Section: General Surgery

Original Research Article

ASSOCIATION BETWEEN OBESITY AND SURGICAL SITE INFECTION AFTER LAPAROSCOPIC ABDOMINAL SURGERY

R. JeyaGanesh[1], V. Om Kumar[2], Karpagavel Chandrabose[3]

[1]*Associate Professor, Department of General Surgery, Velammal Medical College and Research Institute, Madurai, Tamil Nadu, India.*
[2]*Associate Professor, Department of General Surgery, Velammal Medical College and Research Institute, Madurai, Tamil Nadu, India.*
[3]*Professor, Department of General Surgery, Velammal Medical College and Research Institute, Madurai, Tamil Nadu, India.*

Received *: 15/09/2026*
Received in revised form *: 17/10/2026*
Accepted *: 30/10/2026*

Corresponding Author:
Dr. Karpagavel Chandrabose,
Professor, Department of General Surgery, Velammal Medical College and Research Institute, Madurai, Tamil Nadu, India.
Email: drkarpagavel@gmail.com

DOI: 10.70034/ijmedph.2026.4.202

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (4); 1314-1317

ABSTRACT

Background: Surgical site infection (SSI) remains a concern after abdominal surgery, including procedures performed laparoscopically. Obesity has been associated with postoperative infection, but evidence specific to laparoscopic abdominal surgery in Indian tertiary-care settings is limited. The objective is to assess the association between obesity and SSI after laparoscopic abdominal surgery.

Materials and Methods: In this prospective observational study, 40 patients undergoing laparoscopic abdominal surgery at Velammal Medical College and Hospital, Madurai, between 1 December 2025 and 1 August 2026 were enrolled. Participants were classified as obese (BMI ≥ 25 kg/m²) or non-obese and monitored for 30 days. SSI was defined according to CDC/NHSN criteria. Between-group comparisons used Fisher's exact test and the independent t-test.

Results: Of the 40 participants, 22 (55.0%) were obese. SSI developed in 7 participants (17.5%): 6 of 22 obese patients (27.3%) and 1 of 18 non-obese patients (5.6%). The estimated odds of SSI were higher in the obese group (OR 6.38, 95% CI 0.69–58.96), but the difference was not statistically significant (p = 0.105). Mean operative time was longer among obese than non-obese patients (78.4 ± 18.6 vs 64.2 ± 15.3 min, p = 0.013).

Conclusion: SSI was observed more frequently in obese patients, but the difference did not reach statistical significance. The limited sample size and wide confidence interval warrant cautious interpretation.

Keywords: Obesity, Surgical site infection, Laparoscopy, Body mass index, Postoperative complications.

INTRODUCTION

Surgical site infection (SSI) is an important cause of postoperative morbidity and may prolong hospitalisation and increase treatment costs.[1] Prevention of SSI remains a priority in surgical practice, as reflected in established infection-prevention guidance.[2] A 2023 meta-analysis estimated the pooled global incidence of SSI at 2.5%, with substantial differences across regions and surgical specialties.[3] In gastrointestinal surgery, infection rates of 9.4%, 14.0% and 23.2% have been reported in high-, middle- and low-human-development settings, respectively.[4] These differences indicate that the clinical setting and type of operation need to be considered when interpreting infection rates.

Laparoscopic procedures use smaller incisions than conventional open surgery, but wound and port-site infections can still occur. An integrative review of bariatric surgery reported SSI rates of 0.4%–7.6% after laparoscopic procedures.[5] A study of laparoscopic appendectomy likewise documented postoperative SSI and examined its relationship with body mass index (BMI).[6] The smaller access wounds associated with laparoscopy therefore do not eliminate the need to assess patient-related risk factors.

Obesity has been recognised as a potential risk factor for postoperative infection.[7] Research

specifically examining abdominal surgery has also described an association between obesity and SSI.[8] Possible explanations include reduced tissue perfusion, changes in immune function, associated diabetes and inadequate antibiotic concentrations within adipose tissue.[9] A meta-analysis of hysterectomy studies reported an odds ratio of 1.79 for obesity-related SSI.[10] An observational analysis of colectomy and abdominal hysterectomy similarly identified higher unadjusted infection odds in patients with obesity.[11] Findings have not been uniform across surgical settings. In a rural Indian cohort, BMI category was not significantly associated with superficial SSI.[12] This variation suggests that procedure type, patient characteristics and local perioperative practices may influence the observed relationship.

Evidence from Indian tertiary-care settings remains relatively limited for patients undergoing different types of laparoscopic abdominal surgery within the same cohort. Evaluating SSI according to obesity status in this population may help describe the burden of infection and identify areas for closer perioperative monitoring. The present study assessed the association between obesity and SSI within 30 days of laparoscopic abdominal surgery at a tertiary teaching hospital in Madurai.

MATERIALS AND METHODS

Design and Setting: We conducted a prospective observational study in the Department of General Surgery at Velammal Medical College and Hospital, Madurai, between 1 December 2025 and 1 August 2026. The Institutional Ethics Committee approved the study, and all participants provided written informed consent. The study was reported in accordance with the STROBE guideline.

Participants: We enrolled 40 consecutive patients, representing all eligible patients during the study period, using convenience sampling (Figure 1). Eligible participants were adults (≥ 18 years) scheduled for elective laparoscopic abdominal surgery (cholecystectomy, appendicectomy or hernia repair) under general anaesthesia. Patients were excluded if surgery was converted to an open procedure, they were receiving immunosuppressive therapy, they had a pre-existing infection, or follow-up was incomplete.

Exposure and outcome

We calculated BMI as weight in kilograms divided by height in metres squared (m²). Obesity was defined as BMI ≥ 25 kg/m² according to WHO Asia-Pacific criteria; patients below this threshold were classified as non-obese. The primary outcome was SSI occurring within 30 days after surgery. Infections were categorised as superficial incisional, deep incisional or organ/space SSI according to CDC/NHSN definitions.

Data collection

A structured proforma was used to record age, sex, BMI, diabetes, hypertension, ASA grade, procedure type, operative duration, antibiotic prophylaxis, SSI classification, culture findings and length of hospital stay.

Statistical analysis

Analyses were performed using SPSS version 26. Categorical data are reported as numbers and percentages, and continuous data as means and standard deviations. Fisher's exact test was selected for categorical comparisons because expected cell counts were small; continuous variables were compared using the independent t-test. We estimated the odds ratio (OR) and 95% confidence interval for the association between obesity and SSI. Statistical significance was defined as $p < 0.05$.

RESULTS

Of 50 patients screened, 40 met the eligibility criteria and were included in the analysis. [Figure 1] There were 23 women (57.5%), and the mean age was 43.1 ± 11.8 years. Twenty-two patients (55.0%) were classified as obese and 18 (45.0%) as non-obese. The procedures included 25 cholecystectomies, 9 appendicectomies and 6 hernia repairs. Baseline characteristics are shown in Table 1. There were no statistically significant between-group differences in age, sex, diabetes or hypertension. Mean operative time was longer in the obese group (78.4 ± 18.6 vs 64.2 ± 15.3 min; p = 0.013).

SSI occurred in 7 of 40 patients (17.5%): 6 of 22 obese patients (27.3%) and 1 of 18 non-obese patients (5.6%) (Table 2, Figure 2). The estimated odds ratio was 6.38 (95% CI 0.69–58.96), with no statistically significant between-group difference (p = 0.105). The confidence interval was wide and crossed 1, reflecting uncertainty in the estimated association. Of the seven infections, six (85.7%) were superficial incisional and one (14.3%) was deep incisional; no organ/space SSI was recorded. [Table 3, Figure 3] Six cultures were positive: Escherichia coli was isolated in three cases, Staphylococcus aureus in two and Klebsiella pneumoniae in one. One culture was negative. Mean hospital stay was 7.9 ± 2.4 days in patients with SSI compared with 4.2 ± 1.6 days in those without SSI.

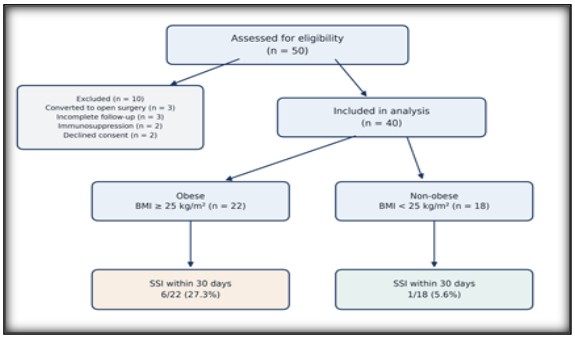


Figure 1: Participant flow through the study. BMI, body mass index; SSI, surgical site infection

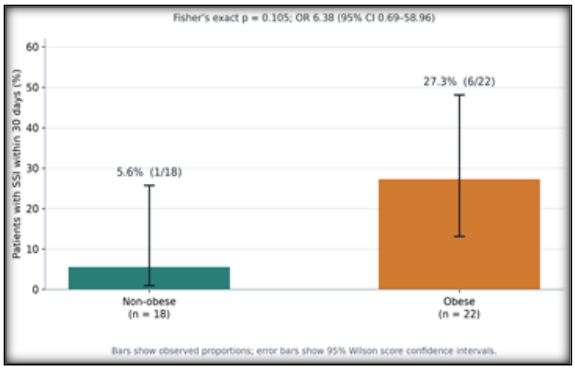


Figure 2: SSI rate within 30 days after surgery, stratified by obesity status

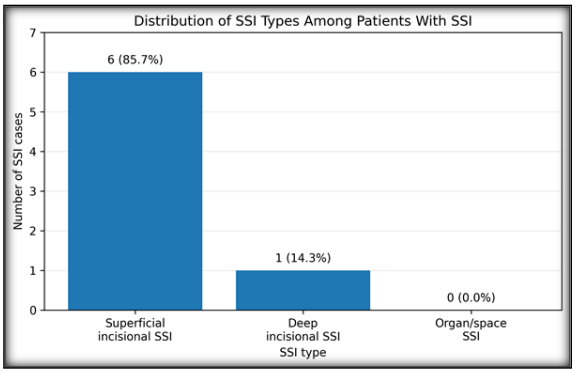


Figure 3: Distribution of SSI types among patients who developed SSI

Table 1: Baseline characteristics of patients by obesity status

Characteristic	Obese (n = 22)	Non-obese (n = 18)	p-value
Age, years, mean ± SD	44.6 ± 11.2	41.2 ± 12.5	0.370
Female sex, n (%)	14 (63.6)	9 (50.0)	0.523
Diabetes mellitus, n (%)	7 (31.8)	2 (11.1)	0.149
Hypertension, n (%)	8 (36.4)	3 (16.7)	0.286
Operative time, min, mean ± SD	78.4 ± 18.6	64.2 ± 15.3	0.013

Obesity was defined as BMI ≥ 25 kg/m². SD, standard deviation. Fisher's exact test was used for categorical variables and the independent t-test for continuous variables.

Table 2: Association between obesity and surgical site infection

Outcome	Obese (n = 22)	Non-obese (n = 18)	OR (95% CI); p
SSI, n (%)	6 (27.3)	1 (5.6)	6.38 (0.69–58.96); 0.105
No SSI, n (%)	16 (72.7)	17 (94.4)	

SSI, surgical site infection; OR, odds ratio; CI, confidence interval. The p-value was calculated using Fisher's exact test.

Table 3: Type of SSI and organisms isolated

Type of SSI / organism	Number	Percentage
Superficial incisional SSI	6	85.7
Deep incisional SSI	1	14.3
Organ/space SSI	0	0
Escherichia coli	3	42.9
Staphylococcus aureus	2	28.6
Klebsiella pneumoniae	1	14.3
Culture negative	1	14.3

Percentages are calculated using the seven infections as the denominator.

Table 4: Summary of published studies on BMI or obesity and surgical site infection

Study	Design (n); setting	Procedure	Finding for BMI / obesity
Liu 2025.[10]	Meta-analysis (14 studies; 152,993)	Hysterectomy	Obesity pooled OR 1.79 (1.43–2.23); I² 67.6%
Qi 2019.[11]	Cross-sectional (149,741); USA	Colectomy; hysterectomy	Obesity unadjusted OR 1.39 (1.24–1.55) and 2.19 (1.75–2.73)
Sumalatha 2025.[1]	Prospective (100); India	Elective abdominal	SSI 30.0% in obese; unadjusted OR 2.90 (p = 0.041); not in restricted adjusted model
Mekhla 2019.[12]	Prospective cohort (100); India	Abdominal (open)	SSI 54.5% obese vs 31.9% normal; RR 2.5 (0.7–9.7), not significant
Cho 2014.[6]	Prospective database (101); Korea	Laparoscopic appendectomy	No SSI in overweight/obese; underweight OR 10.0 (2.0–49.5)
Delgado-Miguel 2020.[15]	Prospective cohort (403 children); Spain	Appendectomy	SSI 10.3% vs 4.2%; RR 1.90 (1.15–3.14); not significant within laparoscopic stratum
Kim 2019.[16]	Retrospective (1,038); Korea	Gastrectomy	BMI > 25 not associated (p = 0.301); VFA-to-SFA ratio OR 8.09 (2.91–22.54)
Silva 2023.[5]	Integrative review (11 studies)	Bariatric surgery	High BMI among risk factors; laparoscopic SSI 0.4–7.6%

Values are reported as presented in the cited studies. OR, odds ratio; RR, relative risk; VFA, visceral fat area; SFA, subcutaneous fat area.

DISCUSSION

The overall SSI rate in this cohort was 17.5%. Although infection occurred more often in obese than non-obese patients (27.3% vs 5.6%), the difference was not statistically significant. The direction of the observed association merits attention, but its magnitude cannot be estimated reliably from these seven events.

Earlier studies have reported varying associations between BMI and SSI across surgical populations. [Table 4] A meta-analysis of hysterectomy studies reported a pooled odds ratio of 1.79.[10] A claims-based analysis also found greater unadjusted odds of SSI following colectomy and hysterectomy.[11] In a prospective cohort of elective abdominal surgery, infection was more frequent in obese patients, although the association was not retained in a restricted multivariable analysis. A paediatric appendicitis study reported more infections in overweight or obese children, without a significant difference after stratification by surgical approach. In a rural Indian cohort, the corresponding rates were 54.5% and 31.9%, but the association was not statistically significant.[12] Differences in procedure type, BMI thresholds, patient characteristics and follow-up practices may contribute to the variation across studies.

Several factors may underlie a greater risk of SSI in patients with obesity. Reduced vascularity of adipose tissue, alterations in immune responses, diabetes and lower antibiotic concentrations at the operative site have been proposed as contributory mechanisms.

BMI does not distinguish visceral from subcutaneous adiposity, which may be relevant when assessing postoperative infection. In a Korean laparoscopic appendectomy study, superficial SSI occurred predominantly among underweight patients, with no cases in those whose BMI was at least 25 kg/m²; few participants had BMI ≥ 30 kg/m². In a gastrectomy cohort, BMI > 25 kg/m² was not associated with SSI, whereas a higher visceral-to-subcutaneous fat ratio predicted infection.[16] Future studies in Indian patients could assess abdominal fat distribution alongside BMI.

These observations reinforce the importance of established perioperative infection-prevention measures, including appropriate antibiotic prophylaxis, careful port-site care, protected specimen retrieval and optimisation of diabetes when present.

CONCLUSION

SSI occurred in 27.3% of obese patients and 5.6% of non-obese patients in this cohort. Although the estimated odds were higher in the obese group, the association was not statistically significant (OR 6.38, 95% CI 0.69–58.96; p = 0.105). The small number of infections and broad confidence interval do not permit a firm conclusion about the independent role of obesity. Operative time was longer among obese patients, but this and other potential confounders could not be accounted for in an adjusted analysis.

Ethics approval and consent: The Institutional Ethics Committee approved the study. Written informed consent was obtained from every participant.

REFERENCES

1. Sumalatha C, Soumya E, Reddy G. Risk factors associated with surgical-site infection following elective abdominal surgery: a hospital-based observational study. CME J Ger Med. 2025;17(7):98-103. doi:10.61336/cmejgm/2025-07-31.
2. Berríos-Torres SI, Umscheid CA, Bratzler DW, Leas B, Stone EC, Kelz RR, et al. Centers for Disease Control and Prevention guideline for the prevention of surgical site infection, 2017. JAMA Surg. 2017;152(8):784-91. doi:10.1001/jamasurg.2017.0904.
3. Mengistu DA, Alemu A, Abdukadir AA, Mohammed Husen A, Ahmed F, Mohammed B, et al. Global incidence of surgical site infection among patients: systematic review and meta-analysis. Inquiry. 2023;60:469580231162549. doi:10.1177/00469580231162549.
4. GlobalSurg Collaborative. Surgical site infection after gastrointestinal surgery in high-income, middle-income, and low-income countries: a prospective, international, multicentre cohort study. Lancet Infect Dis. 2018;18(5):516-25. doi:10.1016/S1473-3099(18)30101-4.
5. Silva AF, Mendes KDS, Ribeiro VS, Galvão CM. Risk factors for the development of surgical site infection in bariatric surgery: an integrative review of literature. Rev Latino-Am Enfermagem. 2023;31:e3798. doi:10.1590/1518-8345.6309.3798.
6. Cho M, Kang J, Kim I, Lee KY, Sohn S-K. Underweight body mass index as a predictive factor for surgical site infections after laparoscopic appendectomy. Yonsei Med J. 2014;55(6):1611-6. doi:10.3349/ymj.2014.55.6.1611.
7. Anaya DA, Dellinger EP. The obese surgical patient: a susceptible host for infection. Surg Infect (Larchmt). 2006;7:473-80.
8. Winfield RD, Reese S, Bochicchio K, Mazuski JE, Bochicchio GV. Obesity and the risk for surgical site infection in abdominal surgery. Am Surg. 2016;82(4):331-6.
9. Pugliese G, Liccardi A, Graziadio C, Barrea L, Muscogiuri G, Colao A. Obesity and infectious diseases: pathophysiology and epidemiology of a double pandemic condition. Int J Obes. 2022;46(3):449-65. doi:10.1038/s41366-021-01035-6.
10. Liu Y, Liu Y, Yang Z, Wu J, Li J. Risk factors for surgical site infection (SSI) in patients undergoing hysterectomy: a systematic review and meta-analysis. BMJ Open. 2025;15:e093072. doi:10.1136/bmjopen-2024-093072.
11. Qi AC, Peacock K, Luke AA, Barker A, Olsen MA, Joynt Maddox KE. Associations between social risk factors and surgical site infections after colectomy and abdominal hysterectomy. JAMA Netw Open. 2019;2(10):e1912339. doi:10.1001/jamanetworkopen.2019.12339.
12. Mekhla, Borle FR. Determinants of superficial surgical site infections in abdominal surgeries at a rural teaching hospital in Central India: a prospective study. J Family Med Prim Care. 2019;8:2258-63. doi:10.4103/jfmpc.jfmpc_419_19.
13. Horan TC, Andrus M, Dudeck MA. CDC/NHSN surveillance definition of health care-associated infection and criteria for specific types of infections in the acute care setting. Am J Infect Control. 2008;36:309-32.
14. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection, 1999. Hospital Infection Control Practices Advisory Committee. Infect Control Hosp Epidemiol. 1999;20:250-78.
15. Delgado-Miguel C, Muñoz-Serrano AJ, Barrena Delfa S, Núñez Cerezo V, Velayos M, Estefanía K, et al. Influence of overweight and obesity on acute appendicitis in children. A cohort study. Cir Pediatr. 2020;33(1):20-4.
16. Kim JH, Kim J, Lee WJ, Seong H, Choi H, Ahn JY, et al. A high visceral-to-subcutaneous fat ratio is an independent predictor of surgical site infection after gastrectomy. J Clin Med. 2019;8:494. doi:10.3390/jcm8040494.