgeons as a result of improper ergonomics have varied from generalized pain, pain in the upper back, lower back, neck, shoulder, and lower extremities, and fatigue to eyestrain, carpal tunnel syndrome, and cervical spondylosis.[3–5] The assessment of postural ergonomics thus assumes importance in the recognition and subsequent correction of the awkward/prolonged postures held by the surgeons.

The existing methods to assess postural ergonomics are many and vary from real-time assessment by placing inertial sensors on the body of the surgeon and subsequent kinematic analysis[6,7] to analysis using scores such as rapid upper limb analysis[8] or rapid entire body analysis.[9] These have the disadvantages of being

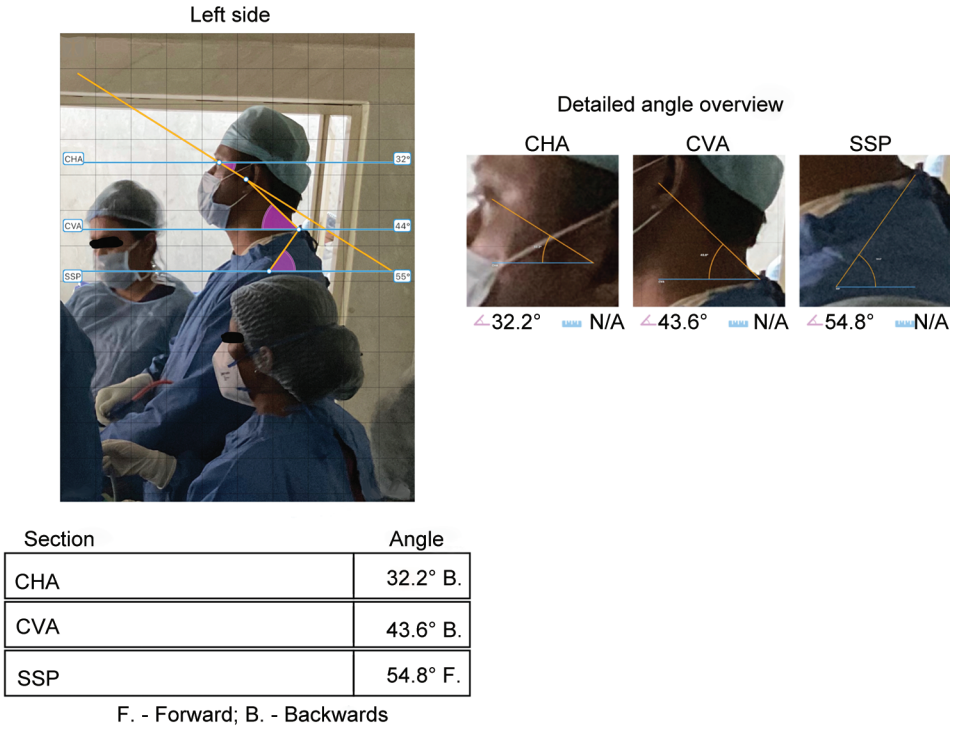
[1–7]Department of General Surgery, Bangalore Medical College & Research Institute, Bengaluru, Karnataka, India

Corresponding Author: Sindhu S, Department of General Surgery, Bangalore Medical College & Research Institute, Bengaluru, Karnataka, India, Phone +91 9844184300, e-mail: mail.drsindhu@gmail.com

How to cite this article: Prem Kumar A, Sindhu S, Manangi M, *et al*. An Adaptation of Computer Vision of Artificial Intelligence for the Assessment of Postural Ergonomics in Laparoscopic Surgery. World J Lap Surg 2023;16(3):119–124.

Source of support: Nil

Conflict of interest: None



Section	Angle
CHA	32.2° B.
CVA	43.6° B.
SSP	54.8° F.

F. - Forward; B. - Backwards

Fig. 1: Calculation of CHA, CVA, and SSP from left view

cumbersome, time consuming, and often require the presence of an expert for the analysis.[10]

The advent of artificial intelligence (AI) has opened a new horizon for the assessment of ergonomics. Machine learning is a branch of AI where training data and/or past experiences are used to create algorithms to successfully execute a performance.[11] Computer vision is a subset of machine learning which aids computers in seeing and making inferences from observed picture data.[12]

The use of AI and computer vision for the assessment of ergonomics is a relatively recent development. This would be a much easier, less time consuming, and more accurate approach to assess ergonomics as opposed to traditional methods.[13,14] However, studies on the use of this technology in the field of laparoscopic ergonomics are limited. This study is an attempt to use the technology of AI and computer vision to assess the postural ergonomics of laparoscopic surgeons.

Objectives

Using AI to assess postural ergonomics among laparoscopic surgeons.

Methodology

This was a prospective observational study conducted at Victoria Hospital in Bengaluru between November 2022 and January 2023. After obtaining prior consent, laparoscopic surgeons were observed while performing various laparoscopic surgeries. A total of 30 laparoscopic surgeries were included in the study. This study analyzed postures held for more than 30s and repetitive movements. These were photographed from the side and front views using a tablet. These photos were then imported onto an AI posture evaluation software app and analysis of the head and neck postures was done. From the front view, the app detected landmarks like outer angles of both eyes, glabella, tip of nose, subnasale, lip junction, and angles of the mouth and mentum. From the side view, it detected landmarks like the outer canthus of the eye, tragus, C7 vertebra, and the acromion process.

Using these landmarks, the app calculates various parameters such as craniohorizontal angle (CHA), craniovertebral angle (CVA), straight sagittal posture (SSP), upper head posture (UHP), lower head posture (LHP), and vertical posture (VP). The app then generates a report containing the analysis based on the angles measured. The reports obtained from the app from various postures across multiple surgeries were tabulated. Data analysis was done using SPSS 23 software and reported using descriptive statistics.

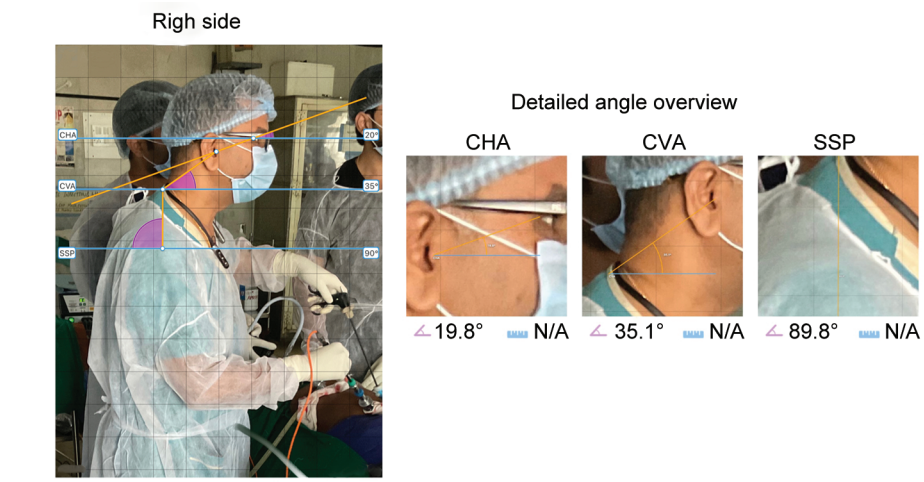
Results

The postures of surgeons while performing 30 surgeries were analyzed, and results were tabulated. Of the surgeries performed, four (13.33%) were laparoscopic appendectomy, nine (30%) were laparoscopic cholecystectomy, eight (26.66%) were intra peritoneal only mesh repair (IPOM), five (16.66%) were diagnostic laparoscopy, one (3.33%) was totally extraperitoneal repair (TEP), and three (10%) were other surgeries such as laparoscopic varicocelectomy, laparoscopic Nissen's fundoplication, and laparoscopic diaphragmatic hernia repair.

Using the above-mentioned landmarks, CHA, CVA, SSP, UHP, LHP, and VP were calculated by the app as shown in Figures 1 to 3.

The mean CHA was 22.19 ± 7.02, with a median of 21.75 (25.20–16.75). The mean CVA was 44.70 ± 18.90, with a median of 44.00 (49.10–35.70). The mean SSP was 58.90 ± 15.24, with a median of 56.65 (68.55–44.92).

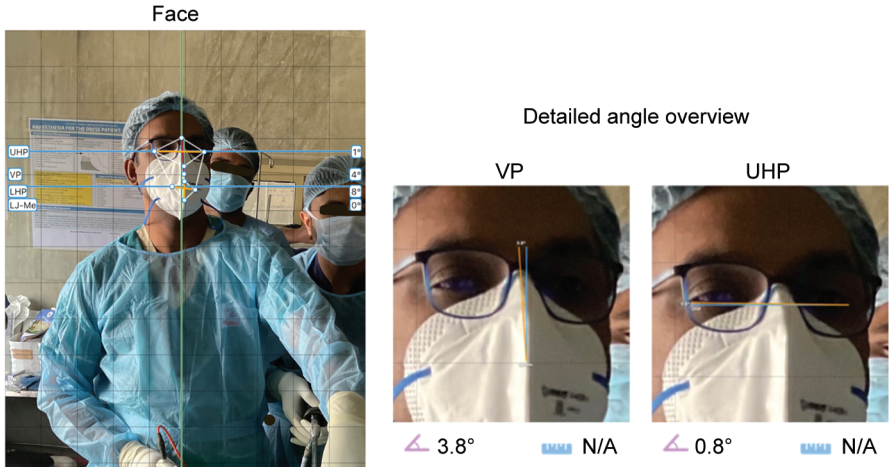
The mean UHP was 8.36 ± 5.71, with a median of 7 (11.52–3.60). The mean LHP was 9.13 ± 8.24, with a median of 6.25 (14.12–3.07). The mean VP was 14.80 ± 12.64, with a median of 11.5 (17.25–7.12)



Section	Angle
CHA	19.8° B.
CVA	35.1° F.
SSP	89.8° F.

F. - Forward; B. - Backwards

Fig. 2: Calculation of CHA, CVA, and SSP from right side



Section	Angle
VP	3.8° L.
UHP	0.8° L.
LHP	8.1° L.
Chin is tilted	0.0° L.

R. - to the right; L. - o the left

Fig. 3: Calculation of UHP, LHP, and VP from front view

(Table 1). The surgeons in all the scenarios showed face tilt towards the right.

Among the 30 scenarios, 16 (53.33%) showed rounded/protracted shoulder posture.

Forward head posture (FHP) was present in 28 (93.3%) scenarios, healthy head posture was present in 1 (3.33%) scenario. Forward head and rounded shoulder posture (RSP) was present in 5 (16.66%) scenarios (Table 2).

Table 1: Mean and median of the parameters measured

Parameter measured	*Mean ± SD*	*Median (IQR)*
CHA	22.19 ± 7.02	21.75 (25.20–16.75)
CVA	44.70 ± 18.90	44.00 (49.10–35.70)
SSP	58.90 ± 15.24	56.65 (68.55–44.92)
UHP	8.36 ± 5.71	7 (11.52–3.60)
LHP	9.13 ± 8.24	6.25 (14.12–3.07)
VP	14.80 ± 12.64	11.5 (17.25–7.12)

IQR, interquartile range

Table 2: Positions of head or shoulder

Position of head or shoulder	*Number (%)*
Rounded shoulder posture or protracted shoulder posture	16 (53.33)
Forward head posture	28 (93.3)
Healthy head posture	1 (3.3)
Forward head with rounded shoulder posture	5 (16.6)

Discussion

Artificial intelligence is concerned with the design and implementation of computer systems capable of solving problems that usually require the ability of human beings. Such problems are of a high complexity and/or involve natural tasks (e.g., vision or natural language understanding), which classical algorithmic methods cannot usually solve. For solving them, AI programs mainly manipulate symbolic information and not just numerical data, as usual in computer science.[15]

Computer vision is a branch of AI that combines concepts, techniques, and ideas from digital image processing, pattern recognition, AI, and computer graphics.[16] It works on the principle of recognition. Recognition is defined by the trial to determine whether or not an input data contains or resembles some specific object, feature, or activity. In computer vision, action recognition refers to being able to detect a particular component from a video or image scenes.[17]

Of particular interest to this study is the branch of face recognition. Facial landmarks, like the corners of the eye, corners of the mouth, tip of the nose, chin, and cheek are located topographically.[18] Separate rectangular search regions are established for the mouth and the eyes. Then appropriate algorithms are used for the extraction of the borders.[19]

Applications of computer vision are varied and range from automatic classification of blood cells in medical images to control of an unnamed lunar rover, from surveillance of parks, streets, and venues to sports video analysis.[20,21] The use of this technology for the assessment of postural ergonomics is a relatively recent development. Although face recognition can detect the landmarks relevant for ergonomics (using which appropriate angles can be measured and deviations from normal can be accurately detected), its use for assessing the same in laparoscopic surgeons has been minimal.

The AI posture evaluation software app we used for the study imports pictures taken during the surgery from front and side views and detects landmarks as described before.

With these landmarks, the software calculates the following angles:

- Craniohorizontal angle: The angle between the intersection of a horizontal line that passes through the tragus of the ear and a line joining the tragus of the ear and the external canthus of the eye.[22] It gives an estimate of the head on neck angle or the position of the upper cervical spine.[23] A higher value indicates FHP.[24]
- Craniovertebral angle: The angle between the intersection of a horizontal line through the spinous process of C7 and a line to the tragus of the ear. It provides an estimation of the position of the neck on the upper trunk. A smaller angle indicates a more FHP.[25]
- Sagittal straight posture: The angle formed by the intersection of a horizontal line that passes through C7 and a line that connects the midpoint of the greater tuberosity of the humerus and the posterior aspect of the acromion. It assesses the shoulder position. A smaller angle means that the shoulder lies anteriorly in relation to C7, in other words, rounded shoulder.[22]
- Vertical posture: Angle between vertical and the line joining glabella to subnasal point.
- Upper head posture: Angle between horizontal and line joining outer canthi of both eyes.
- Lower head posture: Angle between horizontal and line joining angles of the mouth.

The VP, UHP, and LHP assess the tilt of the face.

Forward head posture is seen when the head and upper cervical vertebra extend and the lower cervical vertebra flex.[26] It is known to cause shoulder and neck pain.[27,28] Rounded shoulder posture or protracted shoulder posture or forward shoulder posture occurs when the acromion processes are placed more anteriorly as compared with the mastoid processes. It means that the shoulders are bent forward, caused by elevation of the scapulae and protraction of the acromion. This causes pain in the head, shoulders, and arms.[29–31] It is associated with a risk of increased muscle load, degenerative disc disease, back pain, and chronic shoulder pathologies.[32,33]

In our study, we found the mean CHA to be 22.19 ± 7.02. The mean CVA was 44.7 ± 18.9. The mean SSP was 58.9 ± 15.24. This is suggestive of a FHP with a RSP. The mean UHP was 8.36 ± 5.71. The mean LHP was 9.13 ± 8.24. The mean VP was 14.8 ± 12.64. This is suggestive of a face tilt toward the right.

Among the 30 scenarios, 16 (53.33%) showed rounded/protracted shoulder posture.

Forward head posture was present in 28 (93.3%) scenarios, healthy head posture was present in 1 (3.33%) scenario. Forward head and RSP was present in 5 (16.66%) scenarios.

The severe consequences of musculoskeletal pain occurring as a result of poor ergonomics make it imperative to study and assess postural ergonomics in the field of laparoscopic surgery. Over 50% surgeons have reported that musculoskeletal pain negatively impacts their performance during surgery.[34,35] In contrast to the other fields, laparoscopic surgeons assume an upright posture with a straight back and have fewer trunk movements and weight shifting.[36,37] They perform repetitive movements like looking back and forth from the monitor to the surgical site, and repeated insertion and removal of long laparoscopic instruments. These increase the risk of overuse injuries.[38] Foot pedals are also a source of discomfort for the surgeons.[39] This is because they are often not placed in the direct visual field of the surgeon, and hence the surgeons maintain dorsiflexion of the foot over the pedal to avoid losing contact. This causes an imbalance in the weight distribution across both the legs.[10,40]

Thus, an ideal assessment of the postural ergonomics during laparoscopic surgery would be to assess in real time the whole body (from head to toe) of the surgeon from front, side, and back views, giving importance to the awkward postures held, the duration of time for which each posture is held and the repetitive movements performed.

The real-time ergonomic risk assessment methods in use at present involve the placement of sensors over various landmarks over the surgeons and measuring the movement data.[6,10] However, these methods are difficult to implement due to issues related to sterility, cooperation, and acceptance from surgeons.[10] These issues are alleviated by the use of the technology of AI and computer vision, which has multiple advantages like not requiring the subjects to wear special sensors or special clothing with markers and needing very less and basic equipments.[14] The software used in this study does the ergonomic analysis by using photos of surgeons captured during surgery. There is scope to further develop this into a real-time analysis done during the performance of surgery.

The limitations of the study include inability to capture the entire length of the surgeon from the front while performing the surgery, hence making an assessment of the posture of the whole body difficult. The images captured represent only either the repetitive movements or the postures held for more than 30s, and a comprehensive assessment of the surgeon during the whole procedure, as would occur with a real-time analysis was not possible. Also, the presence of a surgical mask during the procedure makes detection of the facial landmarks difficult.

Conclusion

The technology of AI and computer vision can revolutionize the assessment of postural ergonomics in laparoscopic surgery, making the assessment much easier, quicker, and more accurate. Studies need to be conducted on a larger scale for better validation of results. Further developments in the software need to be made for real-time assessment of postural ergonomics and to provide immediate red alerts for posture correction. Development of a customized software catering to the specific needs of laparoscopic ergonomics, taking into consideration the above-mentioned limitations would be ideal.

Clinical Significance

Artificial intelligence can open up new horizons for the assessment of ergonomics, making the assessment much easier, quicker, and more accurate than the existing methods. We believe that this study can also open up scopes for the development of software for the real-time assessment of ergonomics during the performance of laparoscopic surgery, as well as the development of a customized software for the assessment of laparoscopic ergonomics in particular.

Orcid

Prem Kumar A https://orcid.org/0000-0001-9126-1115
Sindhu S https://orcid.org/0009-0003-4416-5659
Mallikarjuna Manangi https://orcid.org/0000-0002-1509-8501
Santhosh Shivashankar Chikkanayakanahalli https://orcid.org/0000-0003-4656-9465
Sunil Kumar Venkatappa https://orcid.org/0000-0002-8991-2756

References

1. Definition and domains of ergonomics. In: What is Ergonomics? International Ergonomics Association; 2017. http://www.iea.cc/whats/. Accessed 4/11/2017.
2. Alleblas CCJ, de Man AM, van den Haak L, et al. Prevalence of musculoskeletal disorders among surgeons performing minimally invasive surgery: A systematic review. Ann Surg 2017;266(6):905–920. DOI: 10.1097/SLA.0000000000002223.
3. Stucky CH, Cromwell KD, Voss RK, et al. Surgeon symptoms, strain, and selections: Systematic review and meta-analysis of surgical ergonomics. Ann Med Surg (Lond) 2018;27:1–8. DOI: 10.1016/j.amsu.2017.12.013. PMID: 29511535; PMCID: PMC5832650.
4. Hemal AK, Srinivas M, Charles AR. Ergonomic problems associated with laparoscopy. J Endourol 2001;15:499–503. DOI: 10.1089/089277901750299294.
5. Gutierrez-Diez MC, Benito-Gonzalez MA, Sancibrian R, et al. A study of the prevalence of musculoskeletal disorders in surgeons performing minimally invasive surgery. Int J Occup Saf Ergon 2018;24(1):111–117. DOI: 10.1080/10803548.2017.1337682.
6. Sánchez-Margallo FM, Sánchez-Margallo JA. Ergonomics in Laparoscopic Surgery [Internet]. Laparoscopic Surgery. InTech; 2017. DOI: 10.5772/66170.
7. Gómez-Galán M, Pérez-Alonso J, Callejon-Ferre AJ, et al. Musculoskeletal disorders: OWAS review. Ind Health 2017;55(4):314–337. DOI: 10.2486/indhealth.2016-0191.
8. McAtamney L, Nigel Corlett E. RULA: A survey method for the investigation of work-related upper limb disorders. Appl Ergon 1993;24(2):91–99. DOI: 10.1016/0003-6870(93)90080-s. PMID: 15676903.
9. Hignett S, McAtamney L. Rapid entire body assessment (REBA). Appl Ergon 2000;31(2):201–205. DOI: 10.1016/s0003-6870(99)00039-3. PMID: 10711982.
10. Dabholkar T, Dabholkar YG, Yardi S, et al. An objective ergonomic risk assessment of surgeons in real time while performing endoscopic sinus surgery. Indian J Otolaryngol Head Neck Surg 2020;72(3):342–349. DOI: 10.1007/s12070-020-01840-x.
11. Alpaydin E. Introduction to Machine Learning, 4th edition. London, England: The MIT Press; 2020.
12. Karn A. Artificial intelligence in computer vision. Int J Eng Appl Sci Technol 2021;6(1):249–254. DOI: 10.33564/IJEAST.2021.v06i01.037.
13. Fernández MM, Álvaro Fernández J, Bajo JM, et al. Ergonomic risk assessment based on computer vision and machine learning. Comput Ind Eng 2020;149:106816; ISSN: 0360-8352; DOI: 10.1016/j.cie.2020.106816.
14. Fan C, Mei Q, Yang Q, et al. Computer vision based rapid entire body analysis (REBA) estimation. J Ind Constr. In Proceedings MOC Summit: Edmonton, Alberta, Canada; 2022. pp. 90–97.
15. Haton JP. A brief introduction to artificial intelligence. IFAC Proc Vol 2006;39(4):8–16. ISSN: 1474-6670; ISBN: 9783902661050. DOI: 10.3182/20060522-3-FR-2904.00003.
16. Oscar C, Iglesias A, Galvez A, et al. Hybridization of convergent photogrammetry, computer vision, and artificial intelligence for digital documentation of cultural heritage – A case study: The Magdalena Palace. In 2014 International Conference on Cyberworlds (CW). IEEE; 2014. pp. 369–376. DOI: 10.1109/CW.2014.58.
17. Lui YM, Beveridge JR. Tangent bundle for human action recognition, 2011 IEEE International Conference on Automatic Face & Gesture Recognition (FG), Santa Barbara, CA, USA, 2011, pp. 97–102. DOI: 10.1109/FG.2011.5771378.
18. Li SZ, Jain AK. Handbook of Face Recognition, 2nd edition. New York: Springer; 2011.
19. Hess M, Martinez G. Facial feature extraction based on the smallest univalue segment assimilating nucleus (Susan) algorithm. In: Proceedings of Picture Coding Symposium, Vol. 1. Los Alamitos: IEEE Computer Society Press; 2004. pp. 261–266.
20. Nagabhushana S. Computer Vision and Image Processing. New Delhi: New Age International (P) Ltd; 2005.

21. Ahad MAR. Computer Vision and Action Recognition: A Guide for Image Processing and Computer Vision Community for Action Understanding. France: Atlantis Press; 2011.
22. Raine S, Twomey L. Posture of the head, shoulder and thoracic spine in comfortable erect standing. Aus Physiother 1994;40:25–32.
23. Mosaad D, Abdel-Aziem A. Postural balance and neck angle changes in school children while carrying a traditional backpack versus a double-sided bag. Biomed Hum Kinet 2018;10(1):59–66. DOI: 10.1515/bhk-2018-0010.
24. Ramprasad M, Alias J, Raghuveer AK. Effect of backpack weight on postural angles in preadolescent children. Indian Pediatr 2010;47(7):575–580.
25. Rugel JD, Sevek F. The influence of load placement on postural sway parameters. 13th International Conference on Biomedical Engineering. Vol. 23 of the Series IFMBE Proceedings, December 3–6, 2008, Singapore; pp. 1821–1824.
26. Yoo WG, Kim MH. Effect of different seat support characteristics on the neck and trunk muscles and forward head posture of visual display terminal workers. Work 2010;36(1):3–8.
27. Chiu TT, Lam TH, Hedley AJ. Correlation among physical impairments, pain, disability, and patient satisfaction in patients with chronic neck pain. Arch Phys Med Rehabil 2005;86(3):534–540. DOI: 10.1016/j.apmr.2004.02.030.
28. Cote P, Hogg-Johnson S, Cassidy JD, et al. The association between neck pain intensity, physical functioning, depressive symptomatology and time-to-claim-closure after whiplash. J Clin Epidemiol 2001;54(3):275–286. DOI: 10.1016/S0895-4356(00)00319-X.
29. Lukasiewicz AC, McClure P, Michener L, et al. Comparison of 3-dimensional scapular position and orientation between subjects with and without shoulder impingement. J Orthop Sports Phys Ther 1999;29(10):574–586. DOI: 10.2519/jospt.1999.29.10.574.
30. Raine S, Twomey LT. Head and shoulder posture variations in 160 asymptomatic women and men. Arch Phys Med Rehabil 1997;78(11):1215–1223.
31. Michener LA, McClure PW, Karduna AR. Anatomical and biomechanical mechanisms of subacromial impingement syndrome. Clin Biomech (Bristol, Avon) 2003;18(5):369–379.
32. Wong CK, Coleman D, diPersia V, et al. The effects of manual treatment on rounded-shoulder posture, and associated muscle strength. J Bodyw Mov Ther 2010;14(4):326–33. DOI: 10.1016/j.jbmt.2009.05.001.
33. Yoo WG. Comparison of shoulder muscles activation for shoulder abduction between forward shoulder posture and asymptomatic persons. J Phys Ther Sci 2013;25(7):815–816. DOI: 10.1589/jpts.25.815.
34. Esposito C, Najmaldin A, Schier F, et al. Work-related upper limb musculoskeletal disorders in pediatric minimally invasive surgery: A multicentric survey comparing laparoscopic and sils ergonomy. Pediatr Surg Int 2014;30(4):395–399. DOI: 10.1007/s00383-013-3437-y.
35. Filisetti C, Cho A, Riccipetitoni G, et al. Analysis of hand size and ergonomics of instruments in pediatric minimally invasive surgery. Surg Laparosc Endosc Percutan Tech 2015;25(5):e159–e162. DOI: 10.1097/SLE.0000000000000125.
36. Berguer R, Rab GT, Abu-Ghaida H, et al. A comparison of surgeons' posture during laparoscopic and open surgical procedures. Surg Endosc 1997;11(2):139–142.
37. Szeto GP, Cheng SW, Poon JT, et al. Surgeons' static posture and movement repetitions in open and laparoscopic surgery. J Surg Res 2012;172(1):e19–e31. DOI: 10.1016/j.jss.2011.08.004.
38. Reyes DA, Tang B, Cuschieri A. Minimal access surgery (MAS)-related surgeon morbidity syndromes. Surg Endosc 2006;20(1):1–13. DOI: 10.1007/s00464-005-0315-2.
39. Wauben LS, van Veelen MA, Gossot D, et al. Application of ergonomic guidelines during minimally invasive surgery: A questionnaire survey of 284 surgeons. Surg Endosc 2006;20(8):1268–1274. DOI: 10.1007/s00464-005-0647-y.
40. Kranenburg G. Ergonomic problems encountered during video-assisted thoracic surgery. Minim Invasive Ther Allied Technol 2004;13(3):147–155. DOI: 10.1080/13645700410033661.

ORIGINAL ARTICLE

Prediction of Encountering a Difficult Laparoscopic Cholecystectomy Using Clinical and Sonological Data

Jyotirmaya Nayak[1], Parikshita Dalai[2], Sujit Kumar Mohanty[3], Anil Kumar Behera[4], Ipsita Sahoo[5]

Received on: 26 March 2023; *Accepted on:* 15 June 2023; *Published on:* 11 January 2024

Abstract

Introduction: Laparoscopic cholecystectomy is the GOLD STANDARD in the treatment of symptomatic cholelithiasis which has replaced the open cholecystectomy as a treatment option since Philip Mouret did the first lap cholecystectomy in the year 1987. Despite its feasibility and acceptability in some cases it becomes quite difficult to proceed laparoscopically and is converted to open cholecystectomy which is associated with increased risk of morbidity. If we can identify the preoperative factors associated with increased risk of conversion then one can optimize operative room efficiency and improve intraoperative planning to avoid surgery-related complications.

Aim of the study: To identify factors that can predict difficult laparoscopic cholecystectomy using clinical and radiological parameters which can be assessed by the Randhwa and Pujahari scoring system.

Materials and methods: This was a prospective observational study conducted from July 2021 to October 2022 at the Department of General Surgery, SCB Medical College, Cuttack. Total of 150 USG-diagnosed symptomatic cholelithiasis patients were included in the study. Total 9 parameters were taken into consideration to assess the preoperative difficulty. These parameters were: (1) Age (2) Sex (3) Previous history of hospitalization for acute cholecystitis (4) BMI (5) Abdominal scar (6) Palpable gall bladder (7) Gall bladder wall thickness (8) Pericholecystic collection (9) Impaction of stone. The statistical analysis was done by Chi-square test.

Results: Out of 150 patients included in this study 90 (60%) were easy, 50 (33.3%) were difficult and 10 (6.66%) were very difficult which required conversion to open. The overall conversion rate was 6.66% which was within the acceptable conversion range, i.e. 1–13%.

Keywords: Calot's triangle, Cholecystectomy, Conversion, Difficult cholecystectomy.

World Journal of Laparoscopic Surgery (2023): 10.5005/jp-journals-10033-1582

Introduction

Laparoscopic cholecystectomy is the GOLD STANDARD treatment of Cholelithiasis which is one of the most common ailments affecting the hepatobiliary system. In the United States about twenty million people have gallstones and one million new cases are detected per year. In India, prevalence of gallstone disease is about 4%.[1] In the modern laparoscopic era there is better visualization of the biliary system and the rate of severe biliary injury is less than that of open cholecystectomy. However, in some cases, conversion from laparoscopic to an open technique may be required for various reasons. Thus, for surgeons, it would be helpful to establish criteria that would assess the risk of conversion preoperatively. Multiple factors like age, sex, previous h/o hospitalization for acute cholecystitis, BMI, abdominal scar d/t previous abdominal surgeries, palpable gall bladder, gall bladder wall thickness, and stone impaction, or external factors like equipment failure during surgery influence the level of difficulty.[2–6]

In the literature, there are multiple scales to predict a difficult laparoscopic cholecystectomy but the majority of these emphasize conversion rates or operative times which largely depend upon the expertise of the surgeons.[7,8]

However, out of all laparoscopic cholecystectomies, 1–13% require an open conversion for various reasons; that is why it would be helpful for surgeons to establish a preoperative criterion that would predict the risk of conversion preoperatively.[9] Just by predicting the degree of difficulty, we can choose the surgeons, and attendants of the patient can be counseled better after all the surgical team will be ready for the worst possible situation.[10]

[1–5]Department of Surgery, SCB Medical College & Hospital, Cuttack, Odisha, India

Corresponding Author: Jyotirmaya Nayak, Department of Surgery, SCB Medical College & Hospital, Cuttack, Odisha, India, Phone: +91 9438037714, e-mail: drjmnayak@gmail.com

How to cite this article: Nayak J, Dalai P, Mohanty SK, *et al*. Prediction of Encountering a Difficult Laparoscopic Cholecystectomy Using Clinical and Sonological Data. World J Lap Surg 2023;16(3):125–128.

Source of support: Nil

Conflict of interest: None

Aim of the Study

To identify the factors that can predict difficult laparoscopic cholecystectomy using clinical and radiological data which can be assessed using the Randhwa and Pujahari scoring system.

Materials and Methods

All patients with USG-proven symptomatic gallstone disease were included in this prospective observational trial. All patients with obstructive jaundice, cholangitis, elevated ALP, common bile duct stones, gall bladder empyema, acalculous cholecystitis, or

Table 1: Randhawa and Pujahari scoring method

History		*Max score*	
Age	<50 (0)	>50 (1)	1
Sex	Female (0)	Male (1)	1
H/O Hospitalization	No (0)	Yes (4)	1
Clinical			
BMI	<25	>25–27.5 (1) >27.5 (2)	2
Palpable GB	No (0)	Yes (1)	1
Abdominal scar	No (0)	Infraumbilical (1)	2
		Supraumbilical (2)	
Sonography			
Wall thickness	Thin (0)	Thick >4 mm (2)	2
Impacted stones	No (0)	Yes (1)	1
Pericholecystic collection	No (0)	Yes (1)	1

Table 2: Easy vs difficult criteria for cholecystectomy

Factors	*Easy*	*Difficult*	*Very difficult*
Time taken (Minutes)	<60 min	60–120 minutes	>120 minutes
Bile/Stone spillage	No	Yes	Yes
Injury to duct or artery	No	Duct only	Both
Conversion to open	No	No	Yes

who were deemed unsuitable for surgery were excluded from the research. Between July 2021 and October 2022, the Department of Surgery at SCB Medical College, Cuttack, assessed 150 patients with confirmed gallstones in the United States. Preoperatively, patients' information such as history (age, gender, time since hospitalization due to previous acute cholecystitis attack), clinical examination (BMI, palpable gall bladder, abdominal scar from previous surgery), and USG findings (gall bladder wall thickness, impacted stones, pericholecystic collection) were gathered. Each patient was assigned a preoperative score based on the Randhwa and Pujahari rating method (Table 1).

A score of 5 was considered easy, a score of 6–10 was considered challenging, and a score of 11–15 was considered very difficult. We categorize the patients as likely easy, challenging, or extremely difficult cases before surgery (Table 2). A skilled laparoscopic surgeon used the traditional four-port approach to execute the surgery. The time span was measured from the initial port site incision to the final port's closure. All intraoperative occurrences were documented, and all patients got normal postoperative care.

Statistical Method

The statistical software namely SPSS 22 was used for the analysis of the data and Microsoft Word and Excel were used to generate graphs, and tables etc. The Chi-square test/Fisher exact test has been used to find out the significant association between preoperative score and postoperative outcome.

Results

We included 150 patients in our trial, with 92 (61.33%) being female and 58 (38.6%) being male. The patients' ages ranged from 20 to 70 years. The majority of patients (88.6%) were between the ages of 20 and 50. Out of 150 patients, 57 (38%) had prior episodes of cholecystitis for which they were hospitalized at a neighboring hospital (Table 3). Table 3 shows that out of the 57 patients, 44 (77.19%) underwent a challenging laparoscopic cholecystectomy. Similarly, individuals with a higher BMI (more than 25.5 kg/m^2) had more difficulties during surgery. Out of 150 patients, 60 (40%) had undergone previous abdominal surgeries, with patients with upper abdominal scars experiencing greater difficulty, 30 (76.9%) undergoing difficult laparoscopic cholecystectomy, and 4 (10.2%) undergoing very difficult laparoscopic cholecystectomy. Out of 21 patients with infraumbilical scars, 12 (57%) had a difficult laparoscopic cholecystectomy and 3 (14%) had an open cholecystectomy. Patients with palpable gallbladders had a greater level of difficulty during laparoscopic cholecystectomy, with a 13.2% conversion rate. Patients who had a preoperative USG that revealed a gall bladder wall thickness of more than 4 mm had a greater degree of difficulty. Among the 52 patients, 40 underwent a challenging laparoscopic cholecystectomy, whereas 6 patients, accounting for 11.5%, required an open cholecystectomy. The pericholecystic collection also adds to the rise in the severity of the surgery, as 7 patients, or 15.2%, underwent open conversion. All of the aforementioned criteria show a significant relationship with the difficulty of laparoscopic cholecystectomy, with a p-value < 0.001. However, 29 (55.7%) of 52 patients with impacted stones in preoperative ultrasonography were operated on within 1 hour, 18 (34%), faced challenging procedures, and only 5 had an open conversion.

The connection between stone impaction and difficult laparoscopic cholecystectomy is not significant in this study, with a p-value of 0.5. To recap, it was obvious from Table 4 that out of 88 patients with scores from 0 to 5, 84 received simple surgery and 4 faced intraoperative challenges that could be treated laparoscopically within 120 minutes (Table 4). Similarly, 18 of 24 patients with a score of 6–10 were handled laparoscopically, while the surgeon had to convert 6 patients to open cholecystectomy (Table 4). Out of 150 patients, 40 received scores ranging from 11 to 15, with four undergoing surgeries in under an hour. During surgery, a total of thirty patients faced difficulties, which were successfully managed through laparoscopic treatment for all cases. However, four patients with a score of 11–15 received open cholecystectomy (Table 4).

Discussion

Even though laparoscopic cholecystectomy is the GOLD STANDARD therapy for gallstone disease, predicting the risk of conversion preoperatively is an essential element of laparoscopic cholecystectomy planning. If we can forecast intraoperative issues, more experienced surgeons might be asked to be present during the operation rather than less experienced younger ones who extend the procedure and contribute to intraoperative complications. If the challenges can be predicted prior to surgery, an early conversion decision may be taken to prevent needless surgical extension. A lot of studies have tried to construct grading systems to anticipate intraoperative problems, however, the majority of them are rather difficult to follow. Table 5 shows different rates of conversion for difficult gallstone diseases (Table 5). To anticipate intraoperative problems, we used the Randhawa and Pujahari score method in our research.[11]

The total conversion rate in our research was 6.66%, which was within the allowed range of 1–13%. We assigned a greater score

Table 3: Different outcomes corresponding multiple variables

Variables	*Level*	*Easy (90)*	*Difficult (50)*	*Very difficult (10)*	*Chi-square test*	*p-value*
Age	<50	79	5	4	81.72	<0.001
	>50	11	45	6		
Sex	Female	82	7	3	85.02	<0.001
	Male	8	43	7		
H/O Hospitalization	No	84	6	3	94.9	<0.001
	Yes	6	44	7		
BMI	<25.5	80	4	2	128.2	<0.001
	25.5–27.5	7	42	2		
	≥27.5	3	4	6		
Abdominal scar	No	79	8	3	75.5	<0.001
	Infraumbilical	6	12	3		
	Supraumbilical	5	30	4		
Palp. GB	No	86	8	3	94.6	<0.001
	Yes	4	42	7		
GBW thickness	<4 mm	84	10	4	94.67	<0.001
	≥4 mm	6	40	6		
PCC	No	85	16	3	66.7	<0.001
	Yes	5	34	7		
Stone impaction	No	61	32	5	1.31	0.5
	Yes	29	18	5		

Table 4: Preoperative score vs degree of intraoperative difficulty

Preoperative score	*Easy*	*Difficult*	*Very difficult*	*Total*
0–5	84	4	0	88
6–10	2	16	6	24
11–15	4	30	4	38
Total	90	50	10	

Table 5: Previous studies showing various rates of conversion

Name of study	*Rate of conversion*
Sakpal et al.	3.9–7.2%
Sikora et al.	19%
Peter et al.	14%
Kausik et al.	7.06%
Singh et al.	0.42%
Nanchnani et al.	11.4%

to those above the age of 50, which was shown to be significant ($p = 0.001$). Male sex made surgery more difficult in our research, which was statistically significant. Male sex conversion to open and increased morbidity rate were noted.[12] We assessed two to BMI >27.5 kg/m^2 and had a severe laparoscopic cholecystectomy ($p = 0.001$). A previous history of acute cholecystitis rendered surgery challenging, with a substantial $p = 0.001$ due to pericholecystic adhesions as well as collections with thicker gall bladder walls. Previously, clinically palpable gall bladder had not been described as a predictor of difficult cholecystectomy, but it was shown to be significant with $p = 0.001$ in our investigation. More than 4 mm of gall bladder wall thickness was shown to be related to a higher degree of difficulty and a higher conversion rate. Previous upper abdominal procedures made the laparoscopic cholecystectomy more challenging, maybe owing to increased adhesions. We also discovered that it was statistically significant ($p = 0.001$). The pericholecystic collection which may be a consequence of acute attack also contributed to difficulties ($p < 0.001$). However, sonologically affected stones do not contribute to the degree of difficulty in our investigation. From our investigations, it was determined that the sensitivity and specificity of the scoring method for scores 5–9 are 80.5–91.2% and 80.8–85.8% respectively. From ROC, it was confirmed that this study has high sensitivity as well as high specificity (Fig. 1). The area under the ROC curve was determined to be 0.945 which was statistically significant (Table 6).

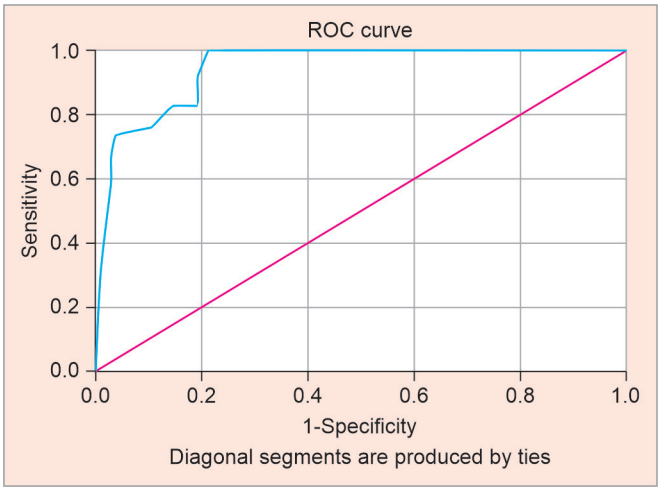


Fig. 1: ROC showing high sensitivity of the study

Table 6: Area under the ROC curve showing significance of the study

Area under the curve				
			95% confidence interval	
Area	*Std. error*	*Significance*	*Lower boundary*	*Upper boundary*
0.945	0.017	<0.001	0.912	0.978

Conclusion

We may infer that the Randhawa and Pujahari score system is a reliable and simple method for identifying the variables responsible for difficult laparoscopic cholecystectomy. However, a limited sample size may be a hindrance to achieving full statistical validity. That is why we suggest a large sample size, and multicentric research to verify and establish the scoring system's effectiveness.

Orcid

Jyotirmaya Nayak https://orcid.org/0000-0003-0452-3522

References

1. Yadav P, Janugade H. A Clinical study to determine predictive factors for difficult laparoscopic cholecystectomy. JMSCR 2019;7(3):741–752.
2. Gupta N, Ranjan G, Arora MP, et al. Validation of a scoring system to predict difficult laparoscopic cholecystectomy. Int J Surg 2013;11(9):1002–1006. DOI: 10.1016/j.ijsu.2013.05.037.
3. Bourgouin S, Mancini J, Monchal T, et al. How to predict difficult laparoscopic cholecystectomy? Proposal for a simple preoperative scoring system. Am J Surg 2016;212(5):873–881. DOI: 10.1016/j.amjsurg.2016.04.003.
4. Hussain A. Difficult laparoscopic cholecystectomy: Current evidence and strategies of management. Surg Laparosc Endosc Percutan Tech 2011;21(4):211–217. DOI: 10.1097/SLE.0b013e318220f1b1.
5. Atta HM, Mohamed AA, Sewefy AM, et al. Difficult laparoscopic cholecystectomy and trainees: Predictors and results in an academic teaching hospital. Gastroenterol Res Pract 2017;2017:e6467814. DOI: 10.1155/2017/6467814.
6. Hu ASY, Menon R, Gunnarsson R, et al. Risk factors for conversion of laparoscopic cholecystectomy to open surgery – A systematic literature review of 30 studies. Am J Surg 2017;214(5):920–930. DOI: 10.1016/j.amjsurg.2017.07.029.
7. Afaneh C, Abelson J, Rich BS, et al. Obesity does not increase morbidity of laparoscopic cholecystectomy. J Surg Res 2014;190(2):491–497. DOI: 10.1016/j.jss.2014.02.014.
8. Schrenk P, Woisetschläger R, Rieger R, et al. A diagnostic score to predict the difficulty of a laparoscopic cholecystectomy from preoperative variables. Surg Endosc 1998;12(2):148–150. DOI: 10.1007/s004649900616.
9. Sharma SK, Thapa PB, Pandey A, et al. Predicting difficulties during laparoscopic cholecystectomy by preoperative ultrasound. Kathmandu Univ Med J (KUMJ) 2007;5(1):8–11. PMID: 18603978.
10. Nassar AHM, Hodson J, Ng HJ, et al. Predicting the difficult laparoscopic cholecystectomy: Development and validation of a pre-operative risk score using an objective operative difficulty grading system. Surg Endosc 2020;34(10):4549–4561. DOI: 10.1007/s00464-019-07244-5.
11. Randhawa JS, Pujahari AK. Preoperative prediction of difficult lap chole: A scoring method. Indian J Surg 2009;71(4):198–201. DOI: 10.1007/s12262-009-0055-y.
12. Russell JC, Walsh SJ, Reed-Fourquet L, et al. Symptomatic cholelithiasis: A different disease in men? Connecticut laparoscopic cholesystectomy registry. Ann Surg 1998;227(2):195–200. DOI: 10.1097/00000658-199802000-00007.

ORIGINAL ARTICLE

External Validity of Preoperative Predictive Risk Scoring System for Assessment of Difficulty in Laparoscopic Cholecystectomy at a Rural Hospital

Mohd Riyaz Lattoo[1], Sonam Gupta[2], Younis Ahmad[3], Nayeem Ul Hassan[4], Syed Misbah[5], Ajay Vane[6], Mohammad Juned Ansari[7], Shamikh Rasool Shah[8], Sadaf Ali[9]

Received on: 29 May 2022; *Accepted on*: 28 October 2023; *Published on*: 11 January 2024

Abstract

Background: Cholelithiasis is one of the most common problems affecting the digestive tract. Laparoscopic cholecystectomy (LC) is the gold standard treatment for symptomatic cholelithiasis. This procedure though mostly safe and uneventful can be difficult at times. A lot of problems can be avoided by correct preoperative prediction of difficult cholecystectomy. Many studies have attempted to create a scoring system to predict difficulty in LC. One such scoring system was devised by Randhawa and Pujahari.

Objective: The aim of our study was to ascertain the validity of this scoring system in our hospital scenario.

Materials and methods: This was a prospective study conducted at District Hospital Anantnag, a rural healthcare center located in the valley of Kashmir, India, from September 2016 to September 2018. Out of 327 patients admitted for LC were enrolled. Each patient was assigned scores preoperatively based on the history, clinical assessment, and sonographic findings as described by Randhawa and Pujahari. All intraoperative events like duration of surgery, bile stone spillage, and injury to duct/artery were recorded. Postoperatively, we defined the surgical procedure as easy, difficult, and very difficult as described by Randhawa and Pujahari.

Results: The mean age of patients in our study was 43 years. In our study, we observed that age >50 years, male sex, body mass index (BMI) >27.5, history of hospitalization for acute cholecystitis, palpable gallbladder on clinical examination, and thick wall gallbladder on sonography were statistically significant predictors of difficult LC. The sensitivity, specificity, positive predictive value and negative predictive value of this scoring system as reported by us are 86.41, 79.76, 92.51, and 67%.

Conclusion: We conclude that the scoring system of Randhawa and Pujahari for the prediction of the difficulty of LC applies to rural settings and has high sensitivity, specificity, and accuracy.

Keywords: Difficult cholecystectomy, Gall bladder, Laparoscopic cholecystectomy.

World Journal of Laparoscopic Surgery (2023): 10.5005/jp-journals-10033-1588

Introduction

Cholelithiasis, a prevalent digestive tract issue with an estimated 4% occurrence in India, often prompts the adoption of laparoscopic cholecystectomy (LC) as the primary treatment modality.[1] Acknowledged as the gold standard, LC's safety and effectiveness were underscored by the National Institute of Health (NIH) in 1992, reinforcing its status as the preferred approach for symptomatic gallstones.[2]

The widespread adoption of laparoscopic techniques, constituting approximately 80% of cholecystectomies, has significantly improved patient outcomes.[3–5] However, the journey towards a successful LC can be hindered, necessitating conversion to open surgery from 2 to 15% of cases.[6] The challenges are diverse, ranging from congenital vascular and ductal anomalies to acute inflammation with dense adhesions in Calot's triangle. Additionally, factors such as small fibrotic, thick-walled gallbladders, and obscured anatomy in the hepatocystic triangle pose difficulties. Cholecystoenteric fistulas further complicate the surgical landscape.[7]

Recognizing the potential hurdles in LC, the importance of accurate preoperative prediction cannot be overstated. This prediction serves as a valuable tool in counseling patients, informing them about the possibility of conversion to open technique, pain associated with a bigger incision, surgical site infection, potential change in postoperative course, longer hospitalization, and the need for more intensive postoperative care. Moreover, surgeons can leverage this information to schedule surgeries more effectively, and hospital administrations can optimize resource allocation and bed management efficiently.[8,9]

In the pursuit of enhancing preoperative predictions, numerous scoring systems have been proposed, with the Randhawa and Pujahari systems being one such attempt.[10] The focus of our study

[1–9]Department of Surgical Gastroenterology, Sher-i-Kashmir Institute of Medical Sciences, Srinagar, Jammu and Kashmir, India

Corresponding Author: Mohd Riyaz Lattoo, Department of Surgical Gastroenterology, Sher-i-Kashmir Institute of Medical Sciences, Srinagar, Jammu and Kashmir, India, Phone: +91 9419049425, e-mail: riyazlattoo@gmail.com

How to cite this article: Lattoo MR, Gupta S, Ahmad Y, *et al*. External Validity of Preoperative Predictive Risk Scoring System for Assessment of Difficulty in Laparoscopic Cholecystectomy at a Rural Hospital. World J Lap Surg 2023;16(3):129–132.

Source of support: Nil

Conflict of interest: None

Table 1: Scoring factors

History			*Max score*
Age	<50 yr (0)	>50 yr (1)	1
Sex	Female (0)	Male (1)	1
History of hospitalization	No (0)	Yes (4)	4
BMI	<25 (0)	25–27.5 (1)	2
		>27.5 (2)	
Abdominal scar	No (0)	Infraumbilical (1)	2
		Supraumbilical (2)	
Palpable gallbladder	No (0)	Yes (1)	1
Wall thickness	Thin (0)	Thick >4 mm (2)	2
Pericholecystic collection	No (0)	Yes (1)	1
Impacted stone	No (0)	Yes (1)	1

lies in evaluating the validity of this scoring system within the unique context of our hospital. By systematically applying the Randhawa and Pujahari scoring criteria to our patient dataset, we aim to determine its efficacy in predicting the challenges associated with LC in our specific setting. This investigation not only contributes to the existing body of knowledge on cholecystectomy but also holds practical implications for surgical planning, patient counseling, and resource optimization within our healthcare facility.

Materials and Methods

This prospective analytical study was conducted at District Hospital Anantnag, a rural healthcare center situated in the Kashmir Valley, India, spanning from September 2016 to September 2018. A total of 327 patients scheduled for LC were included in the study after obtaining written informed consent. Exclusion criteria comprised individuals with acute cholecystitis, choledocholithiasis, increased common bile duct diameter, bleeding diathesis, a history of jaundice or cholangitis, a cholestatic pattern of liver enzymes, age below 15 years, and those unfit for general anesthesia. Patients unwilling to participate were also excluded. The study protocol received approval from the Institutional Review Board, and adherence to the principles of the Declaration of Helsinki was maintained throughout.

The assessment of risk factors included age, sex, body mass index (BMI), history of prior hospitalization, the presence of abdominal scars, palpable gallbladder, gallbladder wall thickness, pericholecystic collection, and impacted stone. Preoperatively, each patient was assigned scores based on history, clinical assessment, and sonographic findings, following the criteria outlined by Randhawa and Pujahari,[10] as detailed in Table 1.

Surgical procedures involved the use of CO_2 pneumoperitoneum with a pressure of 12 mm Hg and the use of four standard ports. The duration of surgery, occurrences such as bile or stone spillage, intraoperative bleeding, and any injuries to the duct/artery were recorded intraoperatively. Postoperatively, the difficulty of the surgical procedure was categorized as easy, difficult, or very difficult, as per the classification by Randhawa and Pujahari[10] detailed in Table 2.

Data recording utilized a pre-designed proforma, and all entries were made in Microsoft Excel. The Chi-square test was employed to determine the *p*-value for differences between predictor strata, considering a *p*-value of < 0.05 as significant. Additionally, correlation coefficients along with *p*-values were calculated to assess the relationship between risk factors and the type of intraoperative difficulty.

Table 2: Criteria for easy, difficult, and very difficult cases

Easy	Time taken <60 min
	No bile spillage
	No injury to duct
	No injury to artery
Difficult	Time taken 60–120 min
	Bile/stone spillage
	Injury to duct
	No conversion
Very difficult	Time taken >120 min
	Conversion

Table 3: Preoperative outcomes

Risk factor	*Level*	*Easy*	*Difficult*	*p-value*
Age	<50 yr	163	55	0.003
	>50 yr	64	45	
Sex	Male	34	52	0.0005
	Female	193	48	
BMI	<25	197	26	0.0005
	25.1–27.5	21	47	
	>27.5	9	27	
Previous surgery	Nil	212	91	0.445
	Yes	15	9	
Hospitalization	Nil	253	65	0.0005
	Yes	28	35	
Gallbladder palpable	No	201	62	0.0005
	Yes	26	38	
Wall thickness	<3 mm	220	91	0.0005
	>3 mm	7	31	
Impacted stone	Nil	209	91	0.746
	Yes	18	9	
Pericholecystic fluid	Nil	223	67	0.410
	Yes	4	3	

Results

The study encompassed a cohort of 327 patients, with a mean age of 43 years (range 1682 years), predominantly concentrated in the age group of 3140 years. The baseline clinical characteristics of the participants are summarized in Table 3.

The average intraoperative time was 45 ± 12.4 minutes (range 25–130 minutes), and the postoperative hospital stay averaged 1.4 ± 0.4 days. Among the 327 patients, 168 (51.37%) scored between 0 and 5, with 163 out of these 168 cases classified as easy and 5 as difficult during LC. For those with a score between 6 and 10 (147 patients), 91 were identified as having difficult LC. Notably, all 12 patients with a score exceeding 10 required conversion to open cholecystectomy, as detailed in Table 4.

Table 5 elucidates the correlation between preoperative predictions of difficulty and intraoperative assessments. This correlation exhibited statistical significance. Univariate analysis of intraoperative outcomes in relation to risk factors identified six variables (age, gender, BMI, palpable gallbladder, history of previous hospitalization, and thick gallbladder wall) that demonstrated statistical significance in the preoperative prediction of difficult LC.

Table 4: Correlation of preoperative score with difficulty level

Preoperative score	*Easy*	*Difficult*	*Very difficult*	*Total*
0–5	163	5	–	168
6–10	56	89	2	147
11–15	–	–	12	12
Total	219	94	14	327

Table 5: Correlation between preoperative and intraoperative difficulty levels

	Intraoperative easy cases	*Intraoperative difficult/ very difficult cases*	*Total*	*p-value*
Preoperative easy case	210 (64.22%)	17 (5.19%)	227	0.0005
Preoperative difficult/very difficult cases	33 (10.9%)	67 (20.48%)	100	
Total	243 (74.3%)	84 (25.68%)	327	

Discussion

Numerous studies have sought to evaluate the preoperative risk factors associated with the conversion of LC. Parameters like male sex, upper abdominal tenderness during surgery, previous upper abdominal surgery, sonographic ascertained thick gallbladder wall, age over 60 years, and a preoperative diagnosis of acute cholecystitis were identified by Kama et al., as significant factors affecting the risk of conversion through multivariate analysis.[5] Another study by Lee et al. echoed similar findings, noting that risk factors for conversion included age over 65 years, male sex, a history of previous upper abdominal surgery, and a documented history of acute cholecystitis.[11]

Age has consistently emerged as a significant risk factor in various studies, with higher conversion rates reported in older individuals, often using 50 years as a cutoff point.[11,12] In the present study, age demonstrated a significant impact on intraoperative difficulty. The relationship between male sex and difficult cholecystectomy has been a subject of debate. Some literature suggests that the male gender is a risk factor for challenging cholecystectomy.[12–14] This could be attributed to delayed diagnosis in males, as cholelithiasis is traditionally considered a predominantly female disease. Late diagnosis may result in substantial adhesions due to recurrent inflammation before detection. In our study, male sex was identified as a statistically significant predictor of difficult LC.

Obesity has been recognized as another risk factor for challenging LC. Difficulties escalate with increasing BMI due to various factors such as port placement, dissection challenges at Calot's triangle, and complications arising from instrument manipulation through a thick abdominal wall.[15] Consistent with these findings, our study identified a BMI greater than 27.5 as a significant factor for predicting difficult LC.

A notable predictor of difficulty in LC is a patient's history of hospitalization due to repeated episodes of acute cholecystitis. This history may lead to increased gallbladder thickness, scarring, and fibrosis in and around the gallbladder, posing challenges in grasping and dissecting the gallbladder. Our data analysis confirmed a significantly elevated risk of difficulty and conversion in patients with a previous history of more than two attacks of acute cholecystitis, aligning with findings in other studies.[16,17]

The presence of supra and infraumbilical scars, indicative of prior abdominal operations, has been associated with adhesions between the viscera or omentum and the abdominal wall. This increases the risk of injury during port insertion, potentially leading to conversion.[12,13] Surprisingly, in our study, abdominal scars did not emerge as a statistically significant factor in predicting the difficulty of LC.

The clinical finding of a palpable gallbladder, often observed in patients with a distended gallbladder due to conditions such as mucocele empyema, or secondary to a thick-walled gallbladder adherent to the omentum, can pose challenges during surgery. In our study, palpable gallbladder was identified as a statistically significant predictor of difficult LC, aligning with the findings of Randhawa and Pujahari.[10]

The thickened gallbladder wall and a small contracted gallbladder observed during perioperative ultrasonography are direct indicators of repeated inflammatory attacks, implying a higher likelihood of fibrosis and scarring in and around the gallbladder. As anticipated, these factors were found to be statistically significant predictors of difficult LC in our study, consistent with observations in several other studies.[6,18–22]

While pericholecystic collection has been suggested as a predictor of difficult LC in some studies,[23] our analysis did not reveal a statistically significant correlation between pericholecystic collection and difficulty in our patient population.

Inflammation around the neck of the gallbladder resulting from an impacted stone introduces technical challenges during surgery. Difficulty in grasping the gallbladder neck for adequate retraction to perform dissection at Calot's triangle can complicate the procedure. Interestingly, in our study, an impacted stone at the neck of the gallbladder did not emerge as a statistically significant factor for predicting difficult LC.

The conversion rate reported in the literature has varied widely, ranging from 7 to 35%.[24] Some authors have specifically associated difficult cases with a conversion rate of 25%.[25] In our study, the conversion rate was 12%, falling within the reported range but emphasizing the importance of acknowledging and managing potential challenges during LC.

Conclusion

A history of prior hospitalization for acute cholecystitis, increased gallbladder wall thickness, along with factors such as age, sex, BMI greater than 27.5, and the presence of a palpable gallbladder were identified as statistically significant predictors of difficult LC. The preoperative scoring system devised by Randhawa and Pujahari.[10] demonstrated its validity in predicting difficult LC, a validation substantiated by our study. The sensitivity, specificity, positive predictive value, and negative predictive value of this scoring system, as determined in our study, were 86.41, 79.76, 92.51, and 67%, respectively.

Orcid

Mohd Riyaz Lattoo https://orcid.org/0000-0001-7866-9511
Sonam Gupta https://orcid.org/0000-0001-6926-9428
Younis Ahmad https://orcid.org/0000-0002-0919-7992
Nayeem Ul Hassan https://orcid.org/0000-0002-9981-0374
Syed Misbah https://orcid.org/0009-0007-5281-2210
Ajay Vane https://orcid.org/0000-0003-0832-7086
Mohammad Juned Ansari https://orcid.org/0009-0001-4997-8662

Shamikh Rasool Shah https://orcid.org/0000-0002-6511-3773
Sadaf Ali https://orcid.org/0000-0002-2496-8935

References

1. Arumugam R, Pandurengan K. Pre-operative prediction of difficult laparoscopic cholecystectomy. Int Surg J 2015;2(4):584–589. DOI: 10.18203/2349-2902.isj20151083.
2. National Institutes of Health. National Institute of Health consensus development conference statement on gallstones and laparoscopic cholecystectomy. Am J Surg 1993;165(4);390–398. DOI: 10.1016/s0002-9610(05)80929-8.
3. Lam CM, Murray FE, Cuschieri A. Increased cholecystectomy rate after the introduction of laparoscopic cholecystectomy in Scotland. Gut 1996;38:282–284. DOI: 10.1136/gut.38.2.282.
4. The Southern Surgeons Club, Meyers WC. A prospective analysis of 1518 laparoscopic cholecystectomy. N Engl J Med 1991;324: 1073–1078. DOI: 10.1056/NEJM199104183241601.
5. Kama NA, Kologlu M, Doganay M, et al. A risk score for conversion from laparoscopic to open cholecystectomy. Am J Surg 2001;181(6): 520–525. DOI: 10.1016/s0002-9610(01)00633-x.
6. Alponat A, Kum CK, Koh BC, et al. Predictive factors for conversion of laparoscopic cholecystectomy. World J Surg 1997;21:629–633. DOI: 10.1007/pl00012288.
7. Kaafarani HM, Smith TS, Neumayer L, et al. Trends, outcomes, and predictors of open and conversion to open cholecystectomy in Veterans Health Administration hospitals. Am J Surg 2010;200(1): 32–40. DOI: 10.1016/j.amjsurg.2009.08.020.
8. Uddin MM, Sharma S, Raman R. A study of preoperative factors predicting difficult laparoscopic cholecystectomy. JMSCR 2019;7(10):365–869. DOI: https://dx.doi.org/10.18535/jmscr/v7i1.153.
9. Gupta N, Ranjan G, Arora MP, et al. Validation of a scoring system to predict difficult laparoscopic cholecystectomy. Int J Sur 2013;11(9):1002–1006. DOI: 10.1016/j.ijsu.2013.05.037.
10. Randhawa JS, Pujahari AK. Preoperative prediction of difficult lap chole: A scoring method. Indian J Surg 2009;71(4):198–201. DOI: 10.1007/s12262-009-0055-y.
11. Lee NW, Collins J, Britt R, et al. Evaluation of prospective risk factors for converting laparoscopic to open cholecystectomy. Am Surg 2012;78(8):831–833. PMID: 22856487.
12. Hussain A. Difficult laparoscopic cholecystectomy: Current evidence and strategies of management. Surg Laparosc Endosc Percutan Tech 2011;21(4):211–217. DOI: 10.1097/SLE.0b013e318220f1b1.
13. Nachnani J, Supe A. Pre-operative prediction of difficult laparoscopic cholecystectomy using clinical and ultrasonographic parameters. Indian J Gastroentrol 2005;24(1):16–18. PMID: 15778520.
14. Lein HH, Huang CS. Male gender: Risk factor for severe symptomatic cholelithiasis. World J Surg 2002;26:598–601. DOI: 10.1007/s00268-001-0275-1.
15. Rosen M, Brody F, Ponsky J. Predictive factors for conversion of laparoscopic cholecystectomy. Am J Surg 2002;184(3):254–258. DOI: 10.1016/s0002-9610(02)00934-0.
16. Bouarfa L, Schneider A, Feussner H, et al. Prediction of intraoperative complexity from preoperative patient date for laparoscopic cholecystectomy. Artif Intell Med 2011;52(3):169–176. DOI: 10.1016/j.artmed.2011.04.012.
17. Majeski J. Significance of preoperative ultrasound measurement of gallbladder wall thickness. Am Surg 2007;73(9):926–929. PMID: 1793942.
18. Fried GM, Barkun JS, Sigman HH, et al. Factors determining conversion to laparotomy in patients undergoing laparoscopic cholecystectomy. Am J Surg 1994;167:35–39. DOI: 10.1016/0002-9610(94)90051-5.
19. Lal P, Agarwal PN, Malik VK, et al. A difficult laparoscopic cholecystectomy that requires conversion to open procedure can be predicted by preoperative ultrasonography. JSLS 2002;6(1):59–63. PMCID: PMC3043388.
20. Jansen S, Jorgensen J, Caplehorn J, et al. Preoperative ultrasound to predict conversion in laparoscopic cholecystectomy. Surg Laparosc Endosc 1997;7(2):121–123. PMID: 9109240.
21. Strasberg SM, Hertl M, Soper NJ. An analysis of the problem of biliary injury during laparoscopic cholecystectomy. J Am Coll Surg 1995;180(1):101–125. PMID: 8000648.
22. Daradkeh SS, Suwan Z, Abu-Khalaf M. Preoperative ultrasonography and prediction of technical difficulties during laparoscopic cholecystectomy. World J Surg 1998;22(1):75–77. DOI: 10.1007/s002689900352.
23. Dhanke PS, Vgane SP. Factors predicting difficult laparoscopic cholecystectomy: A single-institution experience. Int J Stud Res 2014;4:3–7.
24. Khan IA, El-Tinay OE. Laproscopic cholecystectomy for acute cholecystitis: Can preoperative factors predict conversion? Saudi Med J 2004;25:299–302. PMID: 15048165.
25. Szabo K, Rothe A, Shamiyeh A. Laparoscopic cholecystectomy – Review over 20 years with attention on acute cholecystitis and conversion. Eur Surg 2012;44:28–32. DOI: https://doi.org/10.1007/s10353-012-0072-0.

ORIGINAL ARTICLE

A Prospective Follow-up Observational Study of Laparoscopic Insertion of CAPD Catheters as a Modality of Management of End-stage Renal Disease (CKD – Stage V)

Taskeen M Sikora[1], Ravi V Patel[2], Satish J Deshmane[3], Shrinivas Ambike[4]

Received on: 27 June 2022; *Accepted on*: 20 February 2023; *Published on*: 11 January 2024

Abstract

Aim: To study benefits and complications of continuous ambulatory peritoneal dialysis (CAPD) catheter placement laparoscopically with suture fixation technique.

Patients and methods: A total of 41 cases of end-stage renal disease [chronic kidney disease (CKD) – Stage V] were admitted in Jehangir Hospital, Pune. Patients were evaluated, after explaining the procedure, the risks and benefits they were prepared for the procedure. Patients were assessed for complications and mortality as well as the reason for discontinuation of CAPD.

Results: Of 41 cases studied, 39 (95.2%) had CAPD started, in 1 (2.4%) CAPD was not started and 1 (2.4%) did not have CAPD inserted. Of 41 cases studied, 28 (68.3%) had CAPD continued successfully for 2 years. Of 41 cases studied, 4 (9.8%) had catheter outflow block, 4 (9.8%) had peritonitis, 6 (14.6%) had ultrafiltration failure, 3 (7.3%) had exit site leak, 1 (2.4%) had catheter malposition/kinking, none had incisional hernia, 2 (4.9%) had hemoperitoneum. A total of 10 patients (24.4%) had catheter removed at the end of the study.

Conclusion: Approximately, 68% of patients, that is 28 patients out of 41 continued CAPD for 2 years after the catheter was inserted laparoscopically. Out of the 41 patients, 20 patients developed minor complications. Out of the 20 patients, 10 patients developed major complications and needed the catheter to be removed. Mortality was 9.8%, out of which two patients died of sepsis and 2 died of comorbidity-related complications.

Clinical significance: Laparoscopic CAPD catheter placement is an effective method and has good success rate with less complications and better patient tolerability.

Keywords: Continuous ambulatory peritoneal dialysis catheter, Laparoscopic, Tenckhoff catheter.

World Journal of Laparoscopic Surgery (2023): 10.5005/jp-journals-10033-1593

Introduction

The deciding factors for choosing the type of renal replacement therapy is a critical point in decision making for end-stage renal disease (ESRD) patients and the different factors like age of the patient, comorbidities, ability to perform the procedure plays a significant role in patient's choice for either peritoneal dialysis or hemodialysis (HD). Both HD and continuous ambulatory peritoneal dialysis (CAPD) are the main modalities of treatment for ESRD patients. Continuous ambulatory peritoneal dialysis has emerged as a new era in the management of ESRD. Popovich et al.,[1] in their study, very simply described that CAPD uses the process where peritoneal dialysate fluid is present continuously (24 hours a day, 7 days a week) in the peritoneal cavity except for periods of drainage and fresh solution insertion 3–4 times per day. After every peritoneal dialysis cycle, all the tubing are disconnected and a cap is applied over the catheter tip. Patient can resume all his routine activities after that. Continuous ambulatory peritoneal dialysis has many social advantages like simple technique, no electrical equipment requirements, can be done at home, can be used even while long distance travel and an overall reduction in cost and many medical advantages, such as an increased weekly clearances of small and medium molecules, some dietary and fluid restrictions, and decrease in thirst, anemia and hypertension.[2] A successful peritoneal dialysis program depends on the properly positioned CAPD catheter which can be executed either by open surgical, or laparoscopic placements or percutaneously. In recent times, laparoscopic surgery has become first choice in peritoneal catheter placement with many techniques. Mechanical outflow obstruction is a major complication of post-PD catheter insertion probably due to catheter tip migration or by catheter kinking, seen in 4–34.5% of open surgical technique and 4.5–13% in laparoscopically inserted.[3–5]

[1–3]Department of General Surgery, Jehangir Hospital, Pune, Maharashtra, India

[4]Department of Nephrology, Jehangir Hospital, Pune, Maharashtra, India

Corresponding Author: Ravi V Patel, Department of General Surgery, Jehangir Hospital, Pune, Maharashtra, India, Phone: +91 8390986055, e-mail: dr.ravi1211@hotmail.com

How to cite this article: Sikora TM, Patel RV, Deshmane SJ, *et al*. A Prospective Follow-up Observational Study of Laparoscopic Insertion of CAPD Catheters as a Modality of Management of End-stage Renal Disease (CKD – Stage V). World J Lap Surg 2023;16(3):133–136.

Source of support: Nil

Conflict of interest: None

Patients and Methods

Study Type

Prospective follow-up observational study.

A study of 41 patients diagnosed with ESRD [chronic kidney disease (CKD) – Stage V], requiring renal replacement therapy

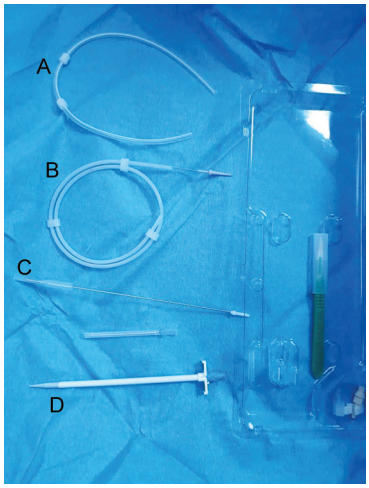


Fig. 1: Continuous ambulatory peritoneal dialysis (CAPD) catheter kit – A, CAPD catheter; B, Guidewire; C, Trocar; D, Sheath

in the form of CAPD and the CAPD catheter being inserted laparoscopically was conducted in our institute. It is a prospective follow-up study during the time period May 2019 to Dec 2020. The study also included patients in whom CAPD catheter was inserted 6 months before the commencement of our study but were fitting in our inclusion criteria. Inclusion criteria being, those with ESRD (CKD – Stage V), those who were compatible to undergo laparoscopic insertion of CAPD catheters and those whose age was >20 years. Exclusion criteria being, age >80 years, patients who don't need long-term dialysis, those with active peritonitis and those in whom CAPD catheter insertion beyond 2 years follow-up.

Statistical Methods

The data on categorical variables are shown as *n* (% of cases) and the data on continuous variables are shown as mean ± standard deviation (SD). As this study is a non-comparative observational only study, we didn't analyze the distributions of several categorical variables. The data were statistically analyzed after arranging it in MS Excel. All results are shown in both tabular and graphical format for better understanding of the frequency distributions of variables. The statistical analysis is done by using Statistical Package for Social Sciences (SPSS ver 22.0, IBM Corporation, USA) for MS Windows.

Criteria of Assessment of Outcome

- The benefits—patient has the benefit of doing dialysis at home, easy to self-usage and less expensive.
- Complication details—peritonitis, catheter block.
- Indications of replacement of catheter—catheter migration, catheter block, and kinking.

In our study, we used laparoscopic Tenckhoff catheter implantation (LTCI) technique. In many studies, the surgical technique involved was suture fixation with omentopexy. In our technique, we only used suture fixation without omentopexy. We used two trocar techniques (10 and 5 mm) (Figs 1 and 2).

Results

Results were considered on factors such as distribution of age, sex, comorbidities, previous operative history, CAPD catheter-related characteristics and complications, incidence of switching over to HD, incidence and cause of mortality and their association with comorbidities.

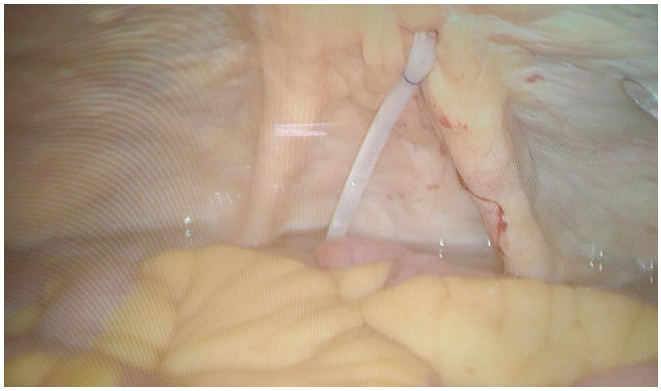


Fig. 2: Catheter fixation using polypropylene suture

Of 41 cases studied, 3 (7.2%) had age less than 50 years, 9 (22.0%) had age between 50 and 59 years, 18 (43.9%) had age between 60 and 69 years, 9 (22%) had age between 70 and 79 years, 2 (4.9%) had age of 80 years in the study. The mean ± SD of age of cases studied was 63.8 ± 10.1 years and the minimum–maximum age range was 32–80 years. In this study group, 28 (68.3%) were male and 13 (31.7%) were female with male to female sex ratio being 2.15:1.00. Of 41 cases studied, 1 (2.4%) had no co-morbidity, 2 (4.9%) had diabetes, 13 (31.7%) had hypertension, 17 (41.5%) had both diabetes and hypertension, 3 (7.3%) had hypertension and ischemic heart disease and the rest 5 (12.2%) had diabetes, hypertension and ischemic heart disease. A total of 25 (61.0%) out of 41 patients had no history of previous surgery out of which for 1 (0.2%) patient CAPD could not be started after insertion as patient had cardiac arrest and expired, the rest 24 (58.5%) had CAPD done for more than 1 year without any complications. Out of the 16 (39%) who had undergone previous surgery, in 1 (0.2%) patient, the CAPD catheter could not be inserted due to adhesions, 15 (36.6%) out of 41 patients had CAPD for more than 1 year without complications out of which 4 (26.6%) patients could not complete dialysis for 2 years due to complications, the rest 10 patients (66.6%) completed 2 years of successful CAPD. Out of 41 patients, 39 (92.5%) had CAPD for more than 1 year, 28 (68.3%) completed 2 years of CAPD. The complications were recorded and it was found that of the 41 cases studied, 4 (9.8%) had catheter outflow block, 4 (9.8%) had peritonitis, 6 (14.6%) had ultrafiltration failure, 3 (7.3%) had exit site leak, 1 (2.4%) had catheter malposition/kinking, none had incisional hernia, 2 (4.9%) had hemoperitoneum, and 10 (24.4%) had catheter removed at the end of the study (Tables 1 and 2).

Of 41 cases studied, 12 (29.3%) switched over to HD. The rate of mortality was 9.8% (4 out of 41). Of the 4 cases who expired, 2 (50.0%) expired due to cardiac arrest, 1 (25.0%) expired due to septic shock (non-CAPD catheter-related) and 1 (25.0%) expired due to peritonitis and septic shock (CAPD catheter-related).

Discussion

Studies done earlier suggest the benefits of laparoscopic PD catheter insertion technique against open method, the advantages of laparoscopy being high catheter acceptance >1 year, reduced catheter migration, better patient convenience and reduced morbidity.[6] The first year failure-free rate of the CAPD catheter was

Table 1: Distribution of CAPD catheter-related characteristics in the study group

Characteristics	*No. of cases*	*% of cases*
CAPD started		
Yes	39	95.2
Not started	1	2.4
Not inserted	1	2.4
CAPD done for >1 year		
Yes	39	95.1
NA	2	4.9
CAPD done for >2 years		
Yes	28	68.3
No	11	26.8
NA	2	4.9
CAPD discontinued within 2 years		
Yes	10	24.4
No	29	70.7
NA	2	4.9

NA, not applicable as CPD was not inserted or not started

Table 2: Distribution of CAPD catheter-related complications in the study group

Complications	*No. of cases*	*% of cases*
Catheter outflow block		
Yes	4	9.8
No	36	87.8
NA	1	2.4
Peritonitis		
Yes	4	9.8
No	36	87.8
NA	1	2.4
Ultrafiltration failure		
Yes	6	14.6
No	34	82.9
NA	1	2.4
Exit site leak		
Yes	3	7.3
No	37	90.2
NA	1	2.4
Catheter malposition/kinking		
Yes	1	2.4
No	39	95.1
NA	1	2.4
Incisional hernia		
Yes	–	–
No	41	100
Hemoperitoneum		
Yes	2	4.9
No	39	95.1
Catheter removed		
Yes	10	24.4
No	31	75.6

NA, not applicable as CAPD was not inserted or not started

80.8% as studied by Khanna et al.[2] In our study, we found 95.2% patient had CAPD catheter for >1 year.

Age and Sex Distribution of Cases Studied

In a study conducted by Öğünç[7] the mean age was 46 years. There was no morbidity or malfunction in CAPD during the follow-up from 20 days to 9 months. In the study conducted by us, the mean age was 63 years. Fenton's data from the Canadian registry are unique in that they describe a lower mortality in PD patients than in HD, for all age ranges.[8]

Comorbidities

Malberti et al. published data from the Lombardy Registry that was dedicated to elderly people. In this study, mortality risk was higher in PD than in HD (RR 1.31), but they recognized that comorbid conditions have less survival. They found a similar hospitalization rate, and they suspected that this result may involve a hidden negative selection of patients for PD.[9]

In this study, 41% of the patients had comorbid conditions, and of the 41 cases, selected 90.2% survived till the period of study with 30 having complications. In this study, comorbid conditions did not reduce survival.

Complications

In this study, we found 9.8% incidence of catheter outflow block against Khanna et al. who found 10 (30%) cases of catheter plugging.[2]

In a series by Khanna et al., they observed that in 132 patients, CAPD was discontinued in 48 patients (36.4%), 14 died (10%) and the remaining 70 were still on CAPD. In this study, the rate of discontinuation was 24.4% (10 patients), mortality rate was 9.8% (four patients).[2]

In this study, conversion rate from PD to HD was 29.3% (12 patients out of 41) which is comparable with the study conducted by Jaar et al.[10] who observed 24.8%.

In our patient, we experienced 7.3% of peri catheter leak which correlates with the finding reported by Ma et al.[6] which was 7.4% incidence.

Complications of CAPD catheter can be either infectious or mechanical. Chances of infections (tunnel site as well as exit site) after laparoscopic CAPD catheter insertion are less common than open procedure.[11] In different studies, the incidence of infection was differed, however, our 14.7% incidence was comparable to the data reported by Öğünç et al. (19%).[12] Post-CAPD catheter insertion, peritonitis pose a major concern. Even though there is availability of various disconnect systems, the severe infections like *Staphylococcus aureus, Pseudomonas* sp., and fungal infection still account a major problem. However, we could eliminate the episodes of mild peritonitis with this disconnect systems. The causative factors of peritonitis can be skin or nasal carriage of bacteria or fungi, diabetes, previous treatment with antibiotics and exit site infections, etc.[13] In this study, 24 out of 41 (58.2%) patient had diabetes which correlates with the data by Harel et al.[14] The most frequently encountered mechanical complications of LTCI are catheter migration, peri-catheter leak, and outflow obstruction. As in laparoscopic surgery, tissue dissection is minimal, the incidence of the later has declined sharply to 6% as compared to 32% in open technique for Tenckhoff catheter implantation.[15,16] Poor dialysate fluid drainage frequently occurs as a result of displacement of the catheter at operation, omental wrapping,

or post-operative adhesion formation. These complications may cause malfunction immediately or may manifest several months after implantation.[5] This can be eliminated by suture fixation of catheter which will reduce the chances of migration as was done in this study and we reported 2.4% cases (one patient only) which was supported by a study done by Ko et al.[17] also showed better results when a polypropylene suture was used to fix the catheter at the lower abdominal wall. In their report, only one late migration of the catheter occurred (2.6%). We found that previous operative history was not significant factor for complication as only one patient out of 16 patients (6%) had complication which is supported by the study conducted by Talwar et al., which stated that there was no statistically significant difference between previous abdomen surgery and complication.[18]

Conclusion

Approximately, 68% of patients, that is 28 patients out of 41 continued CAPD for 2 years after the catheter was inserted laparoscopically. Out of the 41 patients, 20 patients developed minor complications. Out of the 20 patients, 10 patients developed major complications and needed the catheter to be removed. Mortality was 9.8%, out of which two patients died of sepsis and two died of comorbidity-related complications. Thus, we can conclude that laparoscopic CAPD catheter placement is an effective method and has a better success rate with less complications and better patient tolerability. The suture fixation prevents catheter migration. Catheter insertion is done under vision. It had a better acceptance rate for up to 2 years. Omentopexy or omentectomy benefits the patient by preventing catheter block due to omental wrapping which cannot be done in a blind procedure.

Orcid

Taskeen M Sikora https://orcid.org/0000-0001-9714-3902
Ravi V Patel https://orcid.org/0000-0003-3206-8379

References

1. Popovich RP, Moncrief JW, Nolph KD, et al. Continuous ambulatory peritoneal dialysis. Ann Intern Med 1978;88(4):449–456. DOI: 10.7326/0003-4819-88-4-449.
2. Khanna R, Oreopoulos DG, Dombros N, et al. Continuous ambulatory peritoneal dialysis (CAPD) after three years: Still a promising treatment. Perit Dial Int 1980;1(4):1–1. DOI: https://doi.org/10.1177/0896860880001004.
3. Crabtree JH, Fishman A. Laparoscopic omentectomy for peritoneal dialysis catheter flow obstruction: A case report and review of the literature. Surg Laparosc Endosc Percutan Tech 1999;9(3):228–233. PMID: 10804009.
4. Crabtree JH, Fishman A. Videolaparoscopic implantation of long-term peritoneal dialysis catheters. Surg Endosc 1999;13(2):186–190. DOI: 10.1007/s004649900936.
5. Garcia MAV, Urena MAG, Carnero F, et al. Omental entrapping of the peritoneal dialysis catheter solved by a laparoscopic approach. Perit Dial Int 1997;17(2):194–195. PMID: 9159842.
6. Ma JJ, Chen XY, Zang L, et al. Laparoscopic peritoneal dialysis catheter implantation with an intra-abdominal fixation technique: A report of 53 cases. Surg Laparosc Endosc Percutan Tech 2013;23(6):513–517. DOI: 10.1097/SLE.0b013e31828fa6ae.
7. Öğünç G. Videolaparoscopy with omentopexy: A new technique to allow placement of a catheter for continuous ambulatory peritoneal dialysis. Surg Today 2001;31(10):942–944. DOI: https://doi.org/10.1007/s005950170042.
8. Fenton S, Schaubel DE, Desmeules M, et al. Hemodialysis vs. peritoneal dialysis: A comparison of adjusted mortality rates. Am J Kidney Dis 1997;30(3):334–342. DOI: 10.1016/s0272-6386(97)90276-6.
9. Malberti F, Conte F, Limido A, et al. Ten years' experience of renal replacement treatment in the elderly. Geriatr Nephrol Urol 1997;7(1):1–10. DOI: 10.1023/a:1008251929636.
10. Jaar BG, Plantinga LC, Crews DC, et al. Timing, causes, predictors and prognosis of switching from peritoneal dialysis to hemodialysis: A prospective study. BMC Nephrol 2009;10(1):1–2. DOI: 10.1186/1471-2369-10-3.
11. Tsimoyiannis EC, Siakas P, Glantzounis G, et al. Laparoscopic placement of the Tenckhoff catheter for peritoneal dialysis. Surg Laparosc Endosc Percutan Tech 2000;10(4):218–221. PMID: 10961749.
12. Oğünç G, Tuncer M, Oğünç D, et al. Laparoscopic omental fixation technique vs open surgical placement of peritoneal dialysis catheters. Surg Endosc 2003;17(11):1749–1755. DOI: 10.1007/s00464-002-8586-3.
13. Oreopoulos DG. Pathogenesis and management of complications of chronic peritoneal dialysis. Nephrol Dial Transplant 2001;16(Suppl 6):103–105. DOI: https://doi.org/10.1093/ndt/16.suppl_6.103.
14. Harel Z, Wald R, Bell C, et al. Outcome of patients who develop early onset peritonitis. Adv Perit Dial 2006;22:46–49. PMID: 16983938.
15. Lu CT, Watson DI, Elias TJ, et al. Laparoscopic placement of peritoneal dialysis catheter: 7 years experience. ANZ J Surg 2003;73(3):109–111. DOI: 10.1046/j.1445-2197.2003.02651.x.
16. Ortiz AM, Fernandez MA, Troncoso PA, et al. Outcome of peritoneal dialysis: Tenckhoff catheter survival in a prospective study. Adv Perit Dial 2004;20:145–149. PMID: 15384816.
17. Ko J, Ra W, Bae T, et al. Two-port laparoscopic placement of a peritoneal dialysis catheter with abdominal wall fixation. Surg Today 2009;39(4):356–358. DOI: 10.1007/s00595-008-3877-5.
18. Talwar R, Jha A, Madhu G, et al. Comparative study of outcomes following laparoscopic versus open peritoneal dialysis catheter insertion at a tertiary care centre. J Urol Surg 2021;8(1):40–45. DOI: https://doi.org/10.4274/JUS.GALENOS.2020.3845.

ORIGINAL ARTICLE

Our Experience with Flank-free Modified Supine Percutaneous Nephrolithotomy

Mufti Mahmood Ahmed[1], Nasir Hamid Bhat[2], Irshad Ahmad Kumar[3], Fayaz Ahmad Najar[4]

Received on: 01 August 2022; *Accepted on*: 20 February 2023; *Published on*: 11 January 2024

Abstract

Objective: The objective of this study was to evaluate the safety profile and efficacy of "flank-free modified supine position (FFMS)" approach for percutaneous nephrolithotomy (PCNL).

Materials and methods: This study was conducted in the Department of General Surgery over 4-year period from August 2016 to August 2020 on 50 patients after institutional ethical clearance.

Results: The patients in our study were in the range of 21–65 years with mean age of 35.9 SD 9.85 years. Approximately, 62% of patients were males and right kidney was involved in 54%. The mean stone size of our study group was 17.3 SD 1.81 mm with a range of 14.2–21 mm. Pelvic stones were found in 28 (56%) of patients and majority of our patients, i.e., 88% were symptomatic of their disease. The mean operative time in our study was 83.62 SD 16.95 with range of 60–115 minutes. Nephrostomy was placed *in situ* in 84% patients. There was no operation related mortality in our study. The mean hospital stay of our patients was 3.7 SD 1.15 days. Out of total 50 patients, success was achieved in 45 (90%) patients as 6% required auxiliary treatment and 4% was converted to prone position.

Conclusion: Thus, in our study we found that FFMS PCNL surgery is a safe and an effective means of intrarenal access with high success rate and with acceptable morbidity and complications.

Keywords: Flank-free, Nephrolithiasis, Percutaneous nephrolithotomy.

World Journal of Laparoscopic Surgery (2023): 10.5005/jp-journals-10033-1583

Introduction

Urinary stone disease has plagued humanity for generations. Shattock (1950) reported the earliest kidney stone found in an Egyptian corpse from a tomb that dates to around 4400 BC.[1] While the first therapeutic percutaneous nephrostomy was actually carried out by Thomas Hillier in 1865, it is often credited to Goodwin and companions (1955).[2]

A crucial criterion for percutaneous entry into the urinary tract collecting system is a requirement for intrarenal or intraureteral surgical intervention. The treatment modalities include percutaneous nephrolithotomy (PCNL), endopyelotomy, and endoureterotomy, as well as the management of calyceal diverticula and hydrocalyces, and the antegrade ureteroscopic approach for the treatment of sizable ureteral stones. In addition, this procedure encompasses the percutaneous removal of urothelial tumors, as well as the seldom seen therapy of fungal bezoars. Instillation of therapeutic agents directly may also be an indication for upper urinary tract access. This includes the use of chemolysis for the dissolution of urinary calculi and the use of intracavitary topical therapy for the treatment of urothelial cancer. The key procedural components of these techniques are skillfully attaining access, effectively controlling postoperative drainage, and avoiding or treating complications associated with percutaneous access.[3]

The prone position offers various benefits, such as a substantial surface area for the site of puncture, more room for instrument manipulation, unrestricted instrument movements, and the possibility of several entry points. Nevertheless, there are several drawbacks associated with this approach. One such disadvantage is the discomfort experienced by patients' post-surgery due to the prone position, which exposes their bodies to increase the pressure points throughout the procedure. Additionally, this technique often results in longer operative times and poses a higher risk of complications related to pressure points, as well as circulatory and respiratory difficulties. This risk is particularly pronounced in patients who are morbidly obese, kyphotic, or debilitated.[4]

The use of the supine posture for PCNL was first documented by Valdivia et al.[5] The authors proposed that elevating the colon away from the kidney may reduce the risk of retro-renal colon injury. Moreover, the supine posture offers many advantages, such as the ease of patient care, efficient draining of Amplatz-Sheath, and improved management of the airway.[5]

Additional benefits include reduced cardio-circulatory or ventilatory dysfunction and enhanced surgical efficiency. Furthermore, the surgeon will maintain a comfortable seated position during the procedure. The reduction of X-ray exposure is achieved by the use of a puncture and dilatation technique for creating a nephrostomy route that is perpendicular to the body, so ensuring that the operator's hands are kept away from the

[1–4]Department of General Surgery, Government Medical College, Srinagar, Jammu and Kashmir, India

Corresponding Author: Irshad Ahmad Kumar, Department of General Surgery, Government Medical College, Srinagar, Jammu and Kashmir, India, Phone: +91 7006122289, e-mail: irshadahmadkumar@gmail.com

How to cite this article: Ahmed MM, Bhat NH, Kumar IA, *et al*. Our Experience with Flank-free Modified Supine Percutaneous Nephrolithotomy. World J Lap Surg 2023;16(3):137–141.

Source of support: Nil

Conflict of interest: None

fluoroscopic field.[6] However, a significant limitation of the supine position is the lack of enough space for a potential third tract, which limits its suitability for cases with Staghorn calculi.[7] Hence, in order to address this challenge, a modification was delineated for the supine position, resulting in the development of a novel posture referred to as the "flank-free modified supine position (FFMS)."[8]

The primary objective and aims of this research were to evaluate the well-being profile and effectiveness of this technique in PCNL.

Materials and Methods

The current hospital-based prospective research was undertaken at the Department of General Surgery, Govt. Medical College, Srinagar, after permission from the local Ethical Committee (Approval No. 134/ETH/GMC/ICMR). The research included a cohort of 50 functioning renal units, which were recruited between August 2016 and August 2020. The research comprised patients who were above the age of 20 and had renal pelvic, diverticular, and complicated inferior calyx stones. Patients who were excluded from the study included those who were under the age of 20 or had renal abnormalities, full staghorn calculus, stone load in the upper calyx, active infection, renal function less than 15% of global function, uncorrected coagulopathy, or were pregnant.

The patients had first evaluation in the Outpatient Department (OPD) prior to being scheduled for surgery. Upon admission, a comprehensive patient history was obtained, including the presenting complaints, duration of symptoms, past medical history, particularly pertaining to prior surgical procedures, as well as any concurrent conditions such as chronic illnesses and medication use.

A comprehensive physical examination was conducted, with specific attention given to the individual's physique, height, and weight, followed by a thorough assessment of various bodily systems. A comprehensive assessment of the abdomen was conducted for every patient. Every patient or caretaker received a comprehensive explanation of the nature of the treatment in a language that they could comprehend. Additionally, signed informed consent was acquired from each patient prior to the surgical intervention. Several essential investigations were conducted, including the kidney function test, urine culture, coagulogram, ultrasonography, X-ray KUB, intravenous urography (IVU), and CT/CECT, TC99 in selected instances.

Operative Technique

Following the administration of general anesthesia, the first procedural stage included the use of cystoscopy and retrograde ureteric catheterization to provide percutaneous intrarenal access. The procedure of rigid cystoscopy was performed on the patient while they were positioned in the dorsal lithotomy posture. Following the insertion of a 5F ureteric catheter into the relevant ureter, a Foley catheter was then introduced and both catheters were fastened together using a silk tie in order to minimize the risk of displacement of the ureteric catheter during patient repositioning. The ureteric catheter was connected to an intravenous extension tube, which was then carefully positioned inside the operating area on the same side of the body. This facilitated the administration of retrograde contrast media throughout the course of the process. Upon completion of the initial phase, the individual was positioned in the FFMS posture. This was achieved by providing appropriate support using a cushion, such as a 3-liter water bag or sand bag adjusted based on the individual's body mass, under the shoulder on the same side. The arm on the same side was positioned over the thorax, while the leg

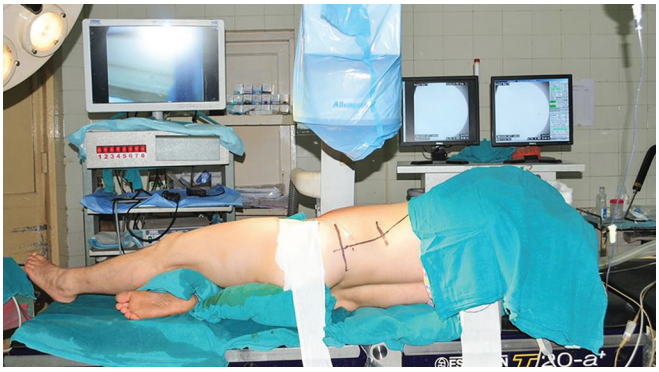


Fig. 1: Position of patient

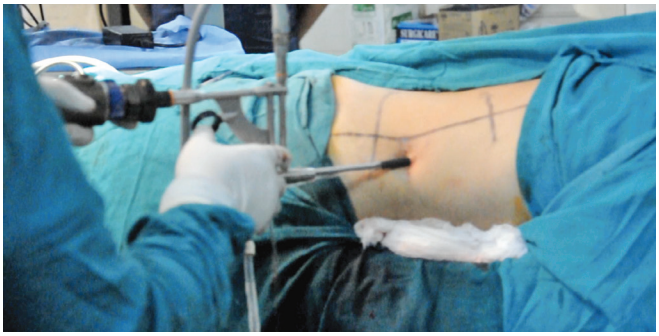


Fig. 2: Introduction of nephroscope

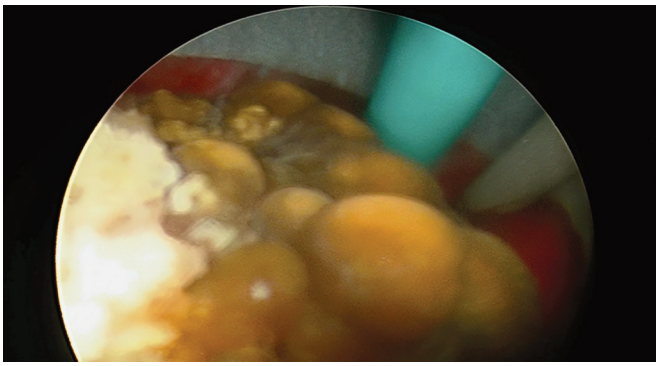


Fig. 3: Endoscope view of stone

on the same side was extended and crossed over the flexed leg on the opposite side (Fig. 1). The procedure included obtaining renal access by means of the posterior axillary line and the tract was dilated over Terumo guidewire up to the required Amplatz diameter for the introduction of the nephroscope (standard/mini) as shown in Figure 2. The LithoClast was introduced to fragment the stones (Fig. 3) and the fragments were removed through the Amplatz sheath. Following the conclusion of the surgery, a nephrostomy tube was inserted. Postoperatively an X-ray KUB was done to check for [Double J (DJ) Stent] position and clearance. All the patients were strictly monitored in postoperative period and follow-up for a period of 4 weeks (First, Second, and Fourth week). The data were recorded and analyzed using SPSS V 20.

Results

The participants included in our research ranged in age from 21 to 65 years, with a mean age of 35.9 SD 9.85 years. Table 1 displays

Table 1: Age distribution of study patients

Age (years)	*Frequency*	*Percentage*
20–29	15	30
30–39	16	32
40–49	15	30
50–59	4	8
Total	50	100
Mean SD (Range) = 35.9 SD 9.85 (21–59)		

Table 2: Distribution of study patients as per stone size (mm)

Stone size	*Frequency*	*Percentage*
14–15.9	9	18
16–17.9	20	40
18–19.9	13	26
≥20	8	16
Total	50	100
Mean SD (Range) = 17.3 SD 1.81 (14.2–21)		

Table 3: Distribution of study patients as per location of disease

Renal stone disease	*Frequency*	*Percentage*
Pelvic stones	28	56
Upper calyx stones	0	0
Lower calyx stones	14	28
Pelvic + lower calyx stones	8	16
Total	50	100

the distribution of patients across different age groups. The largest proportion, at 32% of the total, is within the age range of 30–39 years. Subsequently, the age group of 40–49 years accounts for 30% of the patient population. The study observed that a majority of patients, that is 62%, were identified as males. Additionally, it was found that 54% of the patients had involvement of the right kidney. The average stone size observed in our research cohort was 17.3 SD 1.81 mm, ranging from 14.2 to 21 mm. Table 2 reveals that a significant proportion of patients, that is 40%, had stone sizes within the range of 16–17.9 mm.

Table 3 shows the presence of pelvic stones in 28 patients, accounting for 56% of the total sample. Additionally, lower calyx stones were seen in 14 individuals, representing 28% of the sample.

The vast majority of patients, that is 88%, had symptoms related to their condition. The average duration of the surgical procedure in our research was 83.6 SD 16.95 minutes. The range of operating times observed was from 60 to 115 minutes. A nephrostomy was inserted *in situ* in 84% of the patients, with a mean length of 2.1 days (SD 0.35) ranging from 2 to 3 days.

The assessment of postoperative pain was conducted using the visual analogue scale (VAS) score. The patients were explained the VAS scoring system and then were asked to read their pain depending on the severity. Scores were calculated at postoperative day of 1st, 2nd, and 3rd. The average VAS score for pain in our research was 4.07 on day 1, 2.73 on day 2, and 1.67 on day 3; the average consumption of Tramadol (in milligrams) was 236.0 SD 120.81. There was no operation-related mortality in our study.

Table 4: Distribution of study patients as per complications

Complication	*No.*	*Percentage*
Hemorrhage	1	2
Pelvic perforation	1	2
Colonic injury	0	0
Pleural injury	0	0
Converted to prone	2	4
Postop fever	2	4
Need of auxiliary treatment	3	6
Delayed hematuria	1	2
Total	10	20

The average duration of hospitalization for our patients was 3.7 SD 1.15 days. Approximately, 52% of the patients had a hospital stay ranging from 2 to 3 days. Need of auxiliary treatment was the major complication in 3 (6%) patients, followed by conversion to prone position and postoperative fever, in 2 (4%) patients each as shown in Table 4. Out of total 50 patients, success was achieved in 45 (90%) patients as 6% required auxiliary treatment and 4% were converted to prone position.

Discussion

In order to address the challenges associated with the prone position, many adaptations have been documented, such as the prone split-leg position, reverse lithotomy posture, and lateral decubitus. However, the popularity of these modifications has diminished with time.[9,10]

The supine posture has several benefits. Firstly, it reduces the tediousness of the process, making it more acceptable for the patient. This, in turn, may enable the use of lower amounts of anesthetics. Additionally, there is quicker access to the airway, which may be especially beneficial for patients with reduced cardiopulmonary function or those undergoing lengthy procedures. Consequently, making it a safer option in certain clinical scenarios. Moreover, in cases where it is deemed necessary, the use of the supine posture enables the simultaneous implementation of PCNL and ureteroscopy as a means of effectively controlling intricate stone disease.[10] The safety of this approach has been shown in obese people as well.[11]

Our research included a sample size of 50 patients. The statistical analysis included examining many factors like age, gender, disease laterality, symptomatology, stone size, mean surgical time, nephrostomy status, success rate, complications, postoperation discomfort, and hospital stay.

The average age of participants in our research was 35.9 SD 9.85 years. Majority of our patients, i.e., 16 (32%) belonged to age group of 30–39 years. Comparable age groups were studied by Desoky et al.,[8] Nour et al.,[12] and Miçooğulları et al.[13] with mean age of 40.8, 38.8, and 41.8 years, respectively.

In this conducted research, it was observed that 31 individuals, accounting for 62% of the whole sample, were identified as males, while 19 individuals, representing 38% of the total sample, were identified as females. Comparable results of gender distribution were shown by Wang et al.[14] with 66% were identified as men while 34% were identified as females, resulting in a male to female ratio of 8:4. In our study, 27 (54%) patients had stones on right side while as 23 (46%) had it on left side. Comparable results were shown

by Neto et al.[15] who reported that 40 and 38 of their patients had stones on right and left sides; In their research, Wang et al.[14] also documented the presence of stone laterality, with 31 patients exhibiting right side stones and 29 patients exhibiting left side stones. In our study, average stone was 17.3 SD 1.81 mm. A total of 20 (40%) of our study patients had 16–17.9 mm stone size, followed by 13 (26%) patients with stone size of 18–19.9 mm. A stone size of 14–15.9 mm was seen in 9 (18%) patients while as ≥20 mm stone was observed in 8 (16%) patients.

Out of 50 patients studied, pelvic stone was seen in 28 (56%) patients, 14 (28%) patients had lower calyx stone while as 8 (16%) patients had pelvic + lower calyx stones.

In our study, mean operative time was 83.62 SD 16.95 minutes with range of 60–115 minutes. Abdel-Mohsen et al.[16] and Valdivia et al.[5] reported the mean operating duration of 88 and 85 minutes, respectively. In our study, 2.1 days was the mean duration of nephrostomy with range of 2–3 days. Comparable results were shown by the study of Tefekli et al.[17] with mean duration of nephrostomy 2.4 days.

The assessment of postoperative pain in our research was conducted using the VAS score. The patients were explained the VAS scoring system and then were asked to read their pain depending on the severity. Scores were calculated at postoperative day of 1st, 2nd, and 3rd. The average VAS pain scores observed in our research were 4.07 on day 1, 2.73 on day 2, and 1.67 on day 3; the average consumption of Tramadol (in milligrams) was 236.0 SD 120.81.

In our study, overall complication rate was 20%. Wang et al.[14] and Abdel-Mohsen et al.,[16] in their study showed overall complication rate of 28.3, 20.5, and 17.9%, respectively. Three patients needed auxiliary treatment for residual stones. Extracorporeal shock wave lithotripsy (ESWL) was used in two patients who presented with residual stones larger than 4 mm located in an anatomically challenging calyx. The patient, who had a remaining stone measuring 8 mm in the upper calyx, had spontaneous passage of the stone prior to undergoing ESWL. Two patients were converted to prone PCNL due to difficulty in stone access. Two patients with fever >38°C responded to antibiotics and antipyretics. One patient with delayed hematuria was managed conservatively and does not require blood transfusion. The other less common complications observed in our study were hemorrhage (1, 2%), pelvic perforation (1, 2%) who too were responded to conservative management.

In the conducted research, the average duration of hospitalization was found to be 3.7 days SD 1.15 days. Majority of our patients, i.e., 26 (52%) needed hospitalization for 2–3 days. Comparable results of hospital stay were shown by Hoznek et al.[18] and Falahatkar et al.[19] with mean hospital stays of 3.4 and 3.2 days, respectively.

In a study by Perrella et al., no difference in success rate was observed between various positions of PCNL.[20] In our study, overall success rate was 90%. Wang et al.,[14] Falahatkar et al.,[19] and De Sio et al.,[21] have demonstrated a success rate 88.7, 80.0, and 77.5%, respectively. In our study, the stone size was the only factor determining the success rate of the patient who underwent PCNL. In follow-up, there was no operative-related mortality recorded.

Conclusion

Therefore, our research demonstrates that the use of FFMS PCNL surgery is a reliable and efficient method for achieving intrarenal access. This approach has shown a high rate of success and is associated with an acceptable level of morbidity and complications.

Orcid

Irshad Ahmad Kumar https://orcid.org/0000-0002-6451-5535

References

1. Modlin M. A history of urinary stone. S Afr Med J 1980;58(16):652–655. PMID: 6999641.
2. Goodwin WE, Casey WC, Wolf W. Percutaneous trocar (needle) nephrostomy in hydronephrosis. J Am Med Assoc 1955;157(11): 891–894. DOI: 10.1001/jama.1955.02950280015005.
3. Wolf JS Jr. Percutaneous approaches to the upper urinary tract collecting system. Campbell-Walsh Urology by Alan J Wein, Louis R Kavoussi, 11th Edition. pp. 153–182.
4. Autorino R, Giannarini G. Prone or supine: Is this the question? Eur Urol 2008;54(6):1216–1218. DOI: 10.1016/j.eururo.2008.08.069.
5. Valdivia UJG, Valle Gerhold J, Lopez JA, et al. Technique and complications of percutnaeous nephroscopy: Experience with 557 patients in the supine position. J Urol 1998;160(6.1):1975–1978. DOI: 10.1016/s0022-5347(01)62217-1.
6. De Sio M, Autorino R, Quarto G, et al. Modified supine versus prone position in percutaneous nephrolithotomy for renal stones treatable with single percutaneous access: A prospective randomized trial. Eur Urol 2008;54(1):196–202. DOI: 10.1016/j.eururo.2008.01.067.
7. Ray AA, Chung DG, Honey RJ. Percutaneous nephrolithotomy in prone and prone flexed positions: Anatomic considerations. J Endoruol 2009;23(10):1607–1614. DOI: 10.1089/end.2009.0294.
8. Desoky EAE, Allam MN, Ammar MK, et al. Flank free modified supine position: A new modification for supine percutaneous nephrolithotomy. Arab J Urol 2012;10(2):143–148. DOI: 10.1016/j.aju.2011.12.008.
9. Karami H, Arbab AH, Rezaei A, et al. Percutaneous nephrolithotomy with ultrasonography-guided renal access in the lateral decubitus flank position. J Endourol 2009;23(1):33–35. DOI: 10.1089/end.2008.0433.
10. Lehman T, Bagley DH. Reverse lithotomy, modified prone position for simultaneous nephroscopic and ureteroscopic procedures in women. Urology 1988;32(6):529–531. DOI: 10.1016/s0090-4295(98)90035-8.
11. Desoky E, Abd Elwahab KM, El-Babouly IM, et al. Outcomes of flank-free modified supine percutaneous nephrolithotomy based on BMI. Urol Int 2021;105(1–2):77–82. DOI: 10.1159/000511292.
12. Nour HH, Kamal AM, Ghobashi SE, et al. Percutaneous nephrolithotomy in the supine position: Safety and outcomes in a single-centre experience. Arab J Urol 2013;11(1):62–67. DOI: 10.1016/j.aju.2012.12.007.
13. Miçooğulları U, Kamacı D, Yıldızhan M, et al. Prone versus Barts "flank-free" modified supine percutaneous nephrolithotomy: A match-pair analysis. Turk J Med Sci 2021;51(3):1373–1379. DOI: 10.3906/sag-2011-21.
14. Wang Y, Hou Y, Jiang F, et al. Percutaneous nephrolithotomy for staghorn stones in patients with solitary kidney in prone position or in completely supine position: A single-center experience. Int Braz J Urol 2012;38(6):788–794. DOI: 10.1590/1677-553820133806788.
15. Neto EA, Mitre AI, Gomes CM, et al. Percutaneous nephrolithotripsy with the patient in a modified supine position. J Urol 2007;178(1): 165–168. DOI: 10.1016/j.juro.2007.03.056.
16. Abdel-Mohsen E, Kamel M, Zayed AL, et al. Free-flank modified supine vs. prone position in percutaneous nephrolithotomy: A prospective randomised trial. Arab J Urol 2013;11(1):74–78. DOI: 10.1016/j.aju.2012.11.002.
17. Tefekli A, Karadag MA, Tepeler K, et al. Classification of percutaneous nephrolithotomy complications using the modified Clavien grading

system: Looking for a standard. Eur Urol 2008;53(1):184–190. DOI: 10.1016/j.eururo.2007.06.049.
18. Hoznek A, Rode J, Quzaid I, et al. Modified supine percutaneous nephrolithotomy for large kidney and ureteral stones: Technique and results. Eur Urol 2012;61(1):164–170. DOI: 10.1016/j.eururo.2011.04.031.
19. Falahatkar S, Allahkhan A, Soltanipour S. Supine percutaneous nephrolithotomy: PRO. Urol J 2011;8(4):257–264. PMID: 22090042.
20. Perrella R, Vicentini FC, Paro ED, et al. Supine versus prone percutaneous nephrolithotomy for complex stones: A multicenter randomized controlled trial. J Urol 2022;207(3):647–656. DOI: 10.1097/JU.0000000000002291.
21. De Sio M, Autorino R, Quarto G, et al. Modified supine versus prone position in percutaneous nephrolithotomy for renal stones treatable with a single percutaneous access: A prospective randomized trial. Eur Urol 2008;54(1):196–203. DOI: 10.1016/j.eururo.2008.01.067.

ORIGINAL ARTICLE

A Study of Three-port Laparoscopic Appendectomy with Alternative Port Placement Technique

Sanjay R Chauhan[1], Ronak R Modi[2], Shakib Masu[3], Krunal Chandana[4], Chaitya Shah[5]

Received on: 25 August 2022; *Accepted on:* 27 October 2023; *Published on:* 11 January 2024

Abstract

Aim: To describe alternative port placement techniques for three-port laparoscopic appendectomy.

Background: Appendectomy remains to be the most accepted course of management for appendicitis. Alternative port placement technique described below aids the operating surgeon by providing a better working position and cosmesis.

Materials and methods: A total of 50 patients from July 2021 to July 2022 were admitted to the Surgical Department of Sheth LG General Hospital, AMC MET Medical College, who fulfilled predetermined criteria and underwent laparoscopic appendectomy with this technique of port placement using one umbilical camera port and two working ports in LIF and RIF, are included in this study.

Results: Of 50 patients, 28 males (56%) of mean age 24.33 (±3.25) years and 22 females (44%) of mean age 27.05 (±4.25) years were operated for laparoscopic appendectomy. In two patients (4%), appendectomy approach was converted to open.

Conclusion: This technique of three-port laparoscopic appendectomy is safe and does not require a significant learning curve. It allows better ergonomics for handling the appendix, especially for transfixation of the base without compromising good cosmesis.

Keywords: Appendicitis, Laparoscopic appendectomy, Port placement.

World Journal of Laparoscopic Surgery (2023): 10.5005/jp-journals-10033-1580

Introduction

Acute appendicitis is one of the most common gastrointestinal conditions encountered by general surgeons in emergency practice.[1] Although there are various researches into its conservative management, the most commonly accepted course of management remains to be appendectomy.[2]

Laparoscopic appendectomy is currently the most preferred method for appendectomy owing to better cosmesis, decreased surgical trauma, and complications, especially in obese patients.[3] Various modifications have been developed and proposed by various authors for laparoscopic appendectomy with respect to number of ports used, port placement, dissection method, and retrieval of the appendicular specimen.

Conventional laparoscopic appendectomy involves placement of three ports, one umbilical 10-mm port and two 5-mm ports in the suprapubic region and left lower quadrant.[4] While performing routine conventional laparoscopic appendectomy, the retrocecal position of the appendix could not be approached with ergonomic efficiency. In this study, we have described our experience with alternate port placement, as described below, practiced in 50 cases in pursuit of gaining better ergonomic advantage and cosmesis.

Materials and Methods

A total of 50 patients underwent laparoscopic appendectomy with this technique of port placement in the Surgical Department at Sheth LG General Hospital, AMC MET Medical College, from July 2021 to July 2022.

All patients were explained about the procedure and possibility of conversion to open. Informed and written valid consent was taken. Acute, subacute, and recurrent appendicitis patients were preferred, whereas patients with appendicular lumps were excluded. All appendicitis patients included in this study were categorized on the basis of age, duration of illness, and history of recurrence of pain. Intraoperative time, ergonomic advantage, and requirement of conversion to open as well as postoperative recovery, cosmesis, and complications were noted. Patients were followed up after discharge on an outpatient basis for a period of 21 days.

Technique

All patients underwent laparoscopic appendectomy under general anesthesia in the Trendelenburg position with the left arm tucked alongside the body. Catheterization was done in the selected patients. A single monitor was placed on the right side of the table and surgeon, with one assistant positioned on the left side. After sterile preparation of the abdomen exposed from the epigastrium to the pubis, pneumoperitoneum was created by insufflation of carbon dioxide at 12 mm Hg via Verres needle technique through the umbilicus. A 10-mm Trocar was inserted through the umbilicus, and a 0° laparoscope was introduced. Under visualization, two 5-mm working ports were created in LIF and RIF approximately 2 cm

[1–5]Department of General Surgery, Narendra Modi Medical College, Ahmedabad, Gujarat, India

Corresponding Author: Ronak R Modi, Department of General Surgery, Narendra Modi Medical College, Ahmedabad, Gujarat, India, Phone: +91 9825657821, e-mail: drronakmodi2404@gmail.com

How to cite this article: Chauhan SR, Modi RR, Masu S, *et al*. A Study of Three-port Laparoscopic Appendectomy with Alternative Port Placement Technique. World J Lap Surg 2023;16(3):142–144.

Source of support: Nil

Conflict of interest: None

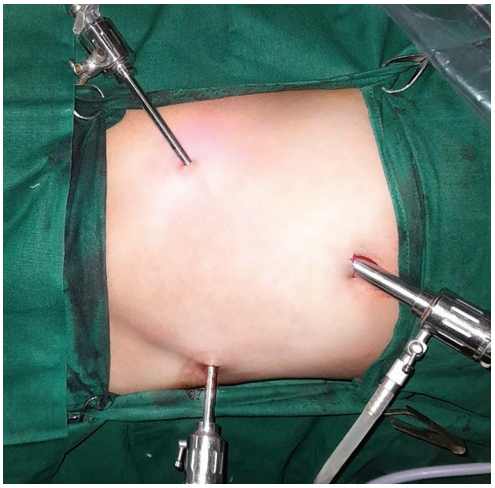


Fig. 1: Photograph showing alternative port placement of one 10-mm umbilical camera port and two 5-mm working ports in LIF and RIF

below the level of ASIS and just lateral to inferior epigastric vessels, as shown in Figure 1. The appendix was identified and lifted through the RIF port, and the mesoappendix was dissected up to the base of the appendix with monopolar cautery. Adequate hemostasis was achieved from the mesoappendix. The base of the appendix was then transfixed with a 2-0 polyglactin 910 (Vicryl) suture. The appendix was cut just distal to transfixation and delivered out through an umbilical 10-mm port by rail-roading technique.

Results

A total of 50 patients were operated on for laparoscopic appendectomy using the described port placement technique. From 50 patients, 28 patients (56%) were male of mean age 24.33 (±3.25) years and 22 patients were female (44%) with mean age 27.05 (±4.25) years. Two patients were converted to open appendectomy due to limited working space in one pediatric patient having dense intra-abdominal inflammatory adhesions with the presence of pus and dilated bowel loops and in another one, there were dense omental adhesions in LIF in case of situs inversus. Mean operative time was 25.6 minutes (±6.2) minutes. None of the patients developed any significant postoperative complications. All patients were satisfied with the cosmetic results on follow-up postop day 14.

Discussion

The appendix was first described by Berengario da Carpi in 1522, and the first successful appendectomy was performed by Claudius Amyand in 1735.[3] Since then, various incisions of open appendectomy have been described by various authors, the most commonly practiced being oblique muscle splitting incision in RIF described by Charles McBurney in 1893.[5] However, open appendectomy scars had to be carried throughout life, especially in young patients, particularly of the adolescent age group. That is why the introduction of laparoscopic appendectomy by Kurt Semm for the first time in 1980[6] opened many possibilities of minimally invasive approaches to appendectomy. From traditional three-port laparoscopic appendectomy (TPLA), we now have single-incision laparoscopic surgery (SILS) and natural orifice transluminal endoscopic surgery (NOTES) appendectomy.

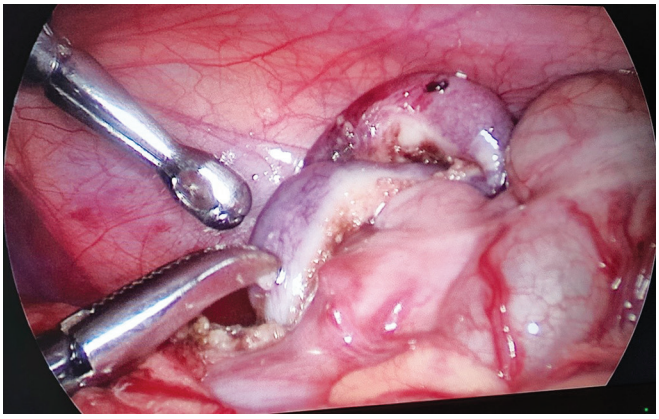


Fig. 2: Intraoperative photograph showing the working angle between Babcock's forceps through the LIF port and Maryland's forceps through the RIF port

However, considering limited facilities and technical expertise, SILS and NOTES appendectomy have not been able to replace TPLA in India yet.

While performing conventional TPLA, which involves one umbilical 10-mm port and two ports in the suprapubic region and LIF, we faced limited space and working angle between instruments through the suprapubic port and LIF port, especially in thin and lean patients and in pediatric patients. Due to limited working space, instrumental swording was commonly encountered in those patients.

In order to achieve better ergonomics, we decided to place working ports in LIF and RIF, which provided a wider working angle and better instrumentation as shown in Figure 2. During dissection of the mesoappendix facing the lateral wall, as in the retrocecal appendix, chances of injury to the cecum and bowel loops from electrocoagulation were more through the LIF port. In those cases, we were able to interchange working hands allowing us to use RIF for dissection of the mesoappendix while lifting the appendix through the LIF port. However, in prolonged operations as in difficult cases or when the surgeon is performing multiple surgeries in the same session, shoulder fatigue happens due to the crossing of arms from the left side of patient's midline.[7]

In conventional TPLA, the base of the appendix can easily be ligated using Roeder's knot, but when we wanted to transfix the base of the appendix, those ports did not provide good ergonomics. Consequently, in our study with alternative port placement, LIF and RIF ports gave better instrumental mobility for suturing, as shown in Figure 3. For removal of appendicular specimens, delivery through a 10-mm umbilical port could easily be performed.

However, in cases where the cecum and appendix were situated more caudally in the pelvis, we faced difficulty in retraction with Babcock's forceps via the RIF port. In those cases, after identifying the location of the cecum, omentum, and bowel, they were displaced cranially using Atraumatic Bowel Grasper from the LIF port allowing better retraction of the appendix with Babcock's forceps from the RIF port.

In our study, peak incidence of appendicitis was found in young patients of 20–29 years age group, so cosmesis was important. Upon observing cosmesis up to day 21, patients were satisfied with the cosmesis achieved as 5-mm scars were found to be minimal and could be easily hidden by clothing.

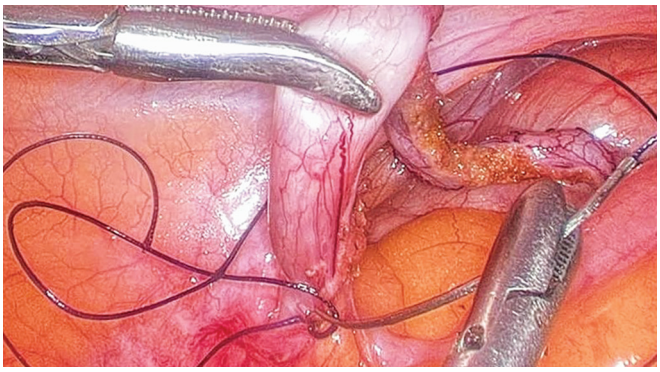


Fig. 3: Intraoperative photograph of endosuturing for transfixation of the base of the appendix

Our technique described above is simple and does not require any additional training than basic laparoscopic skills. Moreover, it can be performed at any hospital without the requirement of any additional instrument other than the basic instruments required in conventional TPLA. It can be used for any age group at any stage of appendicitis and even in perforated appendicitis, especially in females who require any additional pelvic procedure coexisting with the presence of appendicitis.

Conclusion

The laparoscopic appendectomy technique with LIF and RIF working ports is reproducible and provides an effective working position to surgeons by allowing better triangulation as shown in Figure 2. Instrumentation aiding in transfixation of the base of the appendix without compromising safety while achieving good cosmetic results is another advantage, as shown in Figure 3. However, a comparative study and randomized controlled trial would be required to confirm our findings.

References

1. Ferris M, Quan S, Kaplan BS, et al. The global incidence of appendicitis: A systematic review of population-based studies. Ann Surg 2017;266(2):237–241. DOI: 10.1097/SLA.0000000000002188.
2. Lewis FR, Holcroft JW, Boey J, et al. Appendicitis. A critical review of diagnosis and treatment in 1000 cases. Arch Surg 1975;110(5): 677–684. DOI: 10.1001/archsurg.1975.01360110223039.
3. Dasari BV, Baker J, Markar S, et al. Laparoscopic appendicectomy in obese is associated with improvements in clinical outcome: Systematic review. Int J Surg 2015;13:250–256. DOI: 10.1016/j.ijsu.2014.11.052.
4. Semm K. Endoscopic appendectomy. Endoscopy 1983;15(2):59–64. DOI: 10.1055/s-2007-1021466.
5. Meljnikov I, Radonjic B, Grebe dinger S, et al. History of surgical treatment of appendicitis. Med Pregl 2009;62(9–10):489–492. PMID: 20391748.
6. Panait L, Bell RL, Duffy AJ, et al. Two-port laparoscopic appendectomy: Minimizing the minimally invasive approach. J Surg Res 2009;153(1):167–171. DOI: 10.1016/j.jss.2008.02.003.
7. Masu S, Mukadam P. Laproscopic appendicectomy various modification in techniques. Indian J Appl Res 2014;4(5):1–3. DOI: 10.36106/ijar.

ORIGINAL ARTICLE

Paradigm Shift in the Management of Benign Pelvic Neurogenic Tumors: A Single Institution Experience

Subbiah Shanmugam[1], Pravenkumar RR[2]

Received on: 26 August 2023; *Accepted on*: 28 October 2023; *Published on*: 11 January 2024

Abstract

Background and objective: Benign neurogenic tumors are relatively rare in the pelvis and are mostly benign. These tumors are in proximity to multiple structures given the bony confines of the pelvis and its complex anatomy, thus making it a surgical challenge. From the conventional open surgical approach, we have moved on to laparoscopic excision. We sought to analyze the outcomes of surgical excision of such tumors.

Materials and methods: Data of patients who underwent excision of benign pelvic neurogenic tumors either by open or laparoscopic surgery at our institution between 2016 and 2022 were reviewed and analyzed.

Results: A total of seven patients underwent surgery, four by laparotomy and three by laparoscopy. Six patients had tumors located in the presacral space, and one was found in the lateral wall of the pelvis. The mean operative time was less in laparoscopy (140 vs 125 minutes), with a mean blood loss of 100 (90–110) mL. The mean duration of hospital stay was less in laparoscopy (7 vs 4 days). Three patients of open surgery had postoperative complications whereas no complications occurred after laparoscopy. Postoperative pathological examinations showed three schwannomas and four neurofibromas. No patient experienced local recurrence during a mean follow-up period of 30 months.

Conclusion: Laparoscopy is a feasible alternative approach to open surgery for resection of pelvic neurogenic tumors with the advantages of better visualization and preservation of pelvic neurovascular structures, minimal operative morbidity, lesser postoperative pain, and shorter hospital stay.

Keywords: Laparoscopic excision, Neurofibroma, Pelvic malignancy, Pelvic neurogenic tumors, Presacral neurofibroma, Presacral schwannoma, Presacral tumors, Schwannoma.

World Journal of Laparoscopic Surgery (2023): 10.5005/jp-journals-10033-1595

Introduction

Malignant peripheral nerve sheath tumors, ganglioneuromas, schwannomas, neurofibromas, ganglioneuroblastomas, neuroblastomas, and ependymomas are included in the spectrum of neurogenic tumors. The most frequent benign tumor in the Mayo Clinic series of neurogenic pelvic tumors was schwannomas, while the most common malignant lesions were malignant peripheral nerve sheath tumors. Most neurofibromas and schwannomas are nonaggressive, slow-growing tumors. Histologically, schwannoma is a more homogeneous neoplastic growth of mature Schwann cells as opposed to neurofibroma and MPNST. Schwannomas are quite uncommon in the pelvis and are typically found in the head and neck, mediastinum, and extremities. Most patients have minor, nonspecific symptoms or are asymptomatic. Urinary retention, intestinal obstruction, and pelvic pain are all possible effects of large tumors. Lately, there has been a significant rise in the detection rates of these tumors due to incidental discovery by imaging for various reasons. Typically, benign schwannomas and neurofibromas are encapsulated, single, well-circumscribed tumors and malignant transformation rarely occurs. It can be difficult to distinguish between benign and malignant neurogenic tumors before surgery with imaging alone. So preoperative biopsy is paramount for the surgical strategy and approach.[1]

Because of the intricate anatomy and bony constraints of the pelvis, and the tumors being in proximity to pelvic viscera, it presents a surgical challenge. Conventionally, these tumors are excised by an open approach. According to Woodfield's algorithm, tumors below the S3 vertebral level should be operated by a combined open anterior-posterior approach or posterior approach alone.[2] Laparoscopy has refuted this algorithm and helps in the excision of large tumors located below S3. With our experience of using laparoscopy in gynaecological and rectal cancer surgery, we have shifted our operative approach for such tumors from open to laparoscopy.

[1]Department of Surgical Oncology, Kilpauk Medical College; Government Royapettah Hospital, Chennai, Tamil Nadu, India

[2]Department of Surgical Oncology, Government Royapettah Hospital, Chennai, Tamil Nadu, India

Corresponding Author: Subbiah Shanmugam, Department of Surgical Oncology, Kilpauk Medical College; Government Royapettah Hospital, Chennai, Tamil Nadu, India, Phone: +91 9360206030, e-mail: subbiahshanmugam67@gmail.com

How to cite this article: Shanmugam S, Pravenkumar RR. Paradigm Shift in the Management of Benign Pelvic Neurogenic Tumors: A Single Institution Experience. World J Lap Surg 2023;16(3):145–148.

Source of support: Nil

Conflict of interest: None

Materials and Methods

Patients

Data of patients who underwent excision of benign pelvic neurogenic tumors either by open or laparoscopic surgery at our institution between 2016 and 2022 were reviewed and analyzed.

The demographic data were collected. Symptoms, radiological characteristics, tumor location, and size were analyzed. Few patients

Fig. 1: Laparoscopic ports

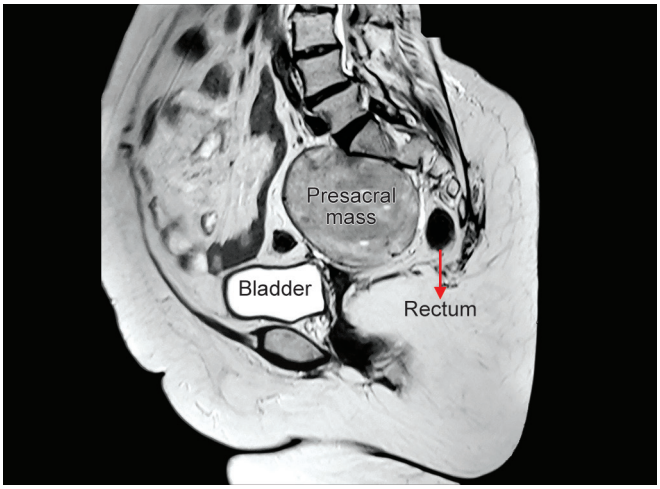


Fig. 2: MRI showing presacral tumor

required a biopsy. Data about surgical approach, operative time, blood loss, complications (Clavien-Dindo), duration of hospital stay, and recurrence were collected and analyzed.

Surgical Procedure

After preoperative bowel preparation, patients were placed in a low lithotomy position and bladder catheterized. In the open anterior approach, a lower midline incision was used and after the incision of the pelvic peritoneum, taking into consideration the anatomical spaces (retrorectal space and pararectal space), ureters, iliac vessels and its branches, hypogastric plexus/nerves, and presacral venous plexus were preserved while carefully dissecting the mass from fascia propria and presacral fascia. Tumors were completely excised. In laparoscopy, five ports were used similar to gynecological or rectal surgery (Fig. 1). A 30-degree telescope was used and a harmonic scalpel was the energy source. Dissection was similar to open surgery and a specimen was placed in an endobag and retrieved through a small suprapubic incision (Figs 2 and 3). The procedure was performed by a senior surgeon with expertise in advanced laparoscopic cancer surgery.

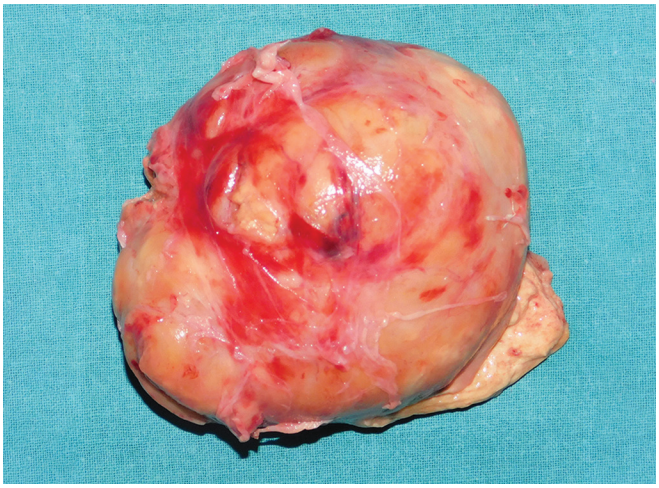


Fig. 3: Laparoscopically excised tumor

Results

Patient and Tumor Characteristics, Imaging, and Biopsy

Seven patients were operated in this period. There were three males and four females, with a mean age of 58. Only two patients were symptomatic with defecation difficulty and urinary retention. The others were incidentally detected by imaging. The mean size was 9 cm (8–11 cm) and all of them were in the retrorectal space except for one tumor which was in the lateral pelvic wall. Four patients were operated by open surgery and three by laparoscopy. Recently, our approach had shifted to laparoscopy except for a case that was operated by open approach due to previous open abdominal surgery and adverse comorbid condition. CT/MRI was mostly confirmatory of benign solid tumor. Tumors were homogeneous and well encapsulated. Two cases had suspicious imaging features of a malignant tumor. Image-guided trans gluteal/sacral approach biopsy was done and both were reported as a benign neurogenic tumor.

Surgical Procedure, Complications, and Postoperative Course

With a mean blood loss of 100 (90–110 mL), laparoscopy required less operative time (125 vs 140 minutes) compared to open surgery. After a laparoscopy, the average length of hospital stay was shorter (4 vs 7 days). Three patients of open surgery had postoperative complications whereas no complications occurred after laparoscopy. One patient had a surgical site infection which settled with IV Antibiotics. Another patient had urinary retention which took 6 months to settle. One patient had significant intraoperative blood loss. Postoperative pathological examination showed three schwannomas and four neurofibromas. During a mean follow-up period of thirty months, no patient reported a local recurrence. The results are summarized in Tables 1 and 2.

Discussion

In the context of pelvic surgery, laparoscopy is frequently employed, particularly for benign and malignant gastrointestinal and gynecological tumors. Regarding the scientific validity of this

Table 1: Summary of all patients

S.No.	Age, Sex	Symptom	Location	Size (cm)	Approach	Operative time (min)	Blood loss (mL)	Complications	Duration of hospital stay (days)	Postop HPE
1	48, F	Asymptomatic	Retrorectal	8	Open	148	250	Wound infection	8	Neurofibroma
2	58, F	Defecation difficulty	Retrorectal	9	Open	139	260	Urinary retention	7	Neurofibroma
3	60, M	Asymptomatic	Lateral pelvic wall	7	Open	132	190	Nil	6	Schwannoma
4	64, M	Urinary retention	Retrorectal	10	Lap	118	110	Nil	5	Neurofibroma
5	54, F	Asymptomatic	Retrorectal	9	Lap	125	90	Nil	3	Schwannoma
6	62, M	Asymptomatic	Retrorectal	11	Open	141	600	Bleeding	7	Neurofibroma
7	57, F	Asymptomatic	Retrorectal	10	Lap	132	100	Nil	4	Schwannoma

Table 2: Surgical outcomes

Analysis	Open surgery	Laparoscopic surgery
Mean operative time (min)	140	125
Mean blood loss (mL)	325	100
Mean duration of stay (days)	7	4
Complications	3/4 patients	Nil
Recurrence	Nil	Nil

method for treating retro rectal tumors, opinions differ. There are not many studies in the literature; the majority are case reports and case series.[3,4] A magnified and clear view of the pelvic viscera is one benefit of laparoscopy. Better visualization of the small surgical field is made possible by the 30° scope, particularly in the case of a narrow male pelvis. The pneumoperitoneum aids in the dissection of retroperitoneal space (retrorectal/pararectal). Better exposure to the operation field, improved anatomical details, decreased chance of unintentional tumor spillage, and reduced colon manipulation are all made possible by laparoscopy. These factors translate into better visualization and preservation of neurovascular structures, less intraoperative blood loss, minimal operative morbidity, and shorter duration of hospital stay.

In open surgery, there was significant blood loss in one case due to inadvertent injury to the presacral venous plexus. One case had prolonged postoperative urinary retention which took six months to settle. Our study shows laparoscopic approach has less blood loss, less operative time, shorter duration of hospital stay, and no complications compared to open surgery. Our results are similar to that of the case series by Nedelcu et al. and Zhou et al.[5,6]

Our experience in laparoscopic rectal and gynecological cancer surgery made us shift our approach toward these benign neurogenic tumors. Based on our observations, we think that a surgeon who chooses to treat these lesions with laparoscopy needs to have the necessary expertise since the surgeon's proficiency with laparoscopic dissection of this area enables them to treat lesions that are below the S3–S4 level. The two major complications are inadvertent rectal wall opening and neurovascular injuries. We have not encountered these in our limited experience.

There is no cut-off point to determine which approach (open or laparoscopic) is best, although research indicates that lesion size can complicate the procedure. To remove the specimen during laparoscopic surgery, we made a little incision across the suprapubic area. In laparoscopic surgery, we used a small suprapubic incision to extract the specimen. The largest lesion size to have been safely removed laparoscopically as per literature stands at 11 cm.[6] In our study, the largest laparoscopically excised lesion measured 11 cm. A laparoscopic procedure is generally recommended only for benign tumors.

Deng et al. have shown that laparoscopy is a feasible approach for pelvic schwannomas.[7] Our results also show that laparoscopy is a feasible approach for benign neurogenic tumors. Owing to the complexity and specific location of the tumor, the surgical approach must be tailored based on patient factors, the characteristics of the tumor, and the surgeon's expertise.

Conclusion

Laparoscopy is a feasible alternative approach to open surgery for the resection of benign pelvic neurogenic tumors with the advantages of better visualization of pelvic viscera and preservation of pelvic neurovascular structures thereby reducing operative morbidity and discomfort, and shorter hospital stay.

Orcid

Subbiah Shanmugam https://orcid.org/0000-0001-5289-3953
Pravenkumar RR https://orcid.org/0000-0002-6032-183X

References

1. Eric J. Dozois Shackelfords surgery of the alimentary tract. Retrorectal tumors: Elsevier: 8th edition, Vol 2, Chapter 174. pp. 2103–2116.
2. Woodfield JC, Chalmers AG, Phillips N, et al. Algorithms for the surgical management of retro rectal tumours. Br J Surg 2008;95(2):214–221. DOI: 10.1002/bjs.5931.
3. Imboden S, Al-Fana A, Kuhn A, et al. Pandora's box and retrorectal tumors in laparoscopy: A case report and review of the literature. Int J Surg Case Rep 2014;5(10):706–709. DOI: 10.1016/j.ijscr.2014.08.012.

4. Hernández Casanovas MP, Martinez MC, Bollo J, et al. Laparoscopic approach for retrorectal tumors – Results of a series of 11 cases. Ann Laparosc Endosc Surg 2017;2(8):126. DOI: 10.21037/ales.2017.07.10.
5. Nedelcu M, Andreica A, Skalli E, et al. Laparoscopic approach for retrorectal tumors. Surg Endosc 2013;27:4177–4183. DOI: 10.1007/s0046401330171.
6. Zhou J, Zhao B, Qiu H, et al. Laparoscopic resection of large retrorectal developmental cysts in adults: Singlecentre experiences of 20 cases. J Min Access Surg 2020;16(2):152–159. DOI: 10.4103/jmas.JMAS_214_18.
7. Deng C, Wang P, Liu Y, et al. Laparoscopic resection of pelvic schwannomas: A 9-year experience at a single center. World Neurosurg X 2022;17:100150. DOI: 10.1016/j.wnsx.2022.100150.

ORIGINAL ARTICLE

Are We Justified in Giving Single-dose Preoperative Antibiotic Prophylaxis for Elective Laparoscopic Cholecystectomy?

Yash Thareja[1], Vijayendra Kedage[2], Badareesh Lakshminarayana[3]

Received on: 19 August 2023; *Accepted on*: 04 September 2023; *Published on*: 11 January 2024

Abstract

Aim: To determine the difference in the rate of surgical site infection (SSI), duration of hospital stay, and cost of treatment in single-dose (SD) (2 gm cefazolin) vs multiple dose (MD) antibiotic prophylaxis in elective laparoscopic cholecystectomy.

Study design: Single-center prospective observational cohort study – 160 patients (80 in each arm).

Place and duration of study: Surgical Department, Kasturba Hospital, Manipal, India, from Jan 2021 to July 2022

Materials and methods: Patients of both genders age >18 years, irrespective of their comorbidity status were selected if they fulfil the eligibility criteria. They were described about the nature of the study and written consent was taken if they were willing to take part in the study and placed in their respective groups based on the antibiotic, they received according to the operating surgeon (SD grouped received SD of Cefazolin 2 g before surgery, MD received MD of antibiotics). All the surgical procedures were carried out as regular standard of care. All patients were followed up for 1 month and data was collected regarding their hospital stay, final bill and SSI.

Results: There is no significant difference in the rate of surgical wound infections between SD (cefazolin 2 g) and MD antibiotic prophylaxis for elective laparoscopic cholecystectomy ($p = 0.216$). The single-dose group had a slightly shorter length of hospital stay (0.48 days) ($p = 0.278$) and a significant difference in the cost of hospitalization (Rs 7,756) ($p = 0.001$).

Conclusion: When it comes to preventing SSIs after laparoscopic cholecystectomy, prophylaxis with an SD of cefazolin 2 g is equally effective as MDs of antibiotic prophylaxis. Moreover, the SD regime has the advantage of a comparatively shorter hospital stay as well as lower treatment costs for the patient.

Keywords: Antibiotic prophylaxis, Cefazolin, Hospital cost, Hospital stay, Laparoscopic cholecystectomy, Prophylaxis, Surgical site infection, Wound infection.

World Journal of Laparoscopic Surgery (2023): 10.5005/jp-journals-10033-1590

Introduction

One of the most common surgeries performed globally is laparoscopic cholecystectomy, used for the removal of the gallbladder. It was first performed on September 12, 1985, by Prof. Erich Muehe, MD, in Boeblingen, Germany.[1] This method has mostly replaced open cholecystectomy as the gold standard for treating gallstone disease.[2–8] Annually, for every 100,000 people worldwide, approximately 115 patients undergo cholecystectomy for benign gallbladder disease.[9] Symptomatic gallstone disease, acute cholecystitis, and gallstone pancreatitis are among the most common indications.[10] Laparoscopic cholecystectomy is associated with an extremely low incidence of postoperative infections compared to open cholecystectomy. The average wound infection rate ranged between 0.4 and 1.1%.[11]

Multiple dose (MD) antibiotics are thought to provide better protection for the patient, but they also burden the patient with additional costs and a longer hospital stay. Although single-dose (SD) antibiotic prophylaxis is beneficial to the patient in terms of cost-effectiveness or hospital stay, physicians prefer MDs of antibiotics for fear of potential future complications. Moreover, unnecessary use of antibiotics leads to increase chances of drug resistance.

Most studies in the literature did not differentiate between SD and MD antibiotics for prophylaxis in laparoscopic cholecystectomy based on hospital stay and cost of treatment.

[1–3]Department of General Surgery, Kasturba Medical College, Manipal Academy of Higher Education, Manipal, Karnataka, India

Corresponding Author: Vijayendra Kedage, Department of General Surgery, Kasturba Medical College, Manipal Academy of Higher Education, Manipal, Karnataka, India, Phone: +91 9844680445, e-mail: vijayendra.kedage@manipal.edu

How to cite this article: Thareja Y, Kedage V, Lakshminarayana B. Are We Justified in Giving Single-dose Preoperative Antibiotic Prophylaxis for Elective Laparoscopic Cholecystectomy? World J Lap Surg 2023;16(3):149–152.

Source of support: Nil

Conflict of interest: None

Aims and Objectives

Aim

To observe the effects of SD vs MD antibiotics for prophylaxis in laparoscopic cholecystectomy.

Objective

Primary: To determine the difference in rate of length of hospital stay, cost of treatment. Secondary: To determine the difference in rate of surgical site infection (SSI) (superficial, deep and organ/space) in two groups.

Materials and Methods

Type of Study: Single-center prospective observational cohort study 160 patients. In which 80 in SD group and rest 80 in MD group (non-randomized, as per preference of surgeon).

Study Period: Jan 2021 to July 2022

Tools Used: Pro forma

Statistical Method

- For SSI → Chi-Square test
- For Cost of treatment → Mann–Whitney *U*-test
- For Hospital stay → Mann–Whitney *U*-test

Inclusion Criteria

- All adult (>18 years of age) patients undergoing elective laparoscopic cholecystectomies and are willing to participate in study.

Exclusion Criteria

- Patients who are unwilling to participate in study.
- Patients who had their surgeries converted to open procedure.
- Patients operated for acute cholecystitis on emergency basis.
- Patients operated ERCP for CBD stone extraction.

Detailed Description of Procedure

Patients were selected after fulfilling the eligibility criteria.

They were described about the nature of the study and written consent was taken. All the surgical procedures were carried out as per regular standard of care.

Patients were selected into either group (SD or MD group)

- Single-dose group: Cefazolin 2 gm, 60 min before incision.
- Multiple dose group: As per the discretion of the surgeon performing the procedure.

They were advised for a follow up visit at 1 week to 10 days which coincides with suture removal. Followed by telephonic interview at 30th day.

During all this period they were monitored for →
Surgical site infection (superficial, deep, and organ/space)

- Superficial → Purulent discharge, pain/tenderness, localized swelling, redness
- Deep → Purulent discharge, pus collection, wound gapping
- Organ/space → Intra-abdominal collection

Observations

The study included 160 participants who were divided into two groups based on the antibiotic given to the patient by the operating surgeon: SD and MD.

Demographic Distribution

The study population consisted of 94 females and 66 males, and the ratio of females to males was 1.42:1, showing that females predominate in patients undergoing laparoscopic cholecystectomy (Table 1).

The mean age of male patients was 50.59 years, compared with 42.27 years for females, with males having a longer hospital stay, higher treatment costs, and higher antibiotic costs.

Table 1: Demographic distribution, OT duration, hospital stay

Sex	*Age (years)*	*OT duration (min)*	*Hospital stay (days)*	*Total cost (Rs)*	*Antibiotic cost (Rs)*
Male	50.59	133.48	4.12	52635	1940
Female	42.27	112.37	3.64	48107	1106

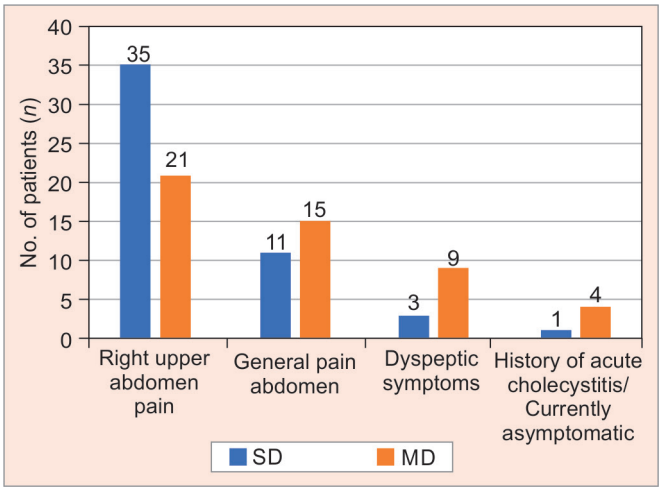


Fig. 1: Presenting symptoms

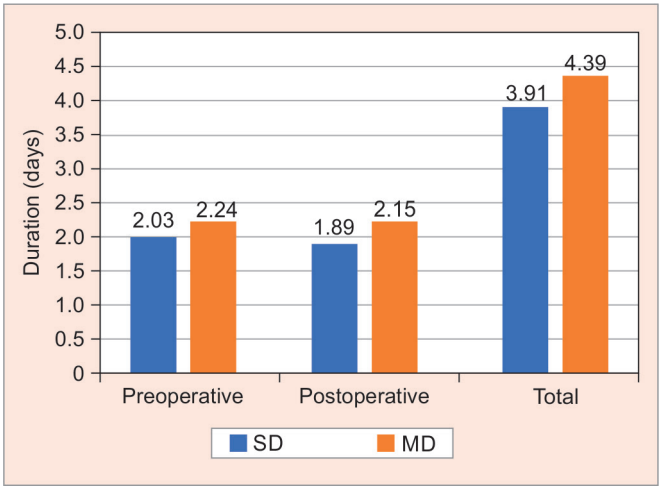


Fig. 2: Length of stay in both the groups

Presenting Symptom

The most common presenting symptom was pain in the right upper abdomen (35%), with an average duration of symptoms of 4.25 months (Fig. 1).

Length of Hospital Stay

The average length of stay in the hospital was 4.15 days as shown in Figure 2 (patients in the SD group had a slightly shorter length of stay than those in the MD group, 3.91 days vs 4.39 days; the *p*-value for this comparison was 0.278, which does not indicate statistical significance).

Hospital Expenses

The cost of hospitalization was 50,555.25 rupees on average (Fig. 3), with the SD group having an average cost of 46,677.08 rupees

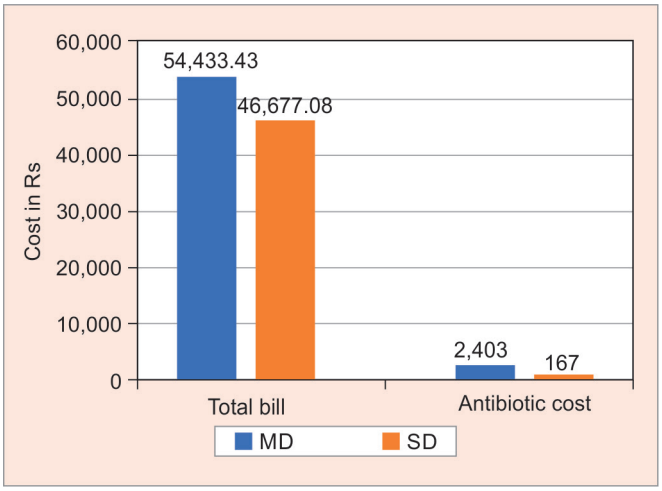


Fig. 3: The cost of antibiotics and total cost between the groups

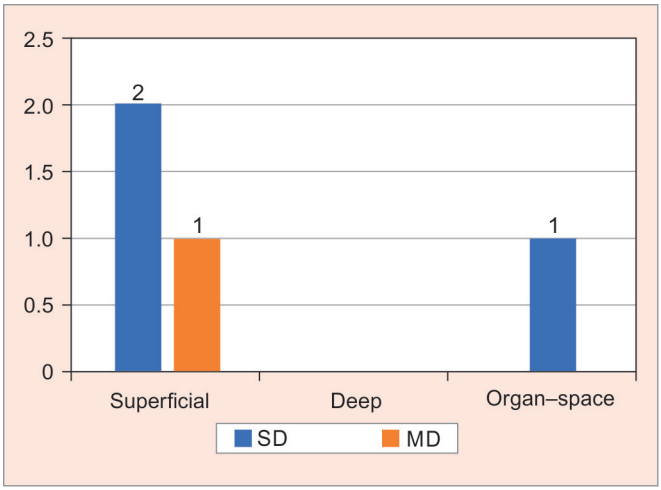


Fig. 4: Distribution of surgical site infection between the groups

and the MD group having an average cost of 54,433.43 rupees, which is a difference of 7,756.35 rupees ($p = 0.001$, which is highly significant). Taking into account that the average price difference between the SD group and the MD group for an antibiotic is Rs 167 in the SD group and Rs 2403 in the MD group, this results in a total of Rs 2,236. The additional cost apart from antibiotic cost, i.e., 5,520.35 rupees (7756.35–2236) could be due to the increased cost of the instruments that are used to administer the antibiotic, in addition to the lengthened length of stay in the hospital required for patients who require MDs of antibiotic prophylaxis following surgical procedures.

Surgical Site Infection

There were a total of 160 patients who underwent laparoscopic cholecystectomy, and 4 of them developed SSI. This results in a rate of SSI of 2.5% overall (Fig. 4). Because three of the participants who developed SSI belonged to the SD group and one of the participants who developed SSI belonged to the MD group, the SSI rate in the SD group was 3.75% and the SSI rate in the MD group was 1.8%. Two of the participants in the SD group who experienced SSI had superficial SSI, while the other participant experienced SSI in the organ space. Only one of the participants in the MD group ended up developing SSI (superficial). The difference in SSI between the two groups did not reach the level of statistical significance required to be considered significant ($p = 0.216$).

Table 2: Length of hospital stay and cost comparison

Study group	*Total cost (Rs) ($p = 0.001$) (HS)*	*Length of hospital stay (days) ($p = 0.278$)*	*SSI N (%) ($p = 0.216$)*
SD	46,677.08	3.91	3 (3.75%)
MD	54,433.43	4.39	1 (1.25%)

Results

- The length of hospital stay in SD was 3.91 days as compared to 4.39 days in MD group which was not statistically significant ($p = 0.278$).
- The total cost of treatment in SD was 46677.08 Rs as compared to 54433.43 Rs in MD group and the cost difference was statistically significant ($p = 0.001$) (Table 2).
- The SSI rate in SD was 3.75% and in MD was 1.25% (average SSI rate 2.5%), the difference was not statistically significant ($p = 0.216$).

Conclusion

When it comes to preventing SSIs after laparoscopic cholecystectomy, prophylaxis with an SD of cefazolin 2 g is equally effective as MDs of antibiotic prophylaxis. Moreover, the SD regime has the advantage of a comparatively shorter hospital stay as well as lower treatment costs for the patient.

Orcid

Yash Thareja https://orcid.org/0009-0001-6691-6447
Vijayendra Kedage https://orcid.org/0000-0001-7691-7104
Badareesh Lakshminarayana https://orcid.org/0000-0002-0762-0427

References

1. W Reynolds Jr. The first laparoscopic cholecystectomy. J Soc Laparoendosc Robot Surg 2001;5(1): 89–94. PMID: 11304004.
2. Evers L, Bouvy N, Branje D, et al. Single-incision laparoscopic cholecystectomy versus conventional four-port laparoscopic cholecystectomy: A systematic review and meta-analysis. Surg Endosc 2017;31(9):3437–3448. DOI: 10.1007/s00464-016-5381-0.
3. Yang J, Gong S, Lu T, et al. Reduction of risk of infection during elective laparoscopic cholecystectomy using prophylactic antibiotics: A systematic review and meta-analysis. Surg Endosc Springer 2021;35(12):6397–6412. DOI: 10.1007/s00464-021-08658-w.
4. Liang B, Dai M, Zou Z. Safety and efficacy of antibiotic prophylaxis in patients undergoing elective laparoscopic cholecystectomy: A systematic review and meta-analysis. J Gastroenterol Hepatol (Australia). 2016;31(5):921–928. DOI: 10.1111/jgh.13246.
5. Krishna A, Bansal VK, Gupta S, et al. Prospective randomized controlled study to compare the outcome of standard 4-port laparoscopic cholecystectomy with single-incision laparoscopic cholecystectomy in patients with gallstone disease. Indian J Surgery 2020;82(4): 616–624. DOI: http://dx.doi.org/10.1007/s12262-020-02081-6.
6. Haribhakti SP, Mistry JH. Techniques of laparoscopic cholecystectomy: Nomenclature and selection. J Minim Access Surg 2015;11(12):113–118. DOI: 10.4103/0972-9941.140220.
7. van Dijk AH, van der Hoek M, Rutgers M, et al. Efficacy of antibiotic agents after spill of bile and gallstones during laparoscopic cholecystectomy. Surg Infect (Larchmt) 2019;20(4):298–304. DOI: 10.1089/sur.2018.195

8. McCormack D, Saldinger P, Cocieru A, et al. Micro-laparoscopic cholecystectomy: An alternative to single-port surgery. J Gastrointest Surg 2011;15(5):758–761. DOI: 10.1007/s11605-011-1438-5.
9. Macano CAW, Griffiths EA, Vohra RS. Current practice of antibiotic prophylaxis during elective laparoscopic cholecystectomy. Ann R Coll Surg Engl 2017;99(3):216–217. DOI: 10.1308/rcsann.2017.0001
10. Umemura A, Suto T, Nakamura S, et al. Comparison of single-incision laparoscopic cholecystectomy versus needlescopic cholecystectomy: A single institutional randomized clinical trial. Dig Surg 2018;36(1):53–58. DOI: 10.1159/000486455.
11. Sarveswaran J, Burke D, Pring C. The impact of prophylactic antibiotics on postoperative infection complication in elective laparoscopic cholecystectomy: A prospective randomized study. Am J Surg 2008;195(1):135. DOI: 10.1016/j.amjsurg.2006.09.034.

ORIGINAL ARTICLE

Outcomes of Laparoscopic vs Open Surgery for Colorectal Cancers

Rishabh Mehta[1], Vijayendra Kedage[2], Badareesh Lakshminarayana[3]

Received on: 12 October 2023; *Accepted on*: 05 November 2023; *Published on*: 11 January 2024

Abstract

Introduction: Colorectal malignancies are one of the most common cancers diagnosed globally. Minimally invasive surgery has gained importance in treating these cancers. However, there is still skepticism with regard to their oncologic outcomes compared to open surgery. With this study, we aim to compare and evaluate both modalities of therapy.

Materials and methods: We conducted a prospective, observational study at Kasturba Hospital, Manipal, Karnataka, India between 15 September 2019 and 15 September 2021. A total of 79 patients were recruited in the study and considered in the final analysis, out of which 33 underwent surgery by laparoscopic technique) and 46 underwent surgery by open technique. Both groups were weighed against each other in relation to oncologic outcomes, complications of the surgery, duration of stay in the hospital, cost, and other variables.

Results: Both groups were similar with respect to oncologic outcomes, surgical complications, duration of stay in the hospital, and cost.

Conclusion: Laparoscopic surgeries are comparable to open surgeries for colorectal cancers with regard to outcome, complications, and cost and should be considered when planning surgery for such malignancies.

Keywords: Colorectal surgery, Hospital cost, Oncologic outcomes, Open surgery.

World Journal of Laparoscopic Surgery (2023): 10.5005/jp-journals-10033-1598

Introduction

In industrialized countries, cancers of the colon and rectum are ranked third in terms of prevalence and are the third most frequent cause of mortality related to cancer in both sexes.[1] When compared to open colorectal surgery, various prospectively randomized studies and meta-analyses of laparoscopic colorectal surgery have found that laparoscopic colorectal surgery had better postoperative outcomes, which included less pain, minimal scar, quick normalization of gastrointestinal functioning, short stay in hospital, with comparable survival in long-term.[2] Due to these benefits, laparoscopic surgery for cancers of colon and rectum has gained widespread acceptance as a viable alternative to traditional open surgery.[3] Despite its potential benefits, laparoscopic aided surgery is not widely practiced for surgical therapy of cancers of the colon and rectum due to concerns about its oncological outcomes. In our study, we set out to assess and compare laparoscopic and open colorectal surgeries, in an attempt to improve our future practice and outcomes.

Aim

To evaluate and compare the outcomes of laparoscopic and open surgeries for cancers of the colon and rectum.

Objectives

- To assess and compare the oncological quality of laparoscopic and open colorectal surgeries for malignancies with respect to circumferential, proximal, and distal margins, and the lymph nodal number retrieved.
- To compare complications between the two groups, which included the incidence of anastomotic leaks, surgical site infections (SSIs) and the need for stoma formation.

[1–3]Department of General Surgery, Kasturba Medical College, Manipal Academy of Higher Education, Manipal, Karnataka, India

Corresponding Author: Vijayendra Kedage, Department of General Surgery, Kasturba Medical College, Manipal Academy of Higher Education, Manipal, Karnataka, India, Phone: +91 9844680445, e-mail: vijayendra.kedage@manipal.edu

How to cite this article: Mehta R, Kedage V, Lakshminarayana B. Outcomes of Laparoscopic vs Open Surgery for Colorectal Cancers. World J Lap Surg 2023;16(3):153–157.

Source of support: Nil

Conflict of interest: None

Materials and Methods

Ours is a prospective observational study of individuals, who underwent surgery for colorectal malignancy by laparoscopic or open technique, and who fulfilled the inclusion criteria, in Kasturba Hospital, Manipal, Karnataka, India. The study period was from 15th September 2019 to 15th September 2021. The total number of patients included was 79. All patients were consented to before recruitment. A comparison of circumferential resection margin, proximal margins, distal margins, and the lymph nodal number dissected was made, to establish the oncological quality of the surgery. Perioperative parameters like duration of surgery, loss of blood, and recovery from surgery with respect to initiation of oral feeds and number of days of stay in hospital were studied. Both groups were compared with respect to the rate of complications such as SSIs and anastomotic leaks, and the requirement of a diversion stoma. All individuals aged 18 and above, with a histopathologically confirmed diagnosis of colorectal malignancy undergoing surgery were included in the study. Patients diagnosed

to have colorectal malignancy, not planned for surgery (metastatic carcinoma, patient not fit for procedure), patients who did not consent to be a part of the study, and in individuals where laparoscopy was converted to open technique were excluded. Those undergoing emergency surgery were also not included. Circumferential resection margin, proximal margin, distal margin, and lymph nodal number dissected were the primary outcome variables that were studied.

Statistical Analysis

Analysis was done using the Statistical Package for the Social Sciences (SPSS) application. The mean and standard deviation for continuous variables were presented. Percentages were used for categorical variables. The Chi-square test was used to assess the relation among categorical variables. Mann–Whitney *U* analysis was done to compare the mean and median of the two groups. Wilcoxon signed rank analysis was done to compare the paired sample median. A value of *p* below 0.05 was used to determine significance.

Results

A total of 79 participants were recruited and considered for final analysis, from which 33 underwent surgery by laparoscopic technique and 46 underwent open technique.

The mean age of participants undergoing laparoscopic surgery in our study was 53.1 ± 11.1 years, and that of patients undergoing open surgery was 60.8 ± 12.4 years. There was a male preponderance in the open group (29/46 = 63%), but the numbers were almost equal in the laparoscopic group (17/33 = 51.50% for males and 16/33 = 48.50% for females) (Fig. 1). Pain abdomen was the most common presenting complaint in both groups, followed by bleeding per rectum and diarrhea (Fig. 2).

The participants were further subdivided into six groups on the basis of the surgical procedure for subgroup analysis. As shown in

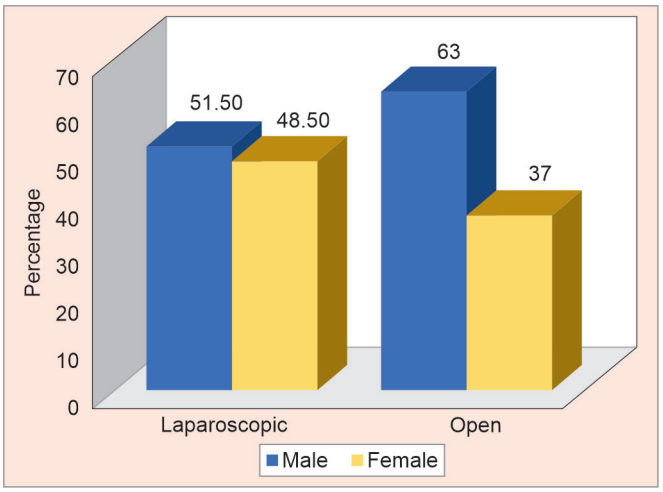


Fig. 1: Sex distribution in the two groups

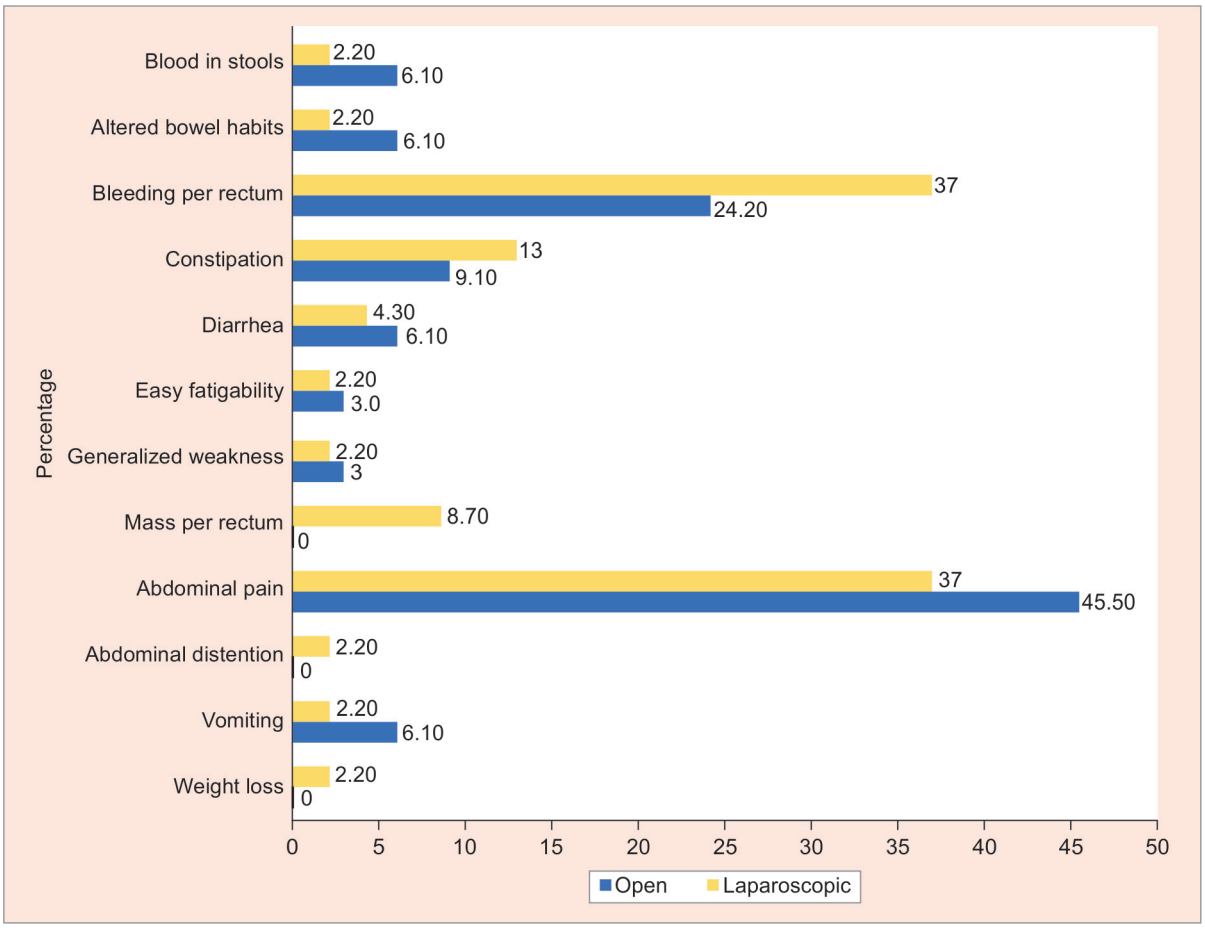


Fig. 2: Presenting complaints and their distribution

Table 1: Types of surgeries performed in each arm

	Laparoscopic	*Open*
Type of surgery	*N*	*N*
Group I – Right-sided surgeries	11	13
Group II – Left-sided surgeries	3	2
Group III – Sigmoid colectomies	1	3
Group IV – Anterior resections	16	17
Group V – Abdominoperineal resections	2	10
Group VI – Total proctocolectomies	0	1
Total	33	46

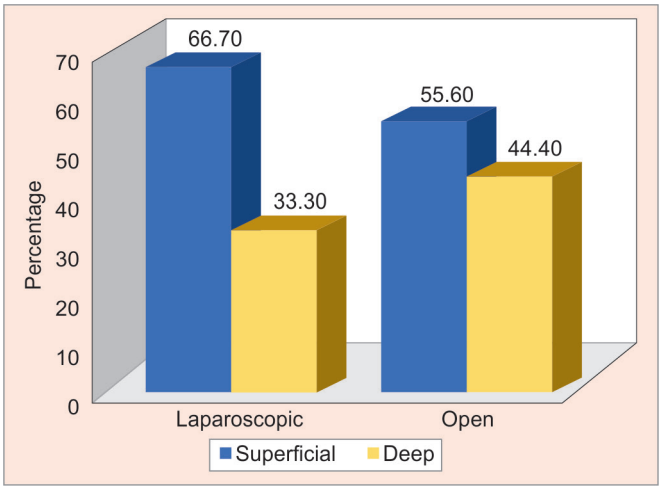


Fig. 3: Type of surgical site infection in each arm

Table 2: Comparison of the various variables between the two arms

Variables	*Laparoscopic (N = 33)*	*Open (N = 46)*	*p-value*
Circumferential margin positivity	1	4	0.308
Mean proximal margin values (cm)	11.8	12.3	0.829
Mean distal margin values (cm)	7.6	7.5	0.933
Mean number of lymph nodes harvested	18.8	20	0.657
Operating time (minutes)	318	264	0.018
Average estimated blood loss (mL)	275.5	416.7	0.095
Mean postoperative day for initiation of oral feeds (days)	2.2	2.9	0.063
Average duration of hospital stays (days)	8.4	9.3	0.229
Average cost of hospitalization (INR)	170,909	166,304	0.769
Incidence of SSI	6	9	0.877
Diversion stoma	2	9	0.087
Number of patients who received NACT/RT	5	15	0.078

INR, Indian rupee; NACT/RT, neoadjuvant chemotherapy/radiotherapy

Table 3: Median pathological stage of the tumor in each arm

	Laparoscopic		*Open*	
Variable	*Colon*	*Rectum*	*Colon*	*Rectum*
NACT/RT received	–	IIA	–	IIA
NACT/RT not received	IIIB	IIB	IIIB	IIIB

NACT/RT, neoadjuvant chemotherapy/radiotherapy

the table (Table 1) above, the clusters were similar with respect to the number of participants. Circumferential positive margin, proximal margin length, distal margin length, and lymph nodes isolated were compared among the groups. All variables were similar with no statistical significance. Average estimated blood loss, mean postoperative day for initiation of oral feeds, average duration of hospital stay, hospital cost, and SSI (Fig. 3) were also compared which were not significantly different among both groups. Duration of surgery was found to be higher in the laparoscopic arm (Table 2). No patients, in either the laparoscopic or the open arm, were diagnosed to have an anastomotic leak, clinically or radiologically. Two patients out of 33 in the laparoscopic arm required the creation of a diversion stoma, compared to nine of the 46 in the group that had open surgery. Additionally, both the patients in the laparoscopic group had a diversion ileostomy, whereas seven in open group had a diversion ileostomy and two had a diversion transverse colostomy.

A total of five patients in the laparoscopic arm received neoadjuvant therapy, in comparison to fifteen patients in the open arm. Among these patients, a total of five patients showed complete response and hence no residual tumor—all in the open arm (Table 3).

Due to a lack of uniform preoperative workup, clinical staging could not be assessed between the groups, and hence pathological staging was examined. The groups were further subdivided to differentiate between colonic and rectal malignancies, due to differences in treatment protocols.

On the final histopathological examination, it was found that the majority of tumors were adenocarcinoma in both arms (97.0% in laparoscopic and 84.8% in open). Five patients had a complete response to neoadjuvant therapy and hence no residual tumor was found. One patient in the open group had a signet ring cell carcinoma, whereas one in the laparoscopic group had a well-differentiated neuroendocrine tumor.

Discussion

The circumferential margin positivity rate in our study was 3.03% for the laparoscopic technique and 8.7% for the open technique, with a *p*-value of 0.308. Thus, both arms showed no significant statistical difference in relation to the margin positivity rate. No circumferential margins were positive in the rectal surgery subgroup of the laparoscopic technique arm, whereas in 2 out of 25 cases, 8% were found to be positive in the open arm. The better percentage in the laparoscopic arm can probably be due to a more complete visualization of the operative field during the surgery, and the lack of tactile guidance, providing the operating surgeon an incentive to take more caution with respect to margin clearance. Circumferential margin is considered positive if the distance from the tumor is below 1 mm, and is an important prognostic marker, as a positive margin increases the chances of recurrence of local disease by 3–4-fold.[4,5] The mean proximal margin distance from the tumor in the laparoscopic arm was 11.8 centimeters, with a deviation of 7.4 cm. The open arm had an average distance of 12.3 cm, with a deviation of 11.2 cm, leading to a *p*-value of 0.829. For rectal surgeries, the mean proximal margin distance was 8.5 cm with a deviation of 4.8 cm for the laparoscopic arm and 10.4 cm with a deviation of 5.5 cm for the open arm. The difference

is thus statistically insignificant, as also seen in studies done by Fujii et al. as well as Chen K et al.[6,7] The Colorectal cancer Laparoscopic or Open Resection II (COLOR II) trial, however, yielded a statistically significant result in this parameter, as well as a considerably longer mean proximal margin distance compared to the rectal surgeries in the current study, though the superiority of the open arm in this situation is not clinically relevant, as a proximal margin of 5 cm is sufficient, which was achieved in both groups.[8,9]

The results for the mean distal margin from the tumor yielded values closer to each other in the two arms. The mean distal margin was 7.6 cm with a deviation of 4.7 cm for the laparoscopic arm and 7.5 cm with a deviation of 7.1 cm for the open arm. The *p*-value was 0.933, proving that there is no significant statistical difference among either of the arms. Fujii et al., Fleshman et al., Chen K et al., and the COLOR II trial have had similar results in regard to this variable.[10] A margin of 2 cm distally is regarded as sufficient in rectal surgeries, with some studies recommending a margin of up to 1 cm in select cases, this result is hence not significant in the long-term outcome, as both the arms led to satisfactory resection.[11]

The average number of lymph nodes isolated was 18.8 among the laparoscopic group with a deviation of 10.2, while the open group yielded 20.0 nodes with a deviation of 13.5. The *p*-value was 0.657. This number was found to be 17.6 with a deviation of 10.2 in the laparoscopic rectal surgeries and 16.5 with a deviation of 11.5 in the open rectal surgeries. The minimum number of lymph nodes that needs to be harvested in resection for colorectal malignancies has been suggested to be 12, with recommendations for harvest of up to 20 nodes for a better long-term outcome. Both arms satisfy the criteria for minimum node harvest and are hence comparable in terms of results.[12]

Laparoscopic surgeries were found to have longer operating times across all types of surgeries. This compares to 264 minutes with a deviation of 84 minutes in the open colorectal surgeries ($p = 0.018$) and 288 minutes with a deviation of 66 minutes in the rectal surgeries ($p = 0.071$), thus being statistically significant. The longer operating times in laparoscopic surgeries were seen in most of the studies with statistically significant results, thus proving that laparoscopic colorectal surgeries are associated with a longer duration of operation. The difference in operating times can probably be explained by the limited access and hence limited degree of freedom in laparoscopic surgery, as well as inexperience and a steeper learning curve leading to more time requirements for each step of the procedure.

The average estimated blood loss in laparoscopic colorectal surgeries was found to be 275.5 mL with a deviation of 152.7 mL, and 416.7 mL with a deviation of 461.2 mL in the open group, leading to a *p*-value of 0.095, which is statistically insignificant. Similarly, the values for rectal surgeries were 276.1 mL with a deviation of 149.8 mL in the laparoscopic group and 393.3 mL with a deviation of 208.3 mL in the open group. This result was significant as the value of *p* is 0.046. This trend was similarly observed in studies by Fujii et al., Chen K et al., Chiu Chong-Chi et al., Bedirli Abdulkadir et al., Fleshman et al., Kang et al. and the COLOR II trial, proving that laparoscopic surgeries are superior in terms of lesser blood loss.[13–16]

The mean postoperative day for initiation of oral feeds (liquids) was found to be 2.2 with a deviation of 1.2 days in the laparoscopic arm, and 2.9 with a deviation of 1.7 days in the open arm, yielding a *p*-value of 0.063. While the result is not statistically significant, it is relevant in comparison to studies like Chen K et al. and Bedirli Abdulkadir et al., demonstrating that laparoscopic surgeries have a better outcome in terms of early initiation of feeds, with both studies yielding statistically significant results. However, in the rectal surgeries, the average was 1.9 days with a deviation of one day in the laparoscopic arm and 3.1 days with a deviation of 1.9 days among open arm, yielding the value of *p* as 0.019, thus being significant statistically, and comparable to the COLOR II trial.

The average duration of stay at the hospital among the laparoscopic surgery group was 8.4 days and had a deviation of 3.0 days. It was 9.3 days with a deviation of 3.5 days for those who underwent open colorectal surgeries. The results did not have statistical significance. The duration of stay at the hospital was 9.2 days with a deviation of 3.5 days for laparoscopic rectal surgeries and 9.7 days with a deviation of 3.4 days for open rectal surgeries, which too was statistically insignificant. Though the results were in accordance with those observed in studies conducted by Fujii et al. and Fleshman et al., other studies by Chen K et al., Chiu Chong-Chi et al., Bedirli Abdulkadir et al., Kang et al., and the COLOR II trial, all yielded statistically significant results with laparoscopic surgeries having a shorter stay in hospital. The difference in results could probably be explained by the need for prolonged stay due to insurance issues, the occurrence of complications such as SSI or pneumonia, and lack of a standard protocol across various units in the hospital. Even then, the numbers were found to be comparable.

A total of 6 patients among the 33 who underwent laparoscopic colorectal surgeries developed SSI, compared to 9 among the 46 in the open group. In rectal surgeries, 3 patients out of 18 who underwent laparoscopic resection developed the complication, compared to 7 out of the 27 in the open group. Both of these results were found to be statistically insignificant. Additionally, 4 patients (66.67%) out of the 6 who developed SSI in the laparoscopic arm had a deep SSI, requiring intravenous antibiotics, compared to 5 out of 9 (55.60%) in the open arm. The rest of the patients had a superficial SSI, which was managed with oral antibiotics. Studies by Chiu Chong-Chi et al. and Bedirli Abdulkadir et al. yielded results that showed significance in this regard, with laparoscopic surgeries proving to be superior, but other studies by Fujii et al., Chen K et al., Kang et al., and the COLOR II trial failed to show such significant results.

No patients, in either the laparoscopic or the open arm, were diagnosed to have an anastomotic leak. These values were found to be an exception, as other studies did show the occurrence of anastomotic leak in both arms, though the numbers were low and variable, except for the COLOR II trial but comparable to the study done by Braga et al.[17]

Two patients out of 33 in the laparoscopic arm required the creation of a diversion stoma, compared to nine of the 46 in the open group, yielding a *p*-value of 0.087, which is statistically insignificant. Both the cases of diversion stoma in the laparoscopic technique group were for rectal malignancy, and six of the nine in the open group fell into the same category. Additionally, both the patients in the laparoscopic group had a diversion ileostomy, whereas seven in the open group had a diversion ileostomy and two had a diversion transverse colostomy. The discretion of creating a stoma, as well as the type of stoma was left to the operating surgeon, who took a call intraoperatively, as judged based on findings. The results were comparable to the study by Kang et al., which also yielded statistically insignificant results.

The average cost of hospital stay was found to be as mentioned in Table 2, with a *p*-value of 0.769 for colorectal surgeries and 0.300

for rectal surgeries, both statistically insignificant. Compared to the study by Chen K et al., where the results were significant, in favor of open surgeries, the difference in the current study could be due to a wide number of insurance schemes available at the center, leading to similar expenditures and hence insignificant results.

Conclusion

- As per the results of our study, we would like to conclude that laparoscopic colorectal surgeries are non-inferior to their open counterparts, in terms of oncological quality, perioperative parameters, and complications and considerations.
- Laparoscopic surgeries provide comparable results with respect to margins and lymph nodes harvested and have a lesser loss of blood and shorter stay in hospital. On the other hand, laparoscopic surgeries take significantly longer operating time.
- Thus, laparoscopic surgeries should be considered as an equivalent modality when planning for a curative resection for colorectal malignancies.

Orcid

Vijayendra Kedage https://orcid.org/0000-0001-7691-7104
Badareesh Lakshminarayana https://orcid.org/0000-0002-0762-0427

References

1. Siegel R, Naishadham D, Jemal A, et al. Cancer statistics, 2013. CA Cancer J Clin 2013;63(1):11–30. DOI: 10.3322/caac.21166.
2. Abraham NS, Young JM, Solomon MJ, et al. Meta-analysis of short-term outcomes after laparoscopic resection for colorectal cancer. Br J Surg 2004;91(9):1111–1124. DOI: 10.1002/bjs.4640.
3. Lee JE, Joh YG, Yoo SH, et al. Long-term outcomes of laparoscopic surgery for colorectal cancer. J Korean Soc Coloproctol 2011;27(2): 64–70. DOI: 10.3393/jksc.2011.27.2.64.
4. Tan KY, Konishi F. Long-term results of laparoscopic colorectal cancer resection: Current knowledge and what remains unclear. Surg Today 2010;40(2):97–101. DOI: 10.1007/s00595-009-4133-3.
5. Quirke P, Steele R, Monson J, et al. Effect of the plane of surgery achieved on local recurrence in patients with operable rectal cancer: A prospective study using data from the MRC CR07 and NCIC-CTG CO16 randomised clinical trial. Lancet 2009;373(9666):821–828. DOI: 10.1016/S0140-6736(09)60485-2.
6. Quirke P, Durdey P, Dixon MF, et al. Local recurrence of rectal adenocarcinoma due to inadequate surgical resection. Histopathological study of lateral tumour spread and surgical excision. Lancet 1986;2(8514):996–999. DOI: 10.1016/s0140-6736(86)92612-7.
7. Fujii S, Ishibe A, Ota M, et al. Short-term results of a randomized study between laparoscopic and open surgery in elderly colorectal cancer patients. Surg Endosc 2014;28(2):466–476. DOI: 10.1007/s00464-013-3223-x.
8. Chen K, Zhang Z, Zuo Y, et al. Comparison of the clinical outcomes of laparoscopic-assisted versus open surgery for colorectal cancer. Oncol Lett 2014;7(4):1213–1218. DOI: 10.3892/ol.2014.1859.
9. van der Pas MH, Haglind E, Cuesta MA, et al. Laparoscopic versus open surgery for rectal cancer (COLOR II): Short-term outcomes of a andomized, phase 3 trial. Lancet Oncol 2013;14(3):210–218. DOI: 10.1016/S1470-2045(13)70016-0.
10. Nelson H, Petrelli N, Carlin A, et al. Guidelines 2000 for colon and rectal cancer surgery. J Natl Cancer Inst 2001;93(8):583–596. DOI: 10.1093/jnci/93.8.583.
11. Fleshman J, Branda M, Sargent DJ, et al. Effect of laparoscopic-assisted resection vs open resection of stage II or III rectal cancer on pathologic outcomes: The ACOSOG Z6051 Randomized Clinical Trial. JAMA 2015;314(13):1346–1355. DOI: 10.1001/jama.2015.10529.
12. Durak D, Alkurt EG, Turhan VB, et al. Comparison of short-term results of laparoscopic and open surgeries for colorectal cancer: A single-center experience. Cureus 2022;14(5):e24635. DOI: 10.7759/cureus.24635.
13. Chiu CC, Lin WL, Shi HY, et al. Comparison of oncologic outcomes in laparoscopic versus open surgery for non-metastatic colorectal cancer: Personal experience in a single institution. J Clin Med 2019;8(6):875. DOI: 10.3390/jcm8060875.
14. Bedirli A, Salman B, Yuksel O. Laparoscopic versus open surgery for colorectal cancer: A retrospective analysis of 163 patients in a single institution. Minim Invasive Surg 2014;2014:530314. DOI: 10.1155/2014/530314.
15. Tan KL, Deng HJ, Chen ZQ, et al. Survival outcomes following laparoscopic vs open surgery for non-metastatic rectal cancer: A two-center cohort study with propensity score matching. Gastroenterol Rep (Oxf) 2020;8(4):319–325. DOI: 10.1093/gastro/goaa046.
16. Manegold P, Taukert J, Neeff H, et al. The minimum distal resection margin in rectal cancer surgery and its impact on local recurrence: A retrospective cohort analysis. Int J Surg 2019;69:77–83. DOI: 10.1016/j.ijsu.2019.07.029.
17. Braga M, Vignali A, Gianotti L, et al. Laparoscopic versus open colorectal surgery: A randomized trial on short-term outcome. Ann Sur 2002;236(6):759–766; discussion 767. DOI: 10.1097/01.SLA.0000036269.60340.AE.

ORIGINAL ARTICLE

Omental Wrapping of the Cecum and Appendix Stump Reduces Postoperative Pain and Speeds Recovery after Laparoscopic Appendectomy: A Prospective Randomized Controlled Trial

Maged Rihan

Received on: 23 October 2023; *Accepted on*: 18 November 2023; *Published on*: 11 January 2024

Abstract

Introduction: Many factors contribute to pain after laparoscopic appendectomy. We devised a method to reduce pain after laparoscopic appendectomy by wrapping the cecum with the greater omentum. This study aimed to investigate the effectiveness of this method.

Materials and methods: This study was conducted to compare the operative and postoperative outcomes in patients with omental wrapping and traditional laparoscopic appendectomy patients. The primary endpoints were the degree of postoperative intra-abdominal pain intensity evaluated by visual analogue scale (VAS), and analgesic use.

The secondary endpoints were the operation time, time to pass gas, white blood cell count, C-reactive protein (CRP) on the second postoperative day, numerical rating scale for postoperative nausea, frequency of antiemetic medications frequency, and length of hospital stay. The study was registered in the International Standard Randomised Controlled Trial Number (ISRCTN) registry (ISRCTN 89363255).

Results: This study evaluated 106 patients. Fifty patients were assigned to the traditional group and 56 to the wrapping group. Pain scores in the first postoperative 24 hours were significantly higher in traditional group patients ($p = 0.007$). Between 24 and 48 hours, pain score was also higher in traditional group patients ($p = 0.01$). Time to pass gas was achieved earlier in the wrapping group ($p < 0.001$).

Conclusion: Omental wrapping of the cecum and appendix stump in laparoscopic appendectomy can provide postoperative pain relief by reducing the intensity of visceral pain.

Keywords: Laparoscopic appendectomy, Omental wrapping, Postoperative pain, Randomized controlled trial.

World Journal of Laparoscopic Surgery (2023): 10.5005/jp-journals-10033-1586

Introduction

Acute appendicitis is the most common indication for emergency abdominal surgical intervention. Approximately 7% of people will have acute appendicitis, with the highest incidence in the second and third decades.[1] Open appendectomy has remained the gold standard surgery for over a century with low morbidity and mortality. Laparoscopic appendectomy has become the standard procedure over the last two to three decades. It results in less postoperative pain, shorter hospital stay, faster postoperative recovery, better visualization of lower abdominal quadrants, and fewer complications than the open method.[2,3]

However, laparoscopy is not a pain-free intervention, and control of pain after laparoscopy remains a major concern.[4] There are many factors that contribute to pain induction after laparoscopic appendectomy, including intraabdominal or visceral causes like pneumoperitoneum, diaphragmatic stretching, and direct tissue injury, and abdominal wall or parietal pain from the incision sites.[5] Different methods have been tried to reduce intraabdominal pain after laparoscopic appendectomy as local anesthetic solutions injection into the peritoneal cavity.[6,7]

The omentum is a dynamic organ, it wanders here and there in the peritoneal cavity handling the contaminations and infections. It controls inflammation, and enhances revascularization and tissue regeneration.[8] It is usually seen covering sites of inflammation and damage and has the ability to hinder the propagation of intra-abdominal infections and isolate it from the surrounding healthy tissues. It achieves this immune job by sticking to inflamed tissues, absorbing contaminants, and providing leukocytes.[9,10]

We devised a method to minimize postoperative pain after laparoscopic appendectomy by wrapping the cecum and the appendix stump by the greater omentum at the end of laparoscopic appendectomy. We named the procedure "omental wrapping of the cecum and appendix stump". This current study aimed to find out the benefits and effectiveness of this method compared to the traditional method.

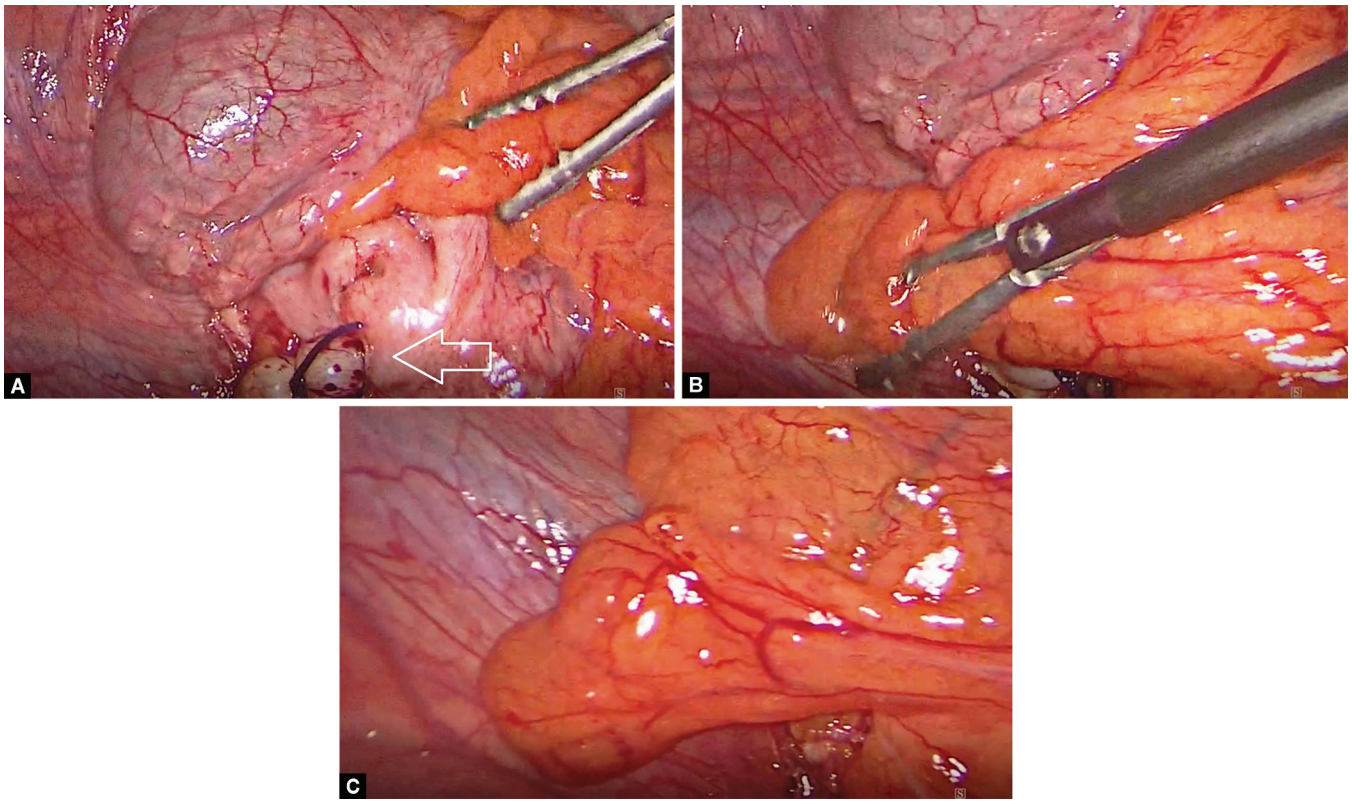
Department of General Surgery, Cairo University Kasr Alainy Faculty of Medicine, Cairo Governorate, Egypt

Corresponding Author: Maged Rihan, Department of General Surgery, Cairo University Kasr Alainy Faculty of Medicine, Cairo Governorate, Egypt, Phone: +00966596519744, e-mail: magedrihan@hotmail.com

How to cite this article: Rihan M. Omental Wrapping of the Cecum and Appendix Stump Reduces Postoperative Pain and Speeds Recovery after Laparoscopic Appendectomy: A Prospective Randomized Controlled Trial. World J Lap Surg 2023;16(3):158–162.

Source of support: Nil

Conflict of interest: None



Figs 1A to C: Operative procedure: The distal greater omentum is mobilized to cover the cecum with appendix stump. Arrow: appendix stump

Materials and Methods

Study Design

This prospective randomized controlled study was designed to compare the operative and postoperative outcomes in omental wrapping patients and traditional laparoscopic appendectomy patients from June 2020 to May 2023 at Jeddah National Hospital (in Jeddah, Kingdom of Saudi Arabia). The study was registered on 7-8-2023 at the International Standard Randomised Controlled Trial Number (ISRCTN) registry (ISRCTN 89363255).

Eligibility and Exclusion Criteria

This study included patients aged more than 18 years, diagnosed with acute appendicitis by clinical examination, ultrasonography, or CT scan. Patients with complicated appendicitis by perforation or abscess formation were excluded. Pregnant women were excluded.

Randomization

Randomization was done by the computational random number generator method. The evaluators for participants and pain were blinded to the appendectomy operation details. The traditional and wrapping groups underwent stratification-randomization in a 1:1 ratio.

Withdrawal Criteria

The patient was withdrawn from evaluation if the surgical technique was changed (conversion to open laparotomy or further surgery was done), the intraoperative finding of short omentum, the drainage tube was placed, the patient could not distinguish between intra-abdominal pain and pain originating from abdominal wounds, or if a patient expressed his desire to terminate the study.

Surgical Technique

In all patients, laparoscopic appendectomy was done by laparoscopic surgery experienced surgeons. Under general anesthesia; the patient was positioned in the Trendelenburg position. The three-port technique (a 10 mm visual in the periumbilical area, a 5 mm in the left iliac region, and a 5 mm in the right upper quadrant) was used. This distribution of the port sites made the lower right region of the abdomen free and far from the wounds, which made it easier for patients to differentiate between the pain coming from inside the abdomen and the pain coming from the wounds after surgery.

In both groups, the harmonic scalpel was used to divide the mesoappendix, and the appendicular base was controlled by three endo loops (two at the cecal side and one at the distal appendix). In the second group, at the end of the procedure the patient position was changed to the anti-Trendelenburg position to allow easy mobilization of the distal part of the greater omentum, and placed over the cecum to cover the appendix stump to act as an insulator between the stump and the parietal peritoneum, using one or two resorbable tacks to fix the lower surface of the omentum to the peritoneal folds or appendices epiploicae of the cecum and not to the cecal wall itself (Fig. 1). In the end, the inflation pressure is gradually decreased, while ensuring that the omentum remains within the scope of vision until it is confirmed that it is in the same place until the abdomen is completely emptied and becomes completely adherent to the parietal peritoneum.

Endpoints

The primary endpoints were the degree of postoperative intraabdominal (visceral) pain intensity evaluated by visual analogue scale (VAS), and analgesics administration in the form

Table 1: Patients' demographic data

	Traditional group (No. 50)	*Wrapping group (No. 56)*	*p-value*
Age (year)	36.8 ± 14.7 (18–72)	40.9 ± 13.9 (18–67)	0.282
Male	31 (62%)	29 (51.8%)	0.513
Body mass index (kg/m^2)	24.54 ± 3.58 (18.13–40.12)	23.42 ± 4.16 (17.84–37.24)	0.278
ASA classification			
I	41 (82%)	46 (82.1%)	
II	8 (16%)	9 (16.1%)	
III	1 (2%)	1 (1.8%)	
History of abdominal surgery	6 (12%)	9 (16.1%)	0.462

Values are presented as number only; mean ± standard deviation (range); No, number of patients; ASA, American Society of Anesthesiologists

of parenteral nonsteroidal anti-inflammatory drugs (NSAIDs). Control of postoperative pain for the two groups followed the same standards and was carried out according to the patient's preference. Patients and nursing staff were blinded to the randomization results. The VAS score was explained to the patients to rate their pain on the specified scale, where 0 is no pain and 10 is the worst imaginable pain.

The secondary endpoints were the operation time, time to pass gas, white blood cell count, and C-reactive protein (CRP) on the second postoperative day. We also evaluated the numerical rating scale for postoperative nausea, frequency of antiemetic medications frequency, and length of hospital stay.

Statistical Analysis

We designed this study to test the hypothesis that omental wrapping is better than traditional laparoscopic appendectomy in relieving postoperative pain. Values are shown as median numbers and the interquartile range (IQR) or mean numbers ± standard deviations (SDs). Continuous variables were analyzed by *t*-test, Mann–Whitney *U* test, or repeated measures design. Discrete variables were compared by Chi-squared test or Fisher's exact test. Analysis used IBM SPSS Statistics version 23.0 (IBM Corp., Armonk, NY, USA). Probability (*p*-value) was considered of significance if ≤ 0.05.

Results

This study finally evaluated 106 patients. Fifty patients were assigned to the traditional group and 56 patients to the wrapping group. All patients were evenly allocated concerning age, sex, body mass index, American Society of Anesthesiologists physical status (ASA) classification, and history of abdominal surgery. There was no difference regarding the previous variables between the two groups (Table 1).

Postoperative Pain Assessment

Pain scores are shown in Table 2. Pain score in the first postoperative 24 hours was significantly higher in traditional group patients ($p = 0.007$). Between 24 and 48 hours, pain score was also higher in traditional group patients ($p = 0.01$). No differences were present for 48 to 72 hours following operation (Fig. 2).

There was a significant difference between the two groups as regards the change in pain score during the postoperative days (Fig. 3).

Higher doses of analgesics were prescribed for patients in the traditional group during the two days following surgery, with no significant difference (Table 3).

Table 2: Postoperative pain score using visual analogue scale

	Traditional group (No. 50)	*Wrapping group (No. 56)*	*p-value*[a]
<24 hours	5 (4–6) 5.2 ± 1.2	3 (2–5) 3.6 ± 1.5	0.007
>24 and <48 hours	3 (2–4) 3.2 ± 1.4	1 (1–2) 1.1 ± 1.2	0.01
>48 and <72 hours	0 (0–1) 0.5 ± 0.3	0 (0–3) 0.4 ± 0.9	1.000

Values are presented as median (interquartile range) and mean ± standard deviation; [a]The Mann–Whitney *U*-test; *p*-values were corrected by Bonferroni's method

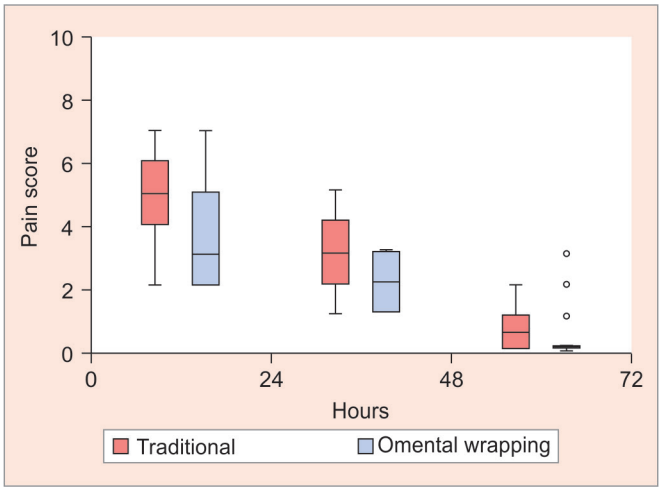


Fig. 2: Postoperative pain score on the visual analogue scale in the two groups

Other Postoperative Outcomes

Times to pass gas were shorter in the wrapping group patients ($p < 0.001$), which was an unexpected finding. Operative time, inflammatory markers (WBC and CRP) levels, nausea degree, antiemetics doses, and hospital length of stay had no significant difference between the two groups (Table 4).

Discussion

Patients after laparoscopic surgeries report severe pain, which is often underestimated. Pain ratings after laparoscopic appendectomy are similar to those after knee joint replacement and sternotomy.[11] Both visceral (intra-abdominal), and parietal

(abdominal wall wounds) pain causes a lot of suffering for patients after laparoscopic appendectomy.[12] In a study of traditional three ports laparoscopic appendectomy patients, The VAS scores were presented as median (interquartile range) and mean ± standard deviation, on 1st day 4 (3–6) 4.7 ± 1.6, on 2nd day 2 (2–3) 2.1 ± 1.3, and on 3rd day 0 (0–3) 0.4 ± 0.8.[13] These scores are slightly lower than those in our study as regards the traditional group, and more than those in the wrapping group.

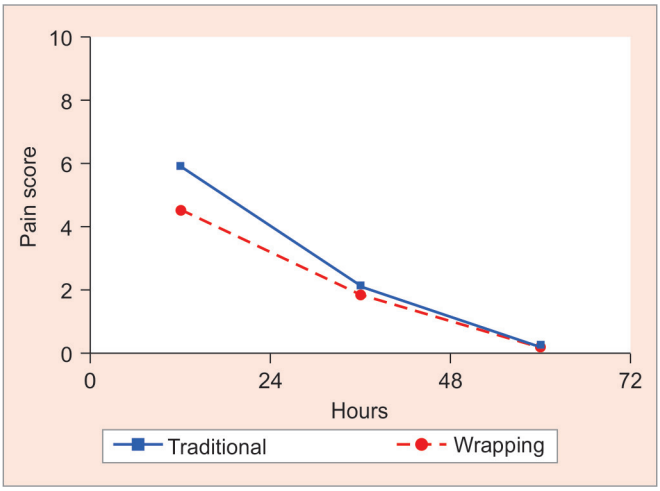


Fig. 3: The change in the visual analogue scale pain score during the postoperative days was significantly different between the two groups ($p = 0.027$ by repeated measures analysis of variance)

Table 3: The mean number of analgesic doses following surgery

	Traditional group (No. 50)	*Wrapping group (No. 56)*	*p-value*
<24 hours	1.35 ± 0.74	0.76 ± 0.68	0.068
>24 hours	0.16 ± 0.41	0.07 ± 0.18	0.16

Values are presented as mean ± SD

Different methods have been tried to minimize the intensity of intra-abdominal pain and to improve outcomes after laparoscopic surgeries, including low-pressure insufflation, subcutaneous anesthetic infiltration, saline washout, and intra-peritoneal instillation of local anesthetics.[14,15] However, the findings of these trials were of low significance.[16]

Transposition of the omentum over the injured organ or tissue is a common surgical procedure. It can be done by simple placing and fixation, or by doing an omental flap (omentoplasty) which is prepared for elongation and better positioning of the omentum on the desired site. It has been used to circumvent around the sites of the intestinal anastomosis to strengthen it, and to prevent leakage. Some characteristics of the omentum such as mobility and adherence to contaminated areas are fully recognized in the context of appendicitis.[17] One study included 112 patients with colorectal resections, and reported positive results with omentoplasty. Only 3.8% of patients with omentoplasty had leaks from the anastomosis, compared to 11.8% of patients who did not have omentoplasty.[18]

Our prospective study presented that the pain score in the two days following laparoscopic appendectomy was higher in the traditional laparoscopic appendectomy group and that a significant difference was present between the two groups regarding the change in pain intensity after surgery. Pain evaluation was blinded and done by the nursing staff that was ignorant of the study details. The time to pass gas was shorter in the omental wrapping group, which may prove the relationship between postoperative pain and delayed recovery of bowel function. Minimizing postoperative pain in laparoscopic appendectomy patients is very important, especially on the first day after surgery. In this study, the traditional group patients were prescribed more total doses of analgesics within 24 hours after the operation, but the difference had no statistical significance because of the relatively small size of the sample and the number of doses of analgesics prescribed in the two groups. In this study, the mean number of doses prescribed during the first day after surgery was 1.35 in the traditional group and 0.76 in the omental wrapping group. In another study, the mean number of

Table 4: Other postoperative outcomes

Variable	*Traditional group (No. 50)*	*Wrapping group (No. 56)*	*p-value*
Operative time (min)	40.3 ± 18.4 (21–90)	38.2 ± 20.6 (18–105)	0.864
Time to pass gas (hour)	32 ± 13.6 (18–46)	18 ± 8.4 (9–32)	<0.001
WBC count (×10^3/μL)			
Preoperative	13.32 ± 3.74 (5.28–19.46)	12.48 ± 3.65 (4.86–20.22)	0.824
>24 and <48 hours	9.15 ± 2.48 (5.62–15.34)	8.87 ± 3.92 (4.43–22.65)	0.632
CRP level (mg/L)			
Preoperative	17.6 ± 32.8 (0.5–135.3)	15.5 ± 26.4 (0.4–125)	0.486
>24 and <48 hours	54.7 ± 51.2 (3.1–185)	64.2 ± 63.6 (4.3–225)	0.763
Nausea (by NRS)			
<24 hours	0.43 ± 1.71 (0–8)	0.12 ± 0.52 (0–4)	0.258
>24 and <48 hours	0.18 ± 1.12 (0–6)	0.41 ± 1.64 (0–8)	0.364
>48 and <72 hours	0.00 ± 0.00 (0–0)	0.04 ± 0.22 (0–2)	0.246
Antiemetics			
<24 hours	0.05 ± 0.32 (0–1)	0.04 ± 0.24 (0–2)	0.778
>24 and <48 hours	0.04 ± 0.20 (0–1)	0.01 ± 0.15 (0–1)	0.352
>48 and <72 hours	0.00 ± 0.00 (0–0)	0.01 ± 0.12 (0–1)	0.164
Hospital stay (day)	1.5 ± 0.6 (1–4)	1.4 ± 0.7 (2–4)	0.867

Values are presented as number only; mean ± standard deviation (range); NRS, numerical rating scale

analgesic doses in the 24 hours after laparoscopic appendectomy ranged from 0.9 to 3.8.[19–21]

This study was carried out by surgeons who primarily perform traditional laparoscopic appendectomy and a surgeon who developed the omental wrapping technique and mainly performed it. So, it possesses the strength of having less possibility of biased results. Another strength point is that the patients and the pain score evaluators were blinded to eliminate subjective confusion as much as possible. Although pain scoring is subjective, it is thought appropriate endpoint because it is well known to be one of the main indicators in the clinical monitoring of any patient.

The weak point is that the difference in scores between the two groups was not as great as was expected at the planning stage.

More studies will be necessary to evaluate the beneficial effects of omental wrapping of the cecum and appendix stump in laparoscopic appendectomy especially in patients with complicated appendicitis and more difficult surgeries.

Conclusion

Omental wrapping of the cecum and appendix stump in laparoscopic appendectomy can provide postoperative pain relief by reducing the intensity of visceral or intra-abdominal pain and can be considered an easy technique to aid in rapid recovery after the operation.

Clinical Significance

To the best of our knowledge, this is the first study that demonstrated the technique of wrapping the omentum around the cecum and appendix stump after laparoscopic appendectomy. We concluded that this technique minimized the pain score and bowel recovery time after surgery.

Ethical Approval

The study was approved by the research ethics board in the Jeddah National Hospital (IRB number: R 20.43). All patients were informed about the nature and the protocol of the study. Written informed consent was collected from each patient before enrollment.

Orcid

Maged Rihan https://orcid.org/0000-0001-9323-9405

References

1. Stewart B, Khanduri P, McCord C, et al. Global disease burden of conditions requiring emergency surgery. Br J Surg 2014;101(1):e9–e22. DOI: 10.1002/bjs.9329.
2. Jaschinski T, Mosch CG, Eikermann M, et al. Laparoscopic versus open surgery for suspected appendicitis. Cochrane Database Syst Rev 2018;11(11):CD001546. DOI: 10.1002/14651858.CD001546.pub4.
3. Wei B, Qi CL, Chen TF, et al. Laparoscopic versus open appendectomy for acute appendicitis: A metaanalysis. Surg Endosc 2011;25(4): 1199–1208. DOI: 10.1007/s00464-010-1344-z.
4. Sjövall S, Kokki M, Kokki H. Laparoscopic surgery: A narrative review of pharmacotherapy in pain management. Drugs 2015;75(16):1867–1889. DOI: 10.1007/s40265-015-0482-y.
5. Barczyński M, Konturek A, Herman RM. Superiority of preemptive analgesia with intraperitoneal instillation of bupivacaine before rather than after the creation of pneumoperitoneum for laparoscopic cholecystectomy: A randomized, double-blind, placebo-controlled study. Surg Endosc 2006;20(7):1088–1093. DOI: 10.1007/s00464-005-0458-1.
6. Papagiannopoulou P, Argiriadou H, Georgiou M, et al. Preincisional local infiltration of levobupivacaine vs ropivacaine for pain control after laparoscopic cholecystectomy. Surg Endosc 2003;17(12): 1961–1964. DOI: 10.1007/s00464-002-9256-1.
7. Boddy AP, Mehta S, Rhodes M. The effect of intraperitoneal local anesthesia in laparoscopic cholecystectomy: A systematic review and meta-analysis. Anesth Analg 2006;103(3):682–688. DOI: 10.1213/01.ane.0000226268.06279.5a.
8. Collins D, Hogan AM, O'Shea D, et al. The omentum: anatomical, metabolic, and surgical aspects. J Gastrointest Surg 2009;13(6): 1138–1146. DOI: 10.1007/s11605-009-0855-1.
9. Liebermann-Meffert D. The greater omentum. Anatomy, embryology, and surgical applications. Surg Clin North Am 2000;80(1):275–293, xii. DOI: 10.1016/s0039-6109(05)70406-0.
10. Hall JC, Heel KA, Papadimitriou JM, et al. The pathobiology of peritonitis. Gastroenterology 1998;114(1):185–196. DOI: 10.1016/s0016-5085(98)70646-8.
11. Gerbershagen HJ, Aduckathil S, van Wijck AJ, et al. Pain intensity on the first day after surgery: A prospective cohort study comparing 179 surgical procedures. Anesthesiology 2013;118(4):934–944. DOI: 10.1097/ALN.0b013e31828866b3.
12. Kahokehr A, Sammour T, Srinivasa S, et al. Metabolic response to abdominal surgery: The 2-wound model. Surgery 2011;149(3): 301–304. DOI: 10.1016/j.surg.2010.10.020.
13. Kim HO, Yoo CH, Lee SR, et al. Pain after laparoscopic appendectomy: A comparison of transumbilical single-port and conventional laparoscopic surgery. J Korean Surg Soc 2012;82(3):172–178. DOI: 10.4174/jkss.2012.82.3.172.
14. Barczyński M, Herman RM. Low-pressure pneumoperitoneum combined with intraperitoneal saline washout for reduction of pain after laparoscopic cholecystectomy: A prospective randomized study. Surg Endosc 2004;18(9):1368–1373. DOI: 10.1007/s00464-003-9299-y.
15. Tam T, Harkins G, Wegrzyniak L, et al. Infiltration of bupivacaine local anesthetic to trocar insertion sites after laparoscopy: A randomized, double-blind, stratified, and controlled trial. J Minim Invasive Gynecol 2014;21(6):1015–10121. DOI: 10.1016/j.jmig.2014.04.013.
16. Gluck O, Barber E, Feldstein O, et al. The effect of subcutaneous and intraperitoneal anesthesia on post laparoscopic pain: A randomized controlled trial. Sci Rep 2021;11(1):81. DOI: 10.1038/s41598-020-80130-6.
17. De Broux E, Parc Y, Rondelli F, et al. Sutured perineal omentoplasty after abdominoperineal resection for adenocarcinoma of the lower rectum. Dis Colon Rectum 2005;48(3):476–481; Discussion: 481–482. DOI: 10.1007/s10350-004-0784-8.
18. Tocchi A, Mazzoni G, Lepre L, et al. Prospective evaluation of omentoplasty in preventing leakage of colorectal anastomosis. Dis Colon Rectum 2000;43(7):951–955. DOI: 10.1007/BF02237357.
19. St Peter SD, Adibe OO, Juang D, et al. Single incision versus standard 3-port laparoscopic appendectomy: A prospective randomized trial. Ann Surg 2011;254(4):586–590. DOI: 10.1097/SLA.0b013e31823003b5.
20. Carter JT, Kaplan JA, Nguyen JN, et al. A prospective, randomized controlled trial of single-incision laparoscopic vs conventional 3-port laparoscopic appendectomy for treatment of acute appendicitis. J Am Coll Surg 2014;218(5):950–959. DOI: 10.1016/j.jamcollsurg.2013.12.052.
21. Frutos MD, Abrisqueta J, Lujan J, et al. Randomized prospective study to compare laparoscopic appendectomy versus umbilical single-incision appendectomy. Ann Surg 2013;257(3):413–418. DOI: 10.1097/SLA.0b013e318278d225.

ORIGINAL ARTICLE

Endoscopic Management of a Perforated Duodenal Ulcer: A Cohort Study

Sayed Mohammed Asfaque Aamir[1], Sujit Kumar Mohanty[2]

Received on: 17 November 2023; *Accepted on*: 09 December 2023; *Published on*: 11 January 2024

Abstract

Introduction: Complicated peptic ulcer is one of the most common abdominal emergencies presenting in our institution settings bringing patients from Eastern Odisha. The high patient load forces us to seek out another standardized method apart from the surgical intervention in our study.

Materials and methods: A cohort study was conducted in a Tertiary Care Hospital with 120 patients after confirmation of a pyloro-duodenal location of the perforated ulcer and allocated to the surgical vs stent group.

Results: Percutaneous drainage was required in fifteen patients due to intra-abdominal abscess (C-D 3). Postoperative leak was observed in six patients and showed leak at leakage test and received a new stent without further complication (C-D 3). Five patients needed postoperative intensive care in the ITU, requiring temporary circulatory and renal support. Unfortunately, three patients in poor condition upon admission did not survive (C-D 5).

Conclusion: Stents had an affirmative role for management in complicated patients of peptic perforation.

Keywords: Duodenal perforation, Endoscopy, Gastroduodenal perforation, Stenting, Upper gastrointestinal endoscopy.

World Journal of Laparoscopic Surgery (2023): 10.5005/jp-journals-10033-1599

Introduction

Historically, the cause of peptic ulcer perforation in the early 1800s was considered as poisoning. Later during the period, when found during autopsy was trifled to be due to the instruments used during the procedure.[1] Baron concluded that duodenal ulcer was discovered through a necropsy at the Middlesex Hospital during the 1850s, recorded in London and New York during the 1860s, followed by a rapid increase.[2] The incidence of uncomplicated peptic ulcer disease has fallen during the last decades and the incidence of perforated peptic ulcer is also decreasing in the western texts.[3] But it doesn't hold true in the Asian side of the world and poses a serious condition with high morbidity and mortality rates varying between 10 and 40%.[4,5]

Materials and Methods

It was a prospective cohort study comprising 120 patients in a Tertiary Care Hospital in Odisha. Patients presenting to the Department of General Surgery aged more than 18 years with free gas under the diaphragm with an endoscopically confirmed duodenal location without any history of abdominal trauma were taken as samples in this study designs. They were randomly allotted into 2 groups

Surgical Group

The patient underwent laparoscopic or open graham patch omentoplasty according to the surgeon's preference. Routine postoperative management was done. Patients presenting with a leak underwent salvage stent treatment.

Stent Group

A partially covered Nitinol stent was placed with the oral end of the stent placed above the pylorus and the covered part of the stent at the perforation site with two bilateral 20 Fr Flank drains placed for percutaneous drainage. All patients were treated with routine postoperative measures.

On postoperative day one, 250 mL of water mixed with 5 mL methylene blue was given orally. If the abdominal drain showed blue fluid, then the patient was further evaluated for stent replacement. The problem of stent migration was dealt with by allowing a liquid diet until stent removal.

Stents were removed in 3–4 weeks after an endoscopic inspection of the target site in uncomplicated patients. Patients showing signs of partial healing had a prolonged stent treatment of 2 weeks.

Demographics, ASA grading, median duration of surgery, time to intervention, complications scored along the Clavien-Dindo grades and mean duration of hospital stay were recorded.

Statistics

Non parametric statistical methods were used for most variables. Differences with $p < 0.05$ were considered significant. Data processed using IBM SPSS software.

[1,2]Department of General Surgery, SCB Medical College & Hospital, Cuttack, Odisha, India

Corresponding Author: Sayed Mohammed Asfaque Aamir, Department of General Surgery, SCB Medical College & Hospital, Cuttack, Odisha, India, Phone: +91 8249262652, e-mail: cruisemi003@gmail.com

How to cite this article: Aamir SMA, Mohanty SK. Endoscopic Management of a Perforated Duodenal Ulcer: A Cohort Study. World J Lap Surg 2023;16(3):163–165.

Source of support: Nil

Conflict of interest: None

Table 1: Demographic data

Demographic data	*Surgical closure*	*Stent treatment*	*All patients*
Number	75	45	120
Median age	75 (23–91)	80 (38–87)	77 (23–91)
Gender (M/F)	45/30	21/24	66/54
Median BMI	28 (21–30)	24 (19–30)	27 (19–30)

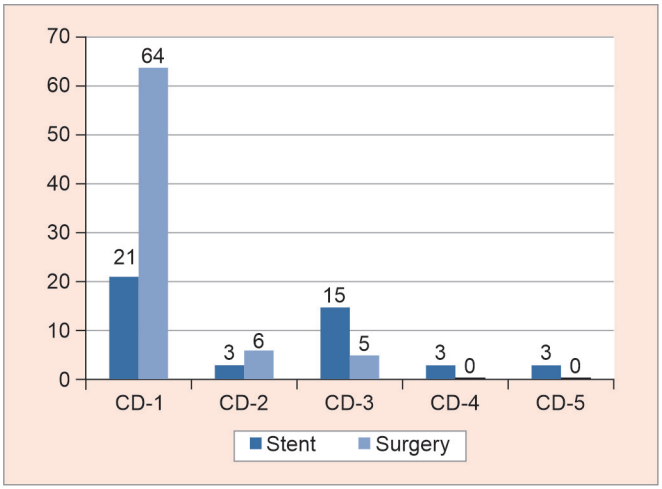


Fig. 1: Complications according to the Clavien – Dindo score

Results

Demographic Data

Most cases were closed surgically of which mostly were male patients with the median age of patients being 75 years. The mean BMI was mostly overweight (Table 1).

ASA Grade

The surgical closure groups individuals had an ASA-score of 1–3. The stent group individuals had an ASA-score of 1–4.

Time to Intervention

A total of 66 out of 120 patients were symptomatic beyond 12 hours out of which 45 out of 75 patients were classified into surgical group and 21 out of 45 patients in the stented group.

Technique of Closure

A total of 45 out of 75 patients had a laparoscopic closure and the rest underwent open surgery.

Median Operation Time

Average time for surgery was 90 minutes and for endoscopic stenting was 60 minutes ($p = 0.002$).

CRP and WBC

No significant differences between the two groups.

Complications

Surgical Group

- Clavien-Dindo-2 complications of postoperative pyrexia were seen in six patients and pneumonia in three patients (Fig. 1).

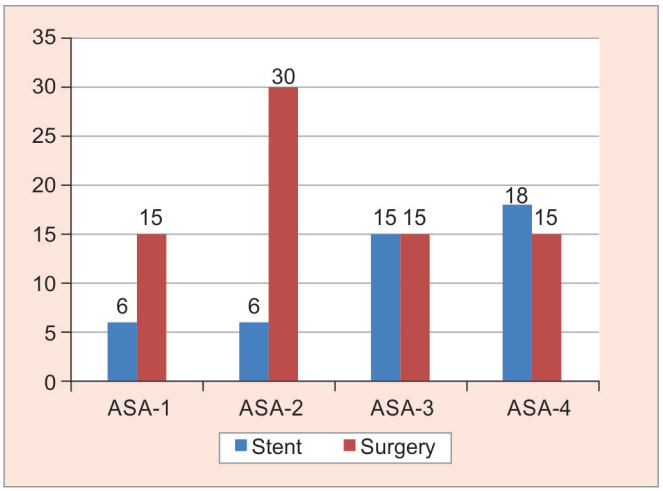


Fig. 2: ASA grade

- Surgical site leak was seen in nine patients who were treated with endoscopic stent placement. Later, the patient developed an intra-abdominal abscess which was aspirated percutaneously (Fig. 1).
- ICU care was required in six patients (C-D 4).

Stent Treatment

- Percutaneous drainage was required in fifteen patients due to intra-abdominal abscess (C-D 3).
- Postoperative leak was observed in six patients and required showed leak at leakage test and received a new stent without further complication (C-D 3) (Fig. 1).
- Postoperative ITU care was required in five patients required temporary circulatory and renal support.
- Three patients presenting in low condition died (C-D 5).

Hospital Stay

Hospital Stay Duration was not different within the 2 groups with 8 days for stent treatment and 7 days for surgery.

Patients presenting late to the hospital beyond 12 hours of symptoms had a prolonged hospital stay (13 days) in comparison to an early presentation (6 days) (p-value < 0.013).

Stent Removal

The stent was removed by 21 days (11–37 days) with no complications.

Discussion

Incidentally, patients with a higher ASA grade ended up in the stented group (Fig. 2), probably indicating its superiority of use in patients presenting in low condition with a prolonged symptomatic period in our study design. We could delineate that the C-D 3–5 group of complications had a statistical correlation to intervention delivered beyond 12 hours of symptoms ($p = 0.004$) (Fig. 1). The mean duration of endoscopic stenting was significant statistically ($p = 0.001$) with lower duration when compared to the surgical group hinting cleverly the importance of less operating duration while dealing with emergency surgeries to minimize morbidity and mortality. Abdominal lavage was a problem in the stent group with 15/45 cases presenting with postoperative Intra-abdominal abscess (Fig. 1). However, it was a minute problem that was dealt with percutaneously with aspiration and conservative

management. In nine patients with postoperative leak, stent treatment was a safe alternative to reoperation with no incidence of stent migration in our study design.

Conclusion

After dealing with 120 patients, despite the small sample size (Table 1) and limited access to the stents, we can strongly conclude that the use of partially covered nitinol stents was advantageous in patients presenting with low conditions who are unable to tolerate anesthesia. Those presenting with a postoperative leak after a modified graham patch omentoplasty, history of previous upper gastrointestinal surgery, aberrant perforation site, ASA grades 3–5 had an uneventful recovery with minimal complications. We can imagine a future where surgical patch closure might become outdated by this novel method to reduce the hospital patient burden of complicated peptic ulcers.

Orcid

Sayed Mohammed Asfaque Aamir https://orcid.org/0009-0007-5103-1711

References

1. Baron JH. Paintress, princess and physician's paramour: Poison or perforation? J R Soc Med 1998;91(4):213–216. DOI: 10.1177/014107689809100413.
2. Baron JH, Sonnenberg A. Hospital admissions for peptic ulcer and indigestion in London and New York in the 19th and early 20th centuries. Gut 2002;50(4):568–570. DOI: 10.1136/gut.50.4.568.
3. Hermansson M, Ekedahl A, Ranstam J, et al. Decreasing incidence of peptic ulcer complications after the introduction of the proton pump inhibitors, a study of the Swedish population from 1974–2002. BMC Gastroenterol 2009;9:25. DOI: 10.1186/1471-230X-9-25.
4. Moller MH, Shah K, Bendix J, et al. Risk factors in patients surgically treated for peptic ulcer perforation. Scand J Gastroenterol 2009;44(2):145–152. DOI: 10.1080/00365520802401261.
5. Bertleff MJ, Lange JF. Perforated peptic ulcer disease: A review of history and treatment. Dig Surg 2010;27(3):161–169. DOI: 10.1159/000264653.

ORIGINAL ARTICLE

Primary Closure of Direct Inguinal Hernia Defect in Laparoscopic Repair by Pre-tied Suture Loop Technique for Prevention of Seroma: A Prospective Cohort Study

Sachin S Singh[1], Ajay M Rajyaguru[2]

Received on: 30 September 2023; *Accepted on*: 28 October 2023; *Published on*: 11 January 2024

Abstract

Aims and background: Postoperative seroma is a common complication of laparoscopic mesh repair of direct inguinal hernia. Several kinds of attempts have been made to reduce its incidence though they are not without problems. The aim of this study was to evaluate the efficiency of a new alternate technique that must be safe and with fewer complications, using a widely available and inexpensive pre-tied suture loop (endoloop) for plication of the weakened transversalis fascia (TF)/pseudosac.

Materials and methods: A prospective cohort study of 47 patients diagnosed with a total of 63 direct inguinal hernias during a 57-month period fit for laparoscopic tranabdominal preperitoneal (TAPP) meshplasty. Each of the M2 or M3 direct defects, according to the European Hernia Society (EHS), was systematically repaired by TAPP using pre-tied suture loop application at the base of TF. Patients were reviewed during follow-up at 2, 6 weeks, and 1 year after the operation to look for primary postoperative outcome parameters, i.e., seroma formation; secondary outcome parameters, i.e., groin pain, wound infection, and recurrence.

Results: During the follow-up period, no patient presented with seroma formation and wound infection. Only two patients had complaints of groin pain at 2-week follow which was resolved by analgesics and there was no hernia recurrence after a follow-up of 1 year.

Conclusion: Application of a pretied suture loop at the base of TF during laparoscopic repair of direct inguinal hernia is cost effective, safe method and does not increase the risk of seroma formation and recurrence.

Clinical significance: Seroma formation is a major concern for surgeons as well as patients during postoperative period following laparoscopic inguinal hernia repair. The development of a cost-effective, reliable technique with the least or no seroma formation and recurrence prevention is needed at this time.

Keywords: Laproscopy, Pseudosac, Pretied suture loop (endoloop), Seroma, Transabdominal preperitoneal meshplasty, Transversalis fascia.

World Journal of Laparoscopic Surgery (2023): 10.5005/jp-journals-10033-1587

Introduction

Seroma is a common complication in postoperative period after performing procedures in which tissue dead spaces have been created. Seromas occur after surgery due to the presence of mesh in pre-peritoneal space and mechanical injury causing local inflammatory response.[1] Mostly seromas are typically self-resolving, but in some cases, if unresolved, they require aspiration under strict aseptic precaution. The formation of seroma causes anxiety and discomfort to the patients. The rate of seroma formation after total extraperitoneal (TEP) repair is between 0.5 and 12.2% and for tranabdominal preperitoneal (TAPP) meshplasty between 3.0 and 8.0% as per the report.[2,3] If measures are not taken for the prevention of seroma, then its incidence is 4–5%.[4] Seroma formation and hernia recurrence may be difficult to distinguish. Seromas carry the risk of becoming infected and resulting in an abscess. Preoperatively, the patient should be explained about the possibility of seroma formation.[5] The clinical factors significantly associated with seroma formation are a large hernia defect, old age, hernia sac extending into the scrotum, and presence of a residual sac of indirect hernia.[1] Seroma formation is a common complication of laparoscopic mesh repair of moderate to large-size direct inguinal hernia.[6] Methods to reduce the incidence include-closed suction drainage of the preperitoneal space or tacking the transversalis fascia (TF) to the pubic ramus.[3,7] But these techniques have their own complications like iatrogenic injuries and postoperative pain. Less number of studies have been conducted on the application of pre-tied suture loop on direct hernial defect at the base of pseudo sac, and studies showed that endoloop application on base of pseudo sac reduces the risk of seroma formation, recurrence, iatrogenic injury, and chronic postoperative pain that occur in tacking.[8] Hence we have conducted a study for seroma prevention by application of endoloop at the base of pseudosac in laparoscopic direct hernia repair to establish its efficacy in our setup.

[1,2]Department of General Surgery, Pandit Deendayal Upadhyay Medical College, Rajkot, Gujarat, India

Corresponding Author: Sachin S Singh, Department of General Surgery, Pandit Deendayal Upadhyay Medical College, Rajkot, Gujarat, India, Phone: +91 7990858247, e-mail: drsachinsingh2930@gmail.com

How to cite this article: Singh SS, Rajyaguru AM. Primary Closure of Direct Inguinal Hernia Defect in Laparoscopic Repair by Pre-tied Suture Loop Technique for Prevention of Seroma: A Prospective Cohort Study. World J Lap Surg 2023;16(3):166–168.

Source of support: Nil

Conflict of interest: None

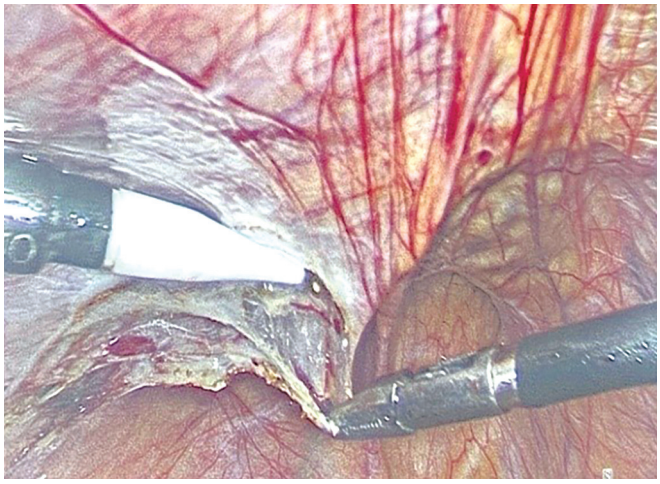


Fig. 1: Peritoneal flap creation

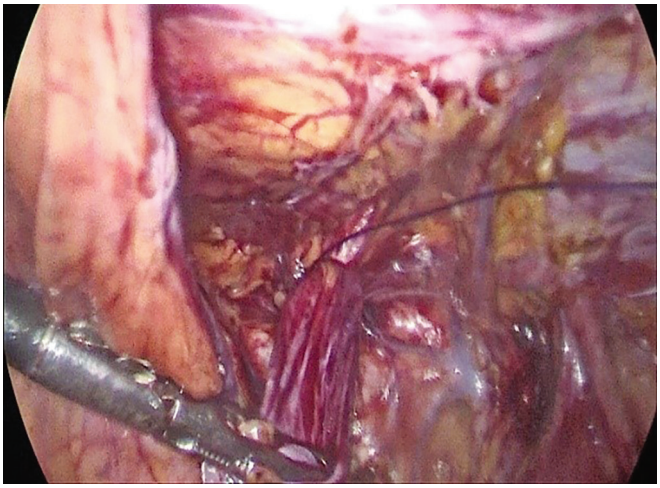


Fig. 2: Endoloop placement at pseudosac

Materials and Methods

Between August 2017 and May 2022, all patients above 18 years of age with direct inguinal hernia having defect size M2 and M3 according to EHS classification, fit for laparoscopic mesh repair were included. All were operated on by laparoscopic TAPP. Peritoneal flap was created (Fig. 1), meticulous dissection was performed in the space of Retzius and the space of Bogros. Intraoperatively the hernia was reduced, base of pseudosac was ligated with a pretied suture loop made by polydioxanone (PDS) 2–0 (Fig. 2). A polypropylene Mesh of size 15 × 13 cm size was placed in preperitoneal space (Fig. 3) and fixed medially at cooper's ligament and rectus using a tacker followed by a closer of the peritoneum.

Results

About 45 patients with only direct inguinal hernia were studied, with 27 unilateral inguinal hernia and 18 bilateral inguinal hernia (Table 1). All patients were male. Around 36 patients have defect size M2 (<3 cm), 27 patients have defect size M3 (>3 cm) (Table 2). All were managed by laparoscopic TAPP with a pre-tied suture loop applied at pseudosac base. Groin pain was developed in two patients during the postoperative period at 2-week follow-up, which was resolved at

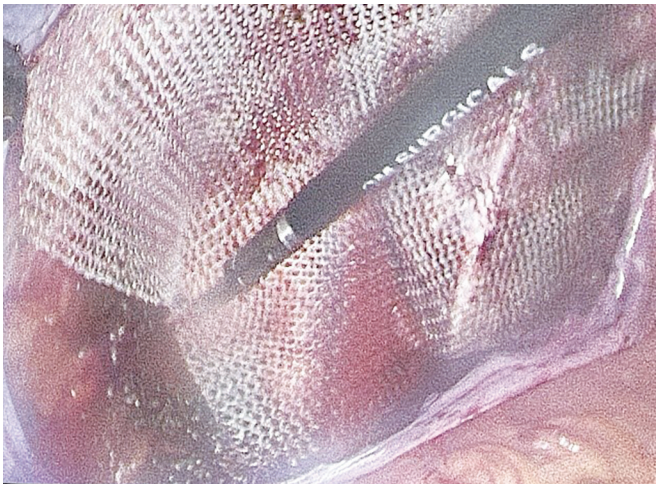


Fig. 3: Mesh placement

Table 1: Total number of cases

	Unilateral	*Bilateral*	*Total no. of cases*
Number of cases	27	18	45

Table 2: Repartition of 63 direct (medial) hernias according to the size of defect as per European Hernia Society (EHS) classification

Size of defect	*Medium (M2)*	*Large (M3)*	*Total no. of cases*
No. of cases	36	27	63

6-week follow-up. No patient developed seroma, wound infection and early recurrence.

Discussion

This study reviewed 45 patients who underwent Laparoscopic repair of moderate and large-size direct inguinal hernial defect closure by endoloop technique. This study has evaluated the outcome of each case and also helped us to identify the safety and effectiveness of the application of a pretied suture loop at the base of TF during laparoscopic repair of direct inguinal hernia. Here we discuss the primary outcome of the study in terms of seroma, and the secondary outcome in terms of groin pain, recurrence, and wound infection, this technique. All patients were male with a median age of 56.5 years. A total 63 direct inguinal hernia repairs are done using a pretied suture loop in laparoscopic technique in 45 patients, with 27 unilateral and 18 bilateral cases. Defect size according to EHS classification was 27 M3 and 36 M2. Only 2 (4.44%) patients, one in case of unilateral and another bilateral inguinal hernia, developed groin pain at 2 weeks follow-up, which was managed with oral analgesics and was resolved at 6 weeks. Further follow-up was done at 1 year when no patient presented with recurrence. Seroma formation can be influenced by several factors, i.e., direct vs indirect or dual hernias, larger defects, inguinoscrotal extension of sac, old age, and presence of a residual sac of indirect hernia. Smaller hernial defects also present with a comparatively lower risk of seroma formation, as do indirect. An analysis showed that glue compared to tacking and non-fixation, led to a higher rate of seroma formation.[6] There is a curtain-like closure after indirect hernial sac excision as these defects are in line with the anatomy of

the groin whereas a direct hernia defect persists as TF evagination after repair.[6] To minimize the postoperative seroma formation, after TEP/TAPP repair of large direct inguinal hernia which can cause discomfort and stress for the patient, there are many intra-operative techniques for prevention of seroma formation i.e. tacking of pseudo sac with pubic bone using tacker, closed suction drainage of the preperitoneal space, fibrin sealant application in preperitoneal dead space as well as postoperative technique such as external compression over inguinal region.[3,7,9] If one pretied suture loop is unable to completely obliterate pseudo sac, then another pretied suture loop can be applied.[8] In the present study we have investigated the feasibility, reliability, and safety of pretied suture loop technique application for the management of direct inguinal hernia defect in laparoscopic repair. No patient developed seroma at 2 weeks and even 6 weeks follow-up. Thus, our study satisfies the primary outcome measure in the sense that the application of a pretied suture loop at the base of TF during Laparoscopic management of direct inguinal hernia is beneficial in the prevention of seroma. Investigating the secondary outcome of the present study, only 4.44% of patients developed groin pain on 2 weeks follow-up which sub-sided at 6 weeks follow-up after giving analgesics. The symptom of groin pain at 2nd week of follow-up is not related to the pretied suture loop but possibly due to exposed cord structures prior to mesh placement and stretching of the genital branch of the genitofemoral nerve while mobilization of the peritoneal sac. Our study has now confirmed that even after long-term follow-up, pre-tied suture loop application does not cause any additional symptoms for the patient and has the advantage of low cost, as there was no requirement of tackers, glue, drain and external compression; thus validates its unrestricted usage for any size of direct hernia defects. This technique of pre-tied suture loop application has been adopted by the International Endo hernia Society's updated guidelines as an alternative to the fixation of transversalis fascia to Copper's ligament, while dealing with large direct defects.

Conclusion

The seroma formation is comparatively more common in direct inguinal hernia and cannot be prevented by laparoscopic inguinal hernia repair. Application of pre-tied suture loop over the base of TF during laparoscopic management of direct inguinal hernia defect is a reliable and safe method for prevention of seroma. This method is cost-effective and does not increase the recurrence risk. This method should be preferred over the tacking of TF or closed suction drainage during repair of direct inguinal hernia defect by laparoscopy.

Clinical Significance

Pretied suture loop application at the base of pseudosac effectively prevents seroma formation and recurrence. This technique is cost-effective, and reliable. Formation of seroma mimics recurrence which creates anxiety and discomfort to the patient, hence development of a cost-effective and reliable technique for seroma prevention by use of a pre-tied suture loop is important.

Orcid

Ajay M Rajyaguru https://orcid.org/0000-0001-9509-5396

References

1. Lau H, Lee F. Seroma following endoscopic extraperitoneal inguinal hernioplasty. Surg Endosc 2003;17(11):1773–1777. DOI: 10.1007/s00464-002-8771-4.
2. Berney CR. The Endoloop technique for the primary closure of direct inguinal hernia defect during the endoscopic totally extraperitoneal approach. Hernia 2012;16(3):301–305. DOI: 10.1007/s10029-011-0892-z.
3. Reddy VM, Sutton CD, Bloxham L, et al. Laparoscopic repair of direct inguinal hernia: A new technique that reduces the development of postoperative seroma. Hernia 2007;11(5):393–396. DOI: 10.1007/s10029-007-0233-4.
4. Cihan A, Ozdemir H, Uçan BH, et al. Fade or fate. Seroma in laparoscopic inguinal hernia repair. Surg Endosc 2006;20(2):325–328. DOI: 10.1007/s00464-005-0052-6.
5. Poelman MM, van den Heuvel B, Deelder JD, et al. EAES consensus development conference on endoscopic repair of groin. Surg Endosc 2013;27(10):3505–3519. DOI: 10.1007/s00464-013-3001-9.
6. Köckerling F, Bittner R, Adolf D, et al. Seroma following transabdominal preperitoneal patch plasty (TAPP): Incidence, risk factors, and preventive measures. Surg Endosc 2018;32(5):2222–2231. DOI: 10.1007/s00464-017-5912-3.
7. Ismail M, Garg M, Rajagopal M, et al. Impact of closed-suction drain in preperitoneal space on the incidence of seroma formation after laparoscopic total extraperitoneal inguinal hernia repair. Surg Laparosc Endosc Percutan Tech 2009:19(3):263–266. DOI: 10.1097/SLE.0b013e3181a4d0e1.
8. Panse M, Deshpande N, Mandhane A, et al. "Seroma prevention technique following endoscopic direct inguinal hernia repair". Journal of Evolution of Medical and Dental Sciences 2013;12(27):4928–4932. DOI: 10.14260/jemds/931.
9. Katkhouda N, Mavor E, Friedlander MH, et al. Use of fibrin sealant for prosthetic mesh fixation in laparoscopic extraperitoneal inguinal hernia repair. Ann Surg 2001;233(1):18–25. DOI: 10.1097/00000658-200101000-00004.

ORIGINAL ARTICLE

Perioperative Outcome and Cost-utility of Mesh Fixation vs Non-fixation in Laparoscopic Transabdominal Preperitoneal Inguinal Hernioplasty: A Prospective Randomized Controlled Trial

Selmy S Awad[1], Fahad H Qahtani[2], Faisal S Alsulaimani[3], Ahmad H Khalid[4], Qasem M Alharthi[5], Musab A AlThomali[6], Nadiah G AlAmri[7], Abdullah A Alshamrani[8], Ahmed H Alsufyani[9], Fahad A Alorabi[10], Abdullah A AlGhuraybi[11], Abdulrahman A Almalki[12], Abdulrahman S Alghamdi[13], Azzah Alzahrani[14], Malak F Almogathali[15], Shumukh A Alkhammash[16], Abdulaziz F Alotaibi[17], Talalalfatimi M Alhassan[18], Abdullah M Altalhi[19], Mahmoud R Abdulshafi[20], Mohamed SA Sheishaa[21]

Received on: 14 March 2022; *Accepted on*: 14 May 2022; *Published on*: 11 January 2024

Abstract

Aim: To analyze laparoscopic transabdominal preperitoneal (TAPP) mesh fixation and non-fixation in the perioperative outcome and cost-utility for inguinal hernia repair. Patients with groin hernias were introduced to laparoscopic TAPP repair to reduce the possibility of recurrence and other complications. Postoperative pain and nerve injury may be exacerbated by mesh fixation. Following preperitoneal inguinal hernia repair, there is controversy as to whether mesh should be fixed to prevent recurrences.

Materials and methods: From the month of February 2017 to January 2018, 60 patients with inguinal hernias were studied prospectively. Using the TAPP approach under general anesthesia (GA) by the same team, thirty hernias were selected randomly and repaired with the fixation of mesh, and the other thirty ones were repaired without mesh fixation with no attention to the type of hernia (direct or indirect) or the size of the defect. Routine clinical examinations were performed for 6 months on all patients as a regular follow-up.

Results: The operative time ranged from 37 to 92 minutes, (with a mean time of 60.44 minutes) in the mesh fixation group and from 40 to 83 minutes (with a mean time of 54.9 minutes). In the mesh fixation group, 15 cases were Rt indirect inguinal hernias. In the mesh non-fixation group, 18 cases were Rt indirect inguinal hernia. The length of the hospital stays ranges from 1 to 3 days with no significance. No statistical significance was noted as regards operative time, intraoperative injury, hospital stay, mesh migration, nerve entrapment, and postoperative analgesia. The significance was observed in cost-utility which represented the cost of trackers mainly.

Conclusion: No recorded significance as regards operative time, intraoperative injury, hospital stay, mesh migration, nerve entrapment, and postoperative analgesia within the analysis of laparoscopic TAPP mesh fixation and non-fixation.

Clinical significance: Mesh without fixation is a viable method and less costly that has the same benefits and excludes risks of fixation.

Keywords: Cost, Inguinal, Laparoscopic, Outcome, Transabdominal preperitoneal.

World Journal of Laparoscopic Surgery (2023): 10.5005/jp-journals-10033-1584

Introduction

Laparoscopic inguinal hernia repair has been demonstrated to be a secure and efficient procedure, resulting in reduced postoperative discomfort, decreased reliance on pain medication, and a more expedient recovery to normal function levels. The use of the transabdominal preperitoneal (TAPP) technique is a popular approach with debatable fixation of the prosthetic patch. It was proposed to form a preperitoneal pocket, insert the patch into it, and then close the peritoneum over it. The results suggest this is a satisfactory method, although follow-up is limited. There are rare reports of tacker-related complications of adhesions, pain, intestinal obstruction, and perforation of the bowel or urinary bladder.[1,2]

Non-fixing the prosthesis can prevent complications such as nerve entrapment and osteitis, causing neuralgia or meralgia-paresthetica. The prosthesis is fixed by the growth of fibrotic tissue upon completion, so it will not recur unless it is anatomically incorrect, the abdominal wall defect is vastly larger than the prosthesis, or a new abdominal wall defect is present next to the

[1]Department of General Surgery, Mansoura University Hospitals, Mansoura, Egypt; King Faisal Medical Complex, Taif, Saudi Arabia

[2–19]Department of General Surgery, King Faisal Medical Complex, Taif, Saudi Arabia

[20,21]Department of General Surgery, Mansoura University Hospitals, Mansoura, Egypt

Corresponding Author: Selmy S Awad, Department of General Surgery, Mansoura University Hospitals, Mansoura, Egypt; King Faisal Medical Complex, Taif, Saudi Arabia, Phone: +966 556466097; +201 030036362, e-mail: selmysabry2007@mans.edu.eg

How to cite this article: Awad SS, Qahtani FH, Alsulaimani FS, *et al*. Perioperative Outcome and Cost-utility of Mesh Fixation vs Non-fixation in Laparoscopic Transabdominal Preperitoneal Inguinal Hernioplasty: A Prospective Randomized Controlled Trial. World J Lap Surg 2023;16(3):169–172.

Source of support: Nil

Conflict of interest: None

prosthesis. Among the first widely used methods was TAPP. With successful peritoneal access, the anatomical identification of the myopectineal orifice (MPO) of Fruchaud is an easy task to achieve.[3,4]

During laparoscopic TAPP, there is a controversy about prosthetic fixation. There is no clear correlation between prosthetic fixation and recurrence experience and pain incidence.[5] A comparison will be held between prosthesis fixation and non-fixation during TAPP repair in terms of the perioperative outcome and cost-utility.

Materials and Methods

Study Design and Recruitment

It was a prospective randomized controlled study that included sixty male patients with inguinal hernia of direct and indirect types, whether primary or recurrent, who underwent laparoscopic hernioplasty after securing the patients' consent and the ethical approval from the institutional research board of Mansoura faculty of medicine. The trial was ethically following the Declaration of Helsinki. These patients were admitted from the outpatient clinics at Mansoura University Hospital during the period between February 2017 and January 2020. Based on the clinical examination, the diagnosis was proved. Using the TAPP approach under general anesthesia (GA), thirty hernias were selected randomly and repaired with fixation of mesh, and the other thirty ones were repaired without mesh fixation with no attention to the type of hernia (direct or indirect) or the size of the defect. All patients more than 18-years-old and fit for pneumoperitoneum were recruited. unfit patients for pneumoperitoneum were excluded. Routine investigations were requested for all patients with preoperative optimization of the co-morbidities.

Steps of Laparoscopic TAPP Repair

Preoperative Preparation

A Foley catheter was inserted if intraoperatively mandated and preoperative voiding was sufficient. The hair from the costal margin to midthigh was shaved off the abdomen and groin. At the time of induction of anesthesia, one gram of 3rd generation cephalosporin was given.

Operative Theater Setup

To facilitate access, the upper limbs were tucked into the operating table. After anesthesia is administered, a routine scrub is performed to the area from the nipples down to the midthigh.

Peritoneal Access

A maximum of 15 mm Hg of carbon dioxide was injected into the peritoneal cavity after open peritoneal access. To visualize the MPO, the candidate is positioned in a Trendelenburg position at 15–30°. The intraabdominal contents are inspected with a 30°, 10 mm laparoscope through the cannula. Next, secondary trocars of 5 mm are introduced.

Exposure of the Defect

Reduction of the sac with proper dissection of the MPO. The prosthesis was placed on the spermatic cord after it was detached from the peritoneum.

Mesh Placement

By housing a large patch of polypropylene mesh measuring about 15 cm × 12 cm (depending on the size of the defect) in the dissected MPO. Thirty cases of hernioplasty were fixed by the tackers. The other thirty cases of hernioplasty were repaired.

Perioperative Follow-up

All patients received one dose of antibiotics postoperatively. Upon completion of the operation, patients were allowed home between 24 and 48 hours later. There are no reports of inguinal discomfort. There is no requirement for inactivity. A follow-up appointment follows the surgery about a week after the procedure.

Parameters Intraoperatively

Operation duration (in min), Intraoperative complications, Type of hernia (Rt or Lt, direct or indirect), and size of the defect.

The Postoperative Parameters Evaluated Included

Mesh curling, recurrence incidence, analgesic need, neurologic affection, infection, LOS, and cost-utility. The follow-up schedule was set at a week, a month, 3 months, and a half of a year, and could be conducted in person or over the phone.

Statistical Assessment

The IBM SPSS software package version 20.0 (Armonk, NY) was utilized to analyze data that were fed into the computer. Quantitative data were described using range (minimum and maximum), mean, standard deviation, and median, while qualitative data were described using numbers and percentages. The normality of distribution was verified using the Kolmogorov-Smirnov test, and the significance of the obtained results was determined at the 5% level. The p-value > 0.05 was deemed insignificant (NS).

Results

Transabdominal preperitoneal repair has been used to treat 60 hernial defects laparoscopically in this study by the same team with or without mesh fixation. For 6 months, patients were examined routinely or contacted by phone. The age within this trial ranged from 24 to 65 years. This table shows the difference as regards age (years), there were mean (41.11 ± 11.67 and 38.70 ± 13.35) respectively, and no statistical significance was noted, with p-value 0.682 = NS. The duration of the procedure ranged from 37 to 92 minutes (with a mean time of 60.44 min) in the prosthetic fixation cases and from 40 to 83 minutes (with a mean time of 54.9 min) in other cases. Table 1 shows the difference as regards intraoperative time, there was a mean (of 60.44 ± 18.60 and 54.90 ± 12.38) respectively, and there was no statistically significant difference recorded, however, it was longer in the 1st group, with a p-value of 0.450 = NS.

In the mesh fixation group,15 cases were Rt indirect inguinal hernias 50%, 12 cases were Lt indirect inguinal hernias 40% and 3 cases were bilateral hernias 10%. In the non-fixation group, 18 cases were Rt indirect inguinal hernia 60%, and 12 cases were Lt indirect inguinal hernia. No statistical significance was noted.

Table 1 shows the discrepancy between group I and group II in site incidence, which was maximum in group II (60%) in Rt indirect inguinal hernias. While it was the minimum group I (40%) in LT inguinal ones. Using Chi-square with p-value 0.580 NS. The size of the defect will be calculated by the multiply of defect length to the defect width which was with no significant variation.

Table 1 shows the difference as regards the size of the defect, there was a mean (12.70 ± 6.18 and 14.60 ± 5.44) respectively, and there was no statistically significant difference between groups, with a p-value of 0.475 NS. In this clinical trial, no single migration was observed during follow-up time.

Table 1: Comparative assessment of the two groups as regards the perioperative outcome and cost

	Group (I) (n = 30) (mesh fixation group)	*Group (II) (n = 30) (mesh non-fixation group)*	*t-test*	
			t	*p-value*
Age (years), mean ± SD	41.11 ± 11.67	38.70 ± 13.35	0.417	0.682
Operative time	60.44 ± 18.60	54.90 ± 12.38	0.772	0.450
LOS	1.80 ± 0.72	1.40 ± 0.91	–0.928	0.366
The cost (in USD)				
The cost of anesthesia	290 ± 48.76	230 ± 44.31		0.041
The mean cost of the LOS	2140 ± 33.98	2110 ± 35.52		
The total cost of the management	4380 ± 235.55	3830 ± 421.56		
Size of defect mean ± SD	12.70 ± 6.18	14.60 ± 5.44	–0.730	0.475
Types of hernia			χ^2	
Rt indirect inguinal hernia	15	18	1.091	0.580
Lt indirect inguinal hernia	12	12		
Bilateral	3	0		
Perioperative complications				
Recurrence rate	2	3	3.529	0.068
Intraoperative injury	0.00	0.00	–	–
Seroma formation	3	2	2.889	0.071

LOS, length of stay

Five cases of seroma were controlled conservatively during the postoperative period within 2–3 weeks and the patients were just reassured during follow-up. Table 1 shows the difference also as regards intraoperative injury, seroma formation, nerve entrapment, and recurrence. No statistical significance was reported, with a *p*-value of 0.071 NS. There were no reported cases of recurrence in this study.

All patients received non-steroidal anti-inflammatory drugs post-operation for 3–5 days with no significant variation or signs of severe pain. There were no reported cases of nerve entrapment nor mesh or surgical site Infection.

The length of hospital stays ranges from 1 to 2 days with no significant difference with a *p*-value 0.366 NS. Table 1 shows the difference in cost (USD) between the two groups which represents the cost of tackers and the difference in operative time used for mesh fixation.

Discussion

General surgery patients most commonly undergo inguinal hernia repair. As a result of the need to prevent recurrences, numerous modifications have been made to the laparoscopic and open hernia repair techniques since 1982, when Ger described the first endoscopic technique.[6,7]

Laparoscopic inguinal hernia repair has been achieved with various methods of fixation for the prosthetic mesh, such as tackers, sutures, or glues. In primary hernias, these neuropathic complications occur at a rate of 0–3%; in recurrent hernias, the rate rises to 5.7%.[8] The cost reduction upon eliminating prosthetic patch fixation is a major concern in low-income countries.[9]

The current trial compared perioperative outcomes and cost efficiency of patch fixation versus prosthetic non-fixation in TAPP repair of groin hernia in sixty patients with inguinal hernia. Data were collected regarding age, gender, duration of surgery, LOS, type of inguinal defect, defect size, prosthetic curling, incidence of recurrence, NSAIDs consumption, neurologic complications, prosthetic patch infection, and cost within the period of 6-months follow-up. The study included patients whose ages ranged from 24 to 66. Approximately 65.7 minutes were spent performing TAPP.[10]

The average operative time in the MRC trial group was 58.4 minutes. In this study, a mean of 60.44 minutes was recorded for those with mesh fixation and 40–83 minutes for those without.[11] The technical issues and learning curve were the reasons for the wide range of diversity in the procedure duration. Compared to other studies, ours had a similar operating time. No significant difference in operative time between the groups of the study, so prosthetic patch fixation is not a major factor affecting operative time.

A rate of 6–31% of complications occur perioperatively with TAPP. Among intraoperative complications, laparoscopic access injuries are the most common, followed by vascular injuries and spermatic cord injuries.[12] An intraoperative complication or technical failure and conversion to an open technique or visceral injury was not observed in this study.

The average hospital stay for the TAPP group was 1.52 ± 0.51.[13] In this study, the average hospital stay in the mesh fixation group was 1.8 ± 0.72 days, and in the mesh non-fixation group it was 1.4 ± 0.91 days in comparison with other studies, there was no difference in LOS between the two groups. The endoscopic repair had the major advantage of allowing a rapid resume of work duties within a few weeks, even strenuous activities.

Prosthetic patch curling and migration are rarely recorded as a postoperative event. This problem may have been caused by the patch fixation patterns and mesh composition as well. Migration rates can be altered by changes in mesh tensile strength and movement. Biomaterials also have a role to play, since they determine the extent and degree to which they interact with the neighboring structures.[14] In this clinical trial, no prosthetic patch curling or migration was recorded.

Patch infection and septic complications are rare events.[15] In our study, mesh infection was not reported. Recurrence was not reported. As the mesh rolls away from the space of Retzius and medial inguinal triangle, various mechanisms of hernia recurrence

have been investigated. Incomplete dissection of MPO and improper patch size are the most common causes of recurrence.[16]

A randomized trial comparing stapled and non-stapled hernia repairs was conducted by Smith et al. in 502 consecutive patients undergoing elective TAPP. About 263 non-stapled repairs and two hundred seventy-three stapled repairs were performed, and the median follow-up was 16 months. The incidence of recurrence was not statistically different.[17]

During the preparation and placement of mesh, the number of clips was reduced, and the autonomic nerve course was carefully observed, thus reducing nerve irritations significantly.[18] Due to meticulously avoiding nerve sites, there was no nerve entrapment in our study.

Non-steroidal anti-inflammatory drugs were given twice daily for 3–5 days with sufficient control of pain. In three studies, the financial burden of prosthesis fixation versus non-fixation was compared, and the biggest difference was in the cost of the tacks. Non-fixation is less expensive than permanent fixation since it provides the same effectiveness.[19] It was the costs of tacks used in prosthetic patch fixation that determined the difference in financial burden between the two groups and it ranges from 425 to 480 USD according to the cost of tacker used. So, mesh fixation is costly in our country.

There is doubt about repair without mesh fixation and the risk of recurrence. Transabdominal preperitoneal repair with fixation increases cost which is important in developing countries. It was a significant parameter, especially in low-income countries which may determine the approach. This study had some limitations like a small sample size, selection bias, and the cost of tackers. It needs to be extended to include different strata of people in multiple centers on a wide scale.

Conclusion

Non-fixation of mesh is a valid method and less costly that has the same benefits and excludes risks of fixation. Hernia recurrence seems not to be increased by non-fixation with no difference as regards procedure duration, intraoperative injury, patch migration, nerve entrapment, stay, and postoperative analgesia.

Clinical Significance

Transabdominal preperitoneal hernia repair with fixation increases the cost which is important in developing countries with no significant difference with non-fixation about the postoperative outcome.

Orcid

Selmy S Awad https://orcid.org/0000-0002-2724-5599

References

1. Mishra, RK. Complications of minimal access surgery. Textbook of practical laparoscopic surgery, 1st edition. New Delhi: Jaypee Brothers Medical Publication; 2008. pp. 388–389.
2. Novik B, Sandblom G, Ansorge C, et al. Association of mesh and fixation options with reoperation risk after laparoscopic groin hernia surgery: A Swedish hernia registry study of 25,190 totally extraperitoneal and transabdominal preperitoneal repairs. J Am Coll Surg 2022;234(3):311–325. DOI: 10.1097/XCS.0000000000000060.
3. Schultz L, Graber J, Pietrafitta J, et al. Laparoscopic herniorrhaphy: A clinical trial preliminary results. J Laparoendosc Surg 1990;1(1): 41–45. DOI: 10.1089/lps.1990.1.41.
4. Nahid AK, Rahman S, Veerapatherar K, et al. Outcomes on mesh fixation vs non-fixation in laparoscopic totally extra peritoneal inguinal hernia repair: A comparative study. Turk J Surg 2021;37(1):1–5. DOI: 10.47717/turkjsurg.2021.4962.
5. Lachin AB, Abdrabbu AA, Darwish AAF, et al. Mesh fixation versus non-fixation in laparoscopic transabdominal preperitoneal inguinal hernia repair. QJM: An International Journal of Medicine 2020;113(suppl 1): Hcaa050.027. DOI: https://doi.org/10.1093/qjmed/hcaa050.027.
6. Abdelhamid MS. Trans abdominal preperitoneal hernia repair with external fixation. Hernia 2011;15(2):185–188. DOI: 10.1007/s10029-010-0766-9.
7. Altintoprak F, Akin E, Gundogdu K, et al. "Laparoscopic Inguinal Hernia Repair: Technical Details, Pitfalls, and Current Results". Hernia Surgery and Recent Developments, edited by Arshad Malik, IntechOpen, 2018. DOI: 10.5772/intechopen.76942.
8. Condon RE, Nyhus LM. Complications of groin hernia. In: Condon RE, Nyhus LM, (Eds). Hernia, 4th edition. Philadelphia: JB Lippincott; 2010. p. 269.
9. Spitz JD, Arregui ME. Laparoscopic Totally Extraperitoneal Repair for Inguinal Hernias. In: Laparoscopic Surgery of the Abdomen, Springer, New York, NY, pp. 295–302.
10. Murthy PK, Ravalia D. Assessment and comparison of laparoscopic hernia repair versus open hernia: A non-randomized study. International Surgery Journal 2018;5(3):1021–1025. DOI: https://doi.org/10.18203/2349-2902.isj20180823.
11. Laparoscopic versus open repair of groin hernia: A randomized comparison. The MRC Laparoscopic Groin Hernia Trial Group. Lancet 1999;354(9174):185–190. PMID: 10421299.
12. Voitk AJ. The learning curve in laparoscopic inguinal hernia repair for the community general surgeon. Can J Surg 1998;41(6):446–450. PMID: 9854534.
13. Anadol ZA, Ersoy E, Taneri F, et al. Outcome and cost comparison of laparoscopic transabdominal preperitoneal hernia repair versus Open Lichtenstein Technique. J Laparoendosc Adv Surg Tech A 2004;14(3):159–163. DOI: 10.1089/1092642041255414.
14. Gandhi D, Marcin S, Xin Z, et al. Chronic abdominal pain secondary to mesh erosion into cecum following incisional hernia repair: A case report and literature review. Ann Gastroenterol 2011;24(4):321–324. PMID: 24713759.
15. Avtan L, Avci C, Bulut T, et al. Mesh infections after laparoscopic inguinal hernia repair. Surg Laparosc Endosc 1997;7(3):192–195. PMID: 9194276.
16. Tamme C, Garde N, Klingler A, et al. Extraperitoneal inguinal hernioplasty with titanium-coated lightweight polypropylene mesh: Early results. Surg Endosc 2005;19(8):1125–1129. DOI: 10.1007/s00464-004-8219-0.
17. Smith AI, Royston CM, Sedman PC. Stapled and nonstapled laparoscopic transabdominal preperitoneal (TAPP) inguinal hernia repair. A prospective randomized trial. Surg Endosc 1999;13(8): 804–806. DOI: 10.1007/s004649901104.
18. Stark E, Oestreich K, Wendl K, et al. Nerve irritation after laparoscopic hernia repair. Surgical endoscopy 1999;13(9):878–881. DOI: 10.1007/s004649901124.
19. Lo CW, Tsai YC, Yang SS, et al. Comparison of short- to mid-term efficacy of nonfixation and permanent tack fixation in laparoscopic total extraperitoneal hernia repair: A systematic review and meta-analysis. Ci Ji Yi Xue Za Zhi 2019;31(4):244–253. DOI: 10.4103/tcmj.tcmj_47_18.

RESEARCH ARTICLE

Can Analysis of Washings Sucked Out during Laparoscopic Surgeries Improve Lymph Node Yield?

Subbiah Shanmugam[1], Aravind Shivakumar[2]

Received on: 24 September 2023; *Accepted on*: 28 October 2023; *Published on*: 11 January 2024

Abstract

Introduction: Lymph node metastasis is one of the most important factors determining survival in most malignancies. Better lymph node yield improves survival in many cancers.

We tried to analyze the laparoscopic surgical washings for the presence of lymphatic tissue/deposits to improve information on nodal involvement. Saline is instilled and washings are sucked out during laparoscopic surgeries. How much information on lymph node involvement is lost because of these washings not being analyzed is an important question we wanted to answer.

Materials and methods: We prospectively evaluated the surgical washings of patients undergoing laparoscopic surgery at our institution from May 2022 to December 2022. All patients with biopsy-proven malignancies who underwent laparoscopic surgery including regional nodal assessment were included in the study. These included patients with carcinoma cervix, carcinoma stomach, carcinoma esophagus, and carcinoma rectum. The only exclusion criterion was not having proof of malignancy through biopsy. The pelvic nodes were separately removed in an endobag for patients with carcinoma cervix, minimizing spillage.

The surgical wash fluid obtained from routine irrigation and suction of the surgical field with 0.9% NS (minimum of 1L) was collected. Unfractionated heparin of 1 mL was added to the fluid. After 24 hours, the solution would be centrifuged and analyzed by the pathologists. Suspicious tissues would be analyzed for the presence of lymphoid material and tumor deposits. A total of 50 patients were analyzed, which included 32 patients with carcinoma cervix, eight patients with carcinoma stomach, four patients with carcinoma esophagus, and six patients with carcinoma rectum.

Results: Amongst the 50 patients studied, none of them had the presence of lymph nodes in the surgical wash fluid.

Conclusion: A simple analysis of the surgical washings of patients undergoing laparoscopic cancer that included nodal dissection failed to provide better information on nodal involvement. With the background of limitations of our study, better handling of fluid irrigated and sucked out may lead to better information. But as of now, analysis of irrigation fluid during laparoscopic surgery is not useful.

Keywords: Laparoscopic, Nodal yield, Surgical washings.

World Journal of Laparoscopic Surgery (2023): 10.5005/jp-journals-10033-1592

Introduction

Lymph node metastasis is one of the most important factors determining survival in most malignancies. Better lymph node yield improves survival in many cancers.

We tried to analyze the laparoscopic surgical washings for the presence of lymphatic tissue/deposits to improve information on nodal involvement. Saline is instilled and washings are sucked out during laparoscopic surgeries. How much information on lymph node involvement is lost because of these washings not being analyzed is an important question we wanted to answer.

Materials and Methods

We prospectively evaluated the surgical washings of patients undergoing laparoscopic surgery at our institution from May 2022 to December 2022. All patients with biopsy-proven malignancies who underwent laparoscopic surgery including regional nodal assessment were included in the study. These included patients with carcinoma cervix, carcinoma stomach, carcinoma esophagus, and carcinoma rectum. The only exclusion criterion was not having proof of malignancy through biopsy. The pelvic nodes were separately removed in an endobag for patients with carcinoma cervix, minimizing spillage.

[1]Department of Surgical Oncology, Government Kilpauk Medical College; Government Royapettah Hospital, Chennai, Tamil Nadu, India

[2]Department of Surgical Oncology, Government Kilpauk Medical College, Chennai, Tamil Nadu, India

Corresponding Author: Subbiah Shanmugam, Department of Surgical Oncology, Government Kilpauk Medical College; Government Royapettah Hospital, Chennai, Tamil Nadu, India, Phone: +91 9360206030, e-mail: subbiahshanmugam67@gmail.com

How to cite this article: Shanmugam S, Shivakumar A. Can Analysis of Washings Sucked Out during Laparoscopic Surgeries Improve Lymph Node Yield? World J Lap Surg 2023;16(3):173–174.

Source of support: Nil

Conflict of interest: None

The surgical wash fluid obtained from routine irrigation and suction of the surgical field with 0.9% NS (minimum of 1L) was collected. Unfractionated heparin of 1 mL was added to the fluid. After 24 hours, the solution would be centrifuged and analyzed by the pathologists. Suspicious tissues would be analyzed for the presence of lymphoid material and tumor deposits. A total of 50 patients were analyzed, which included 32 patients with carcinoma

Table 1: Baseline characteristics of the patients included in the study

Diagnosis	*No. of patients*
Early carcinoma cervix (IB1, IB2, IIA1)	6
Carcinoma cervix IIB S/P CRT	26
Carcinoma stomach S/P pri-op CRT	6
Early gastric cancer	2
Carcinoma distal esophagus S/P CRT	4
Carcinoma rectum S/P pre-op CRT	6

CRT, chemoradiotherapy; S/P, status post

cervix, eight patients with carcinoma stomach, four patients with carcinoma esophagus, six patients with carcinoma rectum.

Results

Amongst the 50 patients studied, none of them had the presence of lymph nodes in the surgical wash fluid.

The Table 1 deals with the patient characteristics included in our study. The stage and details of any preoperative therapy are mentioned.

Discussion

Scientific research involves innovation and experimentation, and these methods need not be necessarily complicated. We presented a simple idea to examine the surgical washings of cancer patients undergoing laparoscopic surgery for the presence of lymphatic tissue/deposits. The surgical washings were collected in a container, added to a heparin solution, and then analyzed.

Peritoneal wash cytopathology has been well-established as a diagnostic and staging tool in the management of various malignancies including ovary.[1] Most of the studies focused on analyzing the presence of malignant cells in the wash fluid which would upstage the disease.[2–5] Here we focussed on the presence of lymphoid tissue and deposits in the fluid irrigated and sucked out during laparoscopic surgeries.

We all know that improving the nodal yield leads to better information and this leads to stage migration and better survival for patients with early-stage disease. This is especially true for the malignancies included in this study such as cervix, rectum, esophagus, and stomach.[6–8] Improving surgical technique is the first and foremost way to improvise nodal yield. We sought out a simple idea to improve the information on nodal metastasis by analyzing the surgical washings where the missed nodes may be found. Unfortunately, none of our patients had either lymphatic tissue or tumor deposits in the surgical washings.

Several factors could explain the negative results of this study. Most of the patients underwent preoperative therapy either in the form of chemotherapy or radiation, which usually reduces the nodal yield significantly. Spilled-out lymphatic tissue out of the field of suction and irrigation may be another reason for the lack of lymphatic tissue/tumor deposits. This sort of displacement is further enhanced by the pneumoperitoneum. Many other hidden factors could be the reason behind the study's negative findings.

It is observed that cohesive nonkeratinizing squamous cell carcinoma cells in cancer cervix can be mistaken for reactive mesothelial cells, especially postirradiation, which might be the reason for missing out nodal tissue or the presence of squamous deposits in them.[9]

Even though this study has negative results, we still want to report them to encourage further research in this area and achieve better information. Our study has some limitations of its own. The procedure involved in analyzing the presence of lymphatic tissue/tumor deposits could be augmented by ultracentrifugation and ultraslicing techniques in future studies.

Conclusion

A simple analysis of the surgical washings of patients undergoing laparoscopic cancer that included nodal dissection failed to provide better information on nodal involvement. With the background of limitations of our study, better handling of fluid irrigated and sucked out may lead to better information. But as of now, analysis of irrigation fluid during laparoscopic surgery is not useful.

Orcid

Subbiah Shanmugam https://orcid.org/0000-0001-5289-3953
Aravind Shivakumar https://orcid.org/0000-0002-6696-1942

References

1. Özkara SK. Significance of peritoneal washing cytopathology in ovarian carcinomas and tumors of low malignant potential: A quality control study with literature review. Acta Cytologica 2011;55(1):57–68. DOI: 10.1159/000320858.
2. Sibio S, Fiorani C, Stolfi C, et al. Detection methods and clinical significance of free peritoneal tumor cells found during colorectal cancer surgery. World J Gastrointest Surg 2015;7(9):178–184. DOI: 10.4240/wjgs.v7.i9.178.
3. Cies´la, Lisiecki R, Ławnicka A, et al. Clinical significance of peritoneal fluid examination for free cancer cells in patients qualified for surgery for gastric cancer. Front Surg 2021;8:685868. DOI: 10.3389/fsurg.2021.685868.
4. Jiang, Xiong XJ, Qiu XS, et al. The morphological analysis of cells in the peritoneal washing fluids of patients with gastric cancer. Cell Transplant 2019;28(11):1384–1389. DOI: 10.1177/0963689719864318.
5. Tustumi F, Bernardo WM, Dias AR, et al. Detection value of free cancer cells in peritoneal washing in gastric cancer: A systematic review and meta-analysis. Clinics 2016;71(12):733–745. DOI: 10.6061/clinics/2016(12)10.
6. Wang R, Tao X, Wu X, et al. Number of removed pelvic lymph nodes as a prognostic marker in FIGO stage IB1 cervical cancer with negative lymph nodes. Journal of minimally invasive gynecology 2020;27(4):946–952. DOI: https://doi.org/10.1016/j.jmig.2019.08.002.
7. Yaqi Wang, Zhou M, Yang J, et al. Increased lymph node yield indicates improved survival in locally advanced rectal cancer treated with neoadjuvant chemoradiotherapy. Cancer Medicine 2019;8(10):4615–4625. DOI: 10.1002/cam4.2372.
8. Henckens SPG, Hagens ERC, van Berge Henegouwen MI, et al. Impact of increasing lymph node yield on staging, morbidity and survival after esophagectomy for esophageal adenocarcinoma European Journal of Surgical Oncology 2023;49(1):89–96. DOI: https://doi.org/10.1016/j.ejso.2022.07.012.
9. Zuna RE. Diagnostic cytopathology of peritoneal washings. Cytojournal 2022;19:9. DOI: 10.25259/CMAS_02_07_2021.

A Minimally Invasive Approach for a Large True Broad Ligament Fibroid

Kavita Khoiwal

Received on: 19 November 2022; *Accepted on:* 20 February 2023; *Published on:* 11 January 2024

Keywords: Broad ligament, Fibroid, Laparoscopic, Myomectomy.
World Journal of Laparoscopic Surgery (2023): 10.5005/jp-journals-10033-1574

Fibroid is the most common uterine tumor. The occurrence of fibroid at extrauterine sites is very rare. If this occurs, the broad ligament is the most common site followed by round ligament, ovarian ligament, and ovaries. The reported incidence of broad ligament fibroid is <1%.[1] Broad ligament fibroids are usually asymptomatic but patients may present with pelvic pain, heaviness, and pressure symptoms to the ureter, bladder, or bowel depending upon the size as these fibroids have the capacity to grow to an enormous size. Rarely menstrual abnormalities can occur if intrauterine myoma coexists. Differential diagnosis includes pedunculated subserosal fibroid or ovarian tumor. There are reports where large broad ligament fibroids mimic ovarian malignancy.[2,3] Exact preoperative diagnosis is difficult still imaging modalities (transvaginal ultrasound, CT and MRI) have been found helpful. Management is purely surgical and is challenging due to its large size and location as surrounded by the ureter, urinary bladder, and iliac vessels. Identification of the course of the ureter is crucial.[4]

We report a case of a large true broad ligament fibroid due to its rare occurrence and demonstrate the surgical technique of laparoscopic myomectomy in such a case. A 33-year-old parous lady presented with a complaint of heaviness in her lower abdomen for 5 months. Ultrasound sonography's (USG) pelvis was suggestive of a large solid right adnexal mass. Contrast enhanced computerized tomography (CECT) abdomen and pelvis revealed a 15 × 15 cm large fibroid either pedunculated subserosal fibroid or broad ligament fibroid. A plan of myomectomy by minimally invasive approach was made after discussion with the patient. Written and informed consent was taken for laparoscopic myomectomy. General anesthesia was administered. The patient was placed in the lithotomy position. Pneumoperitoneum created. A 10 mm supra umbilical port was put for laparoscope. Three accessory 5 mm ports were placed. Intraoperative findings revealed a normal-sized uterus deviated to the left lateral pelvic wall due to a large 15 × 15 cm right-sided broad ligament fibroid (Fig. 1). Bilateral tubes and ovaries were healthy. The right round ligament as well as the infundibulopelvic ligament was stretched over the fibroid. The right ureter was traced and found medial to the fibroid (Fig. 2) which makes it a true broad ligament fibroid. To minimize intraoperative blood loss, diluted vasopressin (20 units of vasopressin in 200 mL of normal saline) was injected at the junction and in the substance of fibroid. The right round ligament was dissected in order to get entry into the fibroid. A combination of sharp and blunt dissection was used to enucleate the fibroid. Myoma screw was used to provide counter traction. Continuous traction and counter traction are essential. The base of the myoma was broad and deeply seated, so it was dissected with a harmonic ace in order to minimize blood loss. The ureter on the side of the surgery was traced again. The bed of fibroid was stitched with a delayed absorbable suture. The round ligament was reapproximated to maintain the ligamentous support of the uterus and to restore pelvis anatomy. Cut edges of the peritoneum were also sutured to avoid adhesion formation and bowel entanglement (Fig. 3). The fibroid was then removed using electronic morcellation. The patient recovered well in the postoperative period and was discharged on the next postoperative day.

Probable surgical complications in large true broad ligament fibroid are excessive intraoperative blood loss, injury of ureter and major blood vessels.

- Tips and tricks for laparoscopic myomectomy:
  - Deep knowledge of pelvic anatomy

Department of Obstetrics and Gynaecology, All India Institute of Medical Sciences, Rishikesh, Uttarakhand, India

Corresponding Author: Kavita Khoiwal, Department of Obstetrics and Gynaecology, All India Institute of Medical Sciences, Rishikesh, Uttarakhand, India, Phone: +91 9013436908, e-mail: kavita.kh27@gmail.com

How to cite this article: Khoiwal K. A Minimally Invasive Approach for a Large True Broad Ligament Fibroid. World J Lap Surg 2023;16(3): 175–176.

Source of support: Nil

Conflict of interest: None

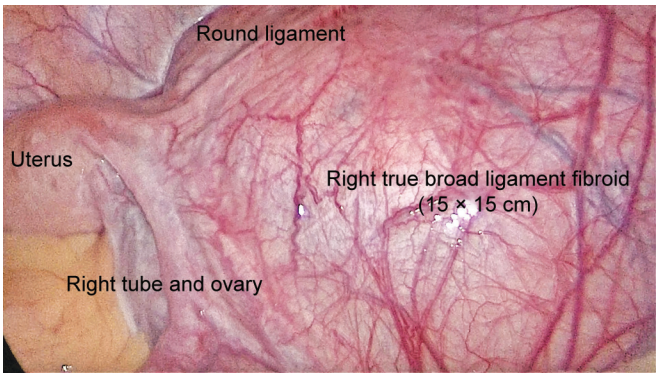


Fig. 1: Laparoscopic image showing a large true broad ligament fibroid

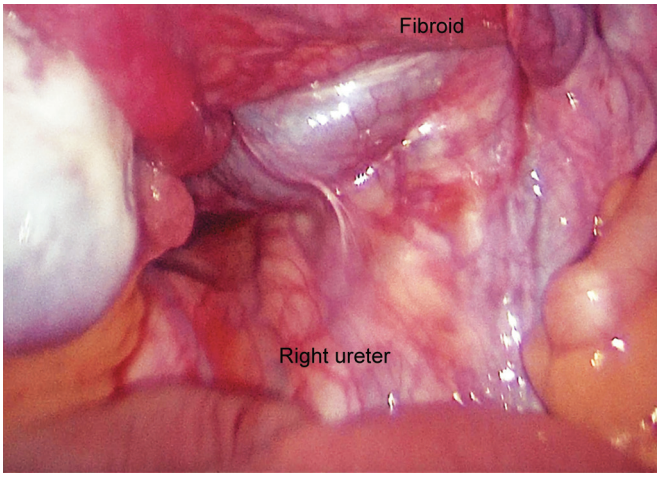


Fig. 2: Laparoscopic image showing ureter medial to the fibroid

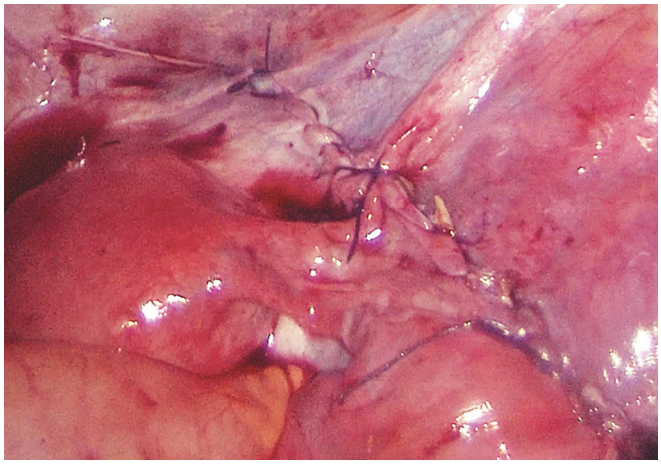


Fig. 3: Peritonization after suturing of myoma bed

- Measures to decrease intraoperative blood loss (e.g., injection vasopressin, uterine or internal iliac artery ligation)
- Keep an eye on the ipsilateral ureter during surgery
- Always operate inside the capsule of fibroid

Orcid

Kavita Khoiwal https://orcid.org/0000-0002-3156-7486

References

1. Parker WH. Uterine myomas: An overview of development, clinical features, and management. Obstet Gynecol 2005;105(1):216–217. DOI: 10.1097/01.AOG.0000150453.10906.b6.
2. Jagtap SV, Gupta A, Kshirsaga NS. Broad ligament myoma mimicking as ovarian tumour. Sch J Appl Med Sci 2014;2(1C):258–260. DOI: 10.36347/sjams.2014.v02i01.0056.
3. Bansal P, Garg D. A case of massive broad ligament leiomyoma imitating an ovarian tumour. J Clin Diagn Res 2014;8(3):136–137. DOI: 10.7860/JCDR/2014/7642.4136.
4. Rajput DA, Gedam JK. Broad ligament fibroid: A case series. IJSS Case Rep Rev 2015;1(11):8–11. DOI: 10.17354/cr/2015/58.