International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

Postoperative Seroma Formation and Complications in Open versus Laparoscopic Ventral Hernia Repair

Sandeep Damera[1], Mahammad Fareedh[2], Ashok Revelli[2*], N Ashok Vardhan[3], Bandi Ajay Kumar[4]

[1]Department of General Surgery, Government General Hospital, Government Medical College, Mancherial, Telangana, India.
[2]Department of General Surgery, Government General Hospital, Singareni Institute of Medical Sciences, Ramagundam, Telangana, India.
[3]Department of Biochemistry, Singareni Institute of Medical Sciences, Ramagundam, Telangana, India.
[4]Department of General Medicine, Singareni Institute of Medical Sciences, Ramagundam, Telangana, India.

OPEN ACCESS

Corresponding Author:

Dr. Ashok Revelli
Department of General Surgery, Government General Hospital, Singareni Institute of Medical Sciences, Ramagundam, Telangana, India.
Email: revelli.ashok@gmail.com

Received: 01-01-2026
Accepted: 07-02-2026
Available online: 28-02-2026

ABSTRACT

Background: Seroma formation and wound-related complications are among the most common issues following ventral hernia repair. This study compares the incidence of seroma, overall postoperative complications, duration of surgery, and length of hospital stay between open and laparoscopic approaches.
Methods: This prospective observational study included 200 consecutive patients undergoing elective ventral hernia mesh repair (173 open, 27 laparoscopic IPOM) at Hindu Rao Hospital, Delhi, from June 2015 to May 2017. Seroma was assessed clinically and by ultrasonography on postoperative day 2 and at discharge. Other complications and length of hospital stay were recorded.
Results: The groups were comparable in age and sex distribution. Seroma (detected on ultrasonography) on postoperative day 2 was observed in 48/173 (27.74%) patients in the open group versus 4/27 (14.81%) in the laparoscopic group. Overall postoperative complications occurred in 52/173 (30.05%) patients in the open group compared to 6/27 (22.2%) in the laparoscopic group. Wound infection was notably higher in the open group (17.34% vs 3.7%). Mean duration of surgery was similar (84.48 ± 27.54 min open vs 90.00 ± 21.88 min laparoscopic, p=0.322). Mean hospital stay was shorter in the laparoscopic group (4.07 ± 0.27 days vs 5.06 ± 1.92 days).
Conclusion: Laparoscopic ventral hernia repair is associated with a lower incidence of seroma formation, fewer wound infections, and reduced length of hospital stay compared to open repair, with comparable operative time. The laparoscopic approach offers advantages in short-term morbidity.

Keywords*: Ventral hernia, Incisional hernia, Laparoscopic hernia repair, Seroma, Surgical site infection, Hospital stay.*

INTRODUCTION

Ventral hernias constitute a substantial challenge in general surgical practice. Although prosthetic mesh reinforcement has markedly decreased recurrence rates, postoperative complications such as seroma formation, surgical site infections, and extended hospital stays remain significant concerns [1]. Introduced in 1993, the laparoscopic intraperitoneal only mesh technique for ventral hernia repair has achieved broad acceptance. Proponents highlight reduced wound-related morbidity and expedited recovery, whereas opponents underscore risks including bowel injury, mesh-associated issues, and seroma development. Importantly, seroma rates reported in the literature show marked variability attributable to inconsistent diagnostic criteria and detection modalities [2].

Furthermore, recent meta-analyses indicate that while some studies associate laparoscopy with lower seroma rates, the causal relationship remains subject to ongoing debate due to conflicting reports in current surgical literature [3]. Specifically, while some investigations emphasize the role of cauterization and suture-based dead space reduction in minimizing fluid accumulation, others suggest that the intraperitoneal only mesh technique may introduce unique risks

related to material-intestine contact [4,5]. Comparative evidence consistently indicates that laparoscopic repair is associated with a significantly lower frequency of wound dehiscence and surgical site infections compared to traditional open techniques [6,7].

Robust comparative data from the Indian subcontinent, especially using combined clinical and ultrasonographic assessment, remain limited. This study was designed to evaluate the incidence of postoperative seroma and other complications, along with key perioperative outcomes, between open and laparoscopic ventral hernia repair [8]. The primary objective of this study was to compare the incidence of postoperative seroma and overall complications between open and laparoscopic ventral hernia repair, as well as the duration of surgery and length of hospital stay.

MATERIALS AND METHODS

Two hundred consecutive patients undergoing elective ventral hernia repair with mesh reinforcement were included.

Inclusion Criteria

- Age 18–80 years
- Elective repair of primary or incisional ventral hernias
- Mesh repair

Exclusion Criteria

- Emergency surgery
- Active infection or infected mesh
- Decompensated liver disease
- Presence of stoma
- Chronic pain syndrome
- Inability to comply with follow-up

Surgical Procedures

Open Repair: Performed predominantly under spinal or combined spinal-epidural anesthesia. Following sac reduction or excision, polypropylene mesh was placed using the only or inlay technique. Drains were used selectively.

Laparoscopic Repair: Performed under general anesthesia using a composite microporous polypropylene mesh. Fixation was achieved with trans fascial sutures and/or tacks in a double-crown fashion. Postoperative compression dressings and abdominal binders were applied.

Outcome Assessment

Seroma:
Clinical: Visible or palpable fluid collection
Ultrasonographic: Fluid collection detected on ultrasound on postoperative day 2 and at discharge
Other Complications: Wound infection, postoperative ileus, hematoma, etc.
Length of Hospital Stay: Calculated from the day of surgery to the day of discharge.
The study protocol was approved by the Institutional Ethics Committee. Written informed consent was obtained from all participants. Categorical data were analyzed using the chi-square or Fisher's exact test. Continuous data were compared using the independent t-test or Mann-Whitney U test, as appropriate. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1: Age Distribution of Patients Studied

Age in years	Open group		Laparoscopy group	
	n=173		n=27	
	Number (n)	Percentage (%)	Number (n)	Percentage (%)
21 - 30	28	16.20	2	7.40
31- 40	30	17.30	10	37.00
41-50	47	27.20	8	29.60
51-60	44	25.40	3	11.10
61-70	24	13.90	4	17.80

Mean age#	46.54 ± 12.48		45.04 ± 11.47	

#p = 0.558; Not significant

Most common age group in open group is 41 – 50 yrs contributing to 27.2% and in laparoscopy group is 31 – 40 yrs contributing to 37%. Mean age was 46.54 ± 12.48 years (open) vs 45.04 ± 11.47 years (laparoscopic, p = 0.558).

Table 2: Sex Distribution of Patients Studied

SEX	Open group		Laparoscopy group	
	Number (n)	Percentage (%)	Number (n)	Percentage (%)
	46	26.60	9	33.30
MALE				
	127	73.40	18	66.70
FEMALE				

p = 0.465; Not significant

Females are most common in both open and laparoscopic group compared to male contributing to 73.4% in open group and 66.7% in laparoscopy group. Females predominated in both groups (73.4% open vs 66.7% laparoscopic, p = 0.465).

Table 3: Etiologial Distribution of Ventral Hernias in Open Group

Type of hernia	Number of patients (n)	Percentage (%)
Epigastric	19	11.00
Umbilical	24	13.90
Paraumbilical	49	28.30
Incisional	81	46.80
Total	173	100

Most common type of hernia which requires open surgery is incisional hernia corresponding to 46.8% followed by paraumbilical hernia corresponding to 28.3%.

Table 4: Etiologial Distribution of Ventral Hernias in Laparoscopic Group

Type of Hernia	Number of Patients (n)	Percentage (%)
Epigastric	2	7.4
Umbilical	10	37.0
Paraumbilical	8	29.6
Incisional	7	25.9
Total	27	100

Most common type of hernia which requires laparoscopic surgery is umbilical hernia corresponding to 37% followed by paraumbilical hernia corresponding to 29.6%.

Table 5: Distribution of Duration of Surgery

Duration of Surgery (mins)	Open Group (N=173)		Laparoscopy Group (N=27)	
	Number (n)	Percentage (%)	Number (n)	Percentage (%)
40 – 60	40	23.12	3	11.11
61 – 80	54	31.213	5	18.51
81 – 100	34	19.653	13	48.14
101 – 120	27	15.606	4	14.81
>120	18	1O.404	2	7.407

Mean duration of surgery[#]	84.48 ± 27.54			90.00 ± 21.88		

#p = 0.322; Not significant

In most of the patients it took 61 to 80 min for open surgery and 81 to 100 minutes to complete surgery in laparoscopy group. Mean duration was 84.48 ± 27.54 minutes in open group vs 90.00 ± 21.88 minutes in laparoscopic group (p = 0.322) not statistically significant.

Table 6: Distribution of Postoperative Seroma

Seroma	Day 2 (Percentage)	At Discharge (Percentage)
Open Group		
Clinically	18 (10.40)	0 (0)
Ultrasonologically	48 (27.74)	6 (3.46)
Total	48 (27.74)	6 (3.46)
Laparoscopy Group		
Clinically	1 (3.7)	0 (0)
Ultrasonologically	4 (14.81)	1 (3.7)
Total	4 (14.81)	1 (3.7)

Postoperative seroma is more common in open group contributing to 27.74% compared to laparoscopy group which accounts to 14.81%. Seroma was more frequently detected in the open group, particularly on radiological evaluation.

Table 7: Distribution of Postoperative Complications

Complication	**Open group [Percentage]n=173**	**Laparoscopy group [Percentage] n=27**	**p value**
Seroma	47 [27.20]	5 [18.5]	0.341^{NS}
Wound Infection	30 [17.34]	1 [3.7]	0.069^{NS}
Postoperative ileus	13 [7.51]	4 [14.81]	
Overall complications	**52 [30.05]**	**6 [22.2]**	

Overall complications were more in open group accounting to 30.05% compared to laparoscopy group which accounts only to 22.2% among all seroma is most common complication in both open and laparoscopy groups. Wound infections were markedly more common after open repair.

Table 8: Distribution of Length of Hospital Stay

Length of hospital stay	**Open group N=173**		**Laparoscopy group n=27**	
	Number	Percentage	Number	Percentage
1-5	49	28.32	20	74.07
6-10	113		6	22.22
11-13	9		1	3.7
>15	2		-	-
mean				

Most of the patients in open group (46.82%) have taken 6 to 10 days to get discharged whereas in laparsocopy group (74.07%) only 1 to 5 days. Length of hospital stay was shorter in the laparoscopic group (mean ≈4.07 days vs 5.06 days).

DISCUSSION

This prospective study demonstrates that laparoscopic ventral hernia repair is associated with a lower incidence of seroma formation, reduced wound infection rates, and shorter hospital stay compared to conventional open mesh repair, with no significant increase in operative time. Furthermore, these findings align with observations that laparoscopic techniques yield faster recovery periods while maintaining equivalent surgical safety profiles [9,10]. Although open repair remains a traditional standard for specific complex abdominal defects, the reduced postoperative pain scores and improved recovery metrics observed in this cohort corroborate the clinical utility of a laparoscopic approach [11,12]. Furthermore, while wound infection and seroma rates remain clinical focus, the implementation of minimally invasive techniques may significantly mitigate the burden of postoperative morbidity [13,14].

The lower seroma rate in the laparoscopic group is likely attributable to minimal subcutaneous dissection, smaller incisions, and the use of compression dressings/abdominal binders. Conversely, the higher incidence of wound infections observed in the open group is primarily linked to more extensive tissue trauma and the larger skin incisions required for prosthetic mesh placement [15,16]. Additionally, the laparoscopic approach facilitates a more rapid restoration of bowel function, contributing to the observed trend of shorter hospital stays compared to the open technique [17,18]. Consistent with these outcomes, existing literature indicates that laparoscopic ventral hernia repair often results in a significantly faster return to daily activities compared to open approaches [19].

Wound infection remains a significant problem in open repairs due to larger incisions and greater tissue trauma. The observed trend toward fewer infections in the laparoscopic group (3.7% vs 17.34%) is clinically meaningful, although statistical significance was borderline due to the smaller sample in the laparoscopic arm. Moreover, several comparative investigations have documented similar advantages, reinforcing the potential for improved patient outcomes when utilizing minimally invasive hernia management [20,21]. Furthermore, the laparoscopic approach has been consistently associated with lower rates of chronic postoperative pain and a reduced risk of long-term complications compared to conventional open techniques [22,23].

Operative time was comparable between groups, reflecting the institutional learning curve. The significantly shorter hospital stay in the laparoscopic group translates into reduced healthcare costs and faster return to normal activity. Furthermore, these findings emphasize that minimally invasive techniques are effective in decreasing both wound-related morbidity and the duration of hospitalization [24,25].

CONCLUSION

The findings of this study reinforce that laparoscopic ventral hernia repair provides superior clinical outcomes, specifically regarding reduced wound complications and accelerated recovery compared to open surgical approaches. Both modalities remain safe and credible options for abdominal wall reconstruction, with long-term follow-up data suggesting that recurrence rates are statistically equivalent regardless of the chosen technique. Future research should prioritize long-term prospective trials focusing on quality of life metrics to further elucidate the nuances between these surgical modalities. Additionally, emerging evidence suggests that robotic-assisted platforms may further optimize these outcomes by offering enhanced ergonomics and precision in complex abdominal wall reconstructions, potentially bridging the recovery gap between minimally invasive and open techniques.

Funding: No external funding.
Conflict of Interest: None declared.

REFERENCES

1. Rosen MJ, Bauer JJ, Harmaty M, Carbonell AM, Cobb WS, Matthews BD, et al. Multicenter, Prospective, Longitudinal Study of the Recurrence, Surgical Site Infection, and Quality of Life After Contaminated Ventral Hernia Repair Using Biosynthetic Absorbable Mesh. Annals of Surgery 2015; 265:205–11. https://doi.org/10.1097/sla.0000000000001601.
2. Bittner R, Bingener-Casey J, Dietz UA, Fabian M, Ferzli G, Fortelny RH, et al. Guidelines for laparoscopic treatment of ventral and incisional abdominal wall hernias (International Endohernia Society [IEHS])—Part 2. Surgical Endoscopy 2013; 28:353–79. https://doi.org/10.1007/s00464-013-3171-5.
3. Bittner R, Bain K, Bansal VK, Berrevoet F, Bingener-Casey J, Chen D, et al. Update of Guidelines for laparoscopic treatment of ventral and incisional abdominal wall hernias (International Endohernia Society (IEHS))—Part A. Surgical Endoscopy 2019;33:3069–139. https://doi.org/10.1007/s00464-019-06907-7.
4. Lindmark M, Strigård K, Löwenmark T, Dahlstrand U, Gunnarsson U. Risk Factors for Surgical Complications in Ventral Hernia Repair. World Journal of Surgery 2018; 42:3528–36. https://doi.org/10.1007/s00268-018-4642-6.
5. Gupta SK, Yadav AS, Sinha R. A comparative study of laparoscopic versus open ventral hernia repair. Asian Journal of Medical Sciences 2022; 13:274–80. https://doi.org/10.3126/ajms.v13i12.48172.
6. Martins MR, Santos-Sousa H, Vale MA do, Bouça-Machado R, Barbosa E, Sousa-Pinto B. Comparison between the open and the laparoscopic approach in the primary ventral hernia repair: a systematic review and meta-analysis. Langenbeck s Archives of Surgery 2024;409. https://doi.org/10.1007/s00423-024-03241-y.
7. Rubby S, Rangaswamy P, Sundar P. A prospective study comparing laparoscopic and open ventral hernia repair. International Surgery Journal 2016. https://doi.org/10.18203/2349-2902.isj20164427.
8. Goyal G. "Outcomes of Laparoscopic ventral hernia repair as compared to Open repair, in a tertiary care government hospital in North India." IOSR Journal of Dental and Medical Sciences 2013; 10:8–10. https://doi.org/10.9790/0853-1060810.
9. Karmarkar PS, Ghuge K, Bhat G. Comparative Study of Short Term Outcomes of Laproscopic Versus Open Ventral Abdominal Wall Hernia Mesh Repair Excluding Groin (Inguinal and Femoral) Hernia in Tertiary Care Hospital. Paripex-Indian Journal of Research 2023:48–50. https://doi.org/10.36106/paripex/6304343.
10. Karthik K, Kumar MS. OUTCOMES OF LAPAROSCOPIC VERSUS OPEN VENTRAL HERNIA REPAIR. INDIAN JOURNAL OF APPLIED RESEARCH 2023:57–60. https://doi.org/10.36106/ijar/0802103.
11. Sahare S, Arya K, Badal RK, Sharma MK. A comparative study of laparoscopic versus open ventral hernia repair: Clinical outcomes, post-operative complications, and recovery profiles. Asian Journal of Medical Sciences 2025; 17:188–93. https://doi.org/10.71152/ajms.v17i1.4941.
12. Vashishtha T, Singh VK. Comparative Study Between Open and Laparoscopic Ventral Hernia Repair. Indian Journal of Applied Research 2023:57–8. https://doi.org/10.36106/ijar/1308424.

13. Kalyan M, Rathore SS, Verma V, Sharma S, Choudhary M, Irshad I, et al. Laparoscopic Versus Open Ventral Hernia Repair: Experience at a Tertiary Care Center in Western Rajasthan. Cureus 2022;14. https://doi.org/10.7759/cureus.27279.
14. Nishan S. Comparative Study Between Laparoscopic and Open Mesh Hernioplasty In Unilateral Uncomplicated Inguinal Hernia. Paripex-Indian Journal of Research 2022:96–9. https://doi.org/10.36106/paripex/4607809.
15. Poster Presentation Abstracts – Day One. Annals of the Academy of Medicine Singapore 2004;33. https://doi.org/10.47102/annals-acadmedsg.v33n5sp93.
16. Mehmood DA, Uzair DM, Afridi DNS, Khalil D, Hussain DMKLDM, Zeb DS. LAPAROSCOPIC REPAIR VERSUS OPEN SURGERY FOR VENTRAL HERNIA: A MULTICENTRIC COMPARISON OF PATIENT OUTCOMES. Northwest Journal of Medical Sciences 2025; 4:55–60. https://doi.org/10.69723/njms.04.01.0481.
17. Jahangir S, Dajah S, ramar sivanandan, Bhat A, Khan SA, IKDhawan Ikd, et al. Laparoscopic Versus Open Repair of Ventral Hernia by A Prosthetic Mesh - A Comparative Study. International Journal of Health and Rehabilitation Sciences (IJHRS) 2017; 6:38–38. https://doi.org/10.5455/ijhrs.0000000121.
18. Shahabuddin M, Taslima A. Exploring ventral hernia repair: a comparison and future outlook on laparoscopic versus open techniques. International Journal of Research in Medical Sciences 2025. https://doi.org/10.18203/2320-6012.ijrms20251460.
19. Kostov K, Marinov V, Ivanova S, Chaneva M, Atanasov P, Atanasova V. Laparoscopic IPOMPLUS repair-current outcomes and complications. Pharmacia 2023; 70:1239–42. https://doi.org/10.3897/pharmacia.70.e113883.
20. Schjøth-Iversen L, Sahakyan MA, Lai X, Refsum A. Laparoscopic vs open repair for primary midline ventral hernia: a prospective cohort study. Langenbeck s Archives of Surgery 2023;408. https://doi.org/10.1007/s00423-023-02958-6.
21. Umamaheswaran S. Comparative study and advantages of laparoscopic ventral hernia mesh repair Versus conventional open mesh repair. 2018.
22. Saikumar I, Kshirsagar V, Dnyanmote A, Tirmanwar V, Agarwal S. A Comparative Study of Open versus Laparoscopic Sublay Repair for Ventral Hernia. Annals of African Medicine 2025. https://doi.org/10.4103/aam.aam_206_25.
23. Sermonesi G, Tian B, Vallicelli C, Abu-Zidan FM, Damaskos D, Kelly MD, et al. Cesena guidelines: WSES consensus statement on laparoscopic-first approach to general surgery emergencies and abdominal trauma. World Journal of Emergency Surgery 2023;18. https://doi.org/10.1186/s13017-023-00520-9.
24. Zhang Y, Zhou H, Chai Y, Cao C, Jin K, Hu Z. Laparoscopic Versus Open Incisional and Ventral Hernia Repair: A Systematic Review and Meta-analysis. World Journal of Surgery 2014; 38:2233–40. https://doi.org/10.1007/s00268-014-2578-z.
25. Castro PMV, Rabelato J, Monteiro GGR, Guerra GCD, MAZZURANA M, Alvarez GA. LAPAROSCOPY VERSUS LAPAROTOMY IN THE REPAIR OF VENTRAL HERNIAS: systematic review and meta-analysis. Arquivos de Gastroenterologia 2014; 51:205–11. https://doi.org/10.1590/s0004-2803201400030008.