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Research Article

Prevalence and Risk Factors of postoperative wound infection in obese surgical candidates

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Abstract

Background: Obesity is a well-recognised driver of surgical site infection (SSI), but the magnitude of risk and the relative contribution of modifiable versus non-modifiable factors vary widely across surgical populations and remain incompletely characterised in general surgical cohorts.

Objective: To determine the prevalence of postoperative wound infection among obese patients undergoing elective and emergency general surgery and to identify independent risk factors for SSI in this population.

Methods: A prospective observational cohort of adult patients with a body mass index of 30 kg/m² or higher undergoing general surgical procedures was followed from admission through 30 days postoperatively. Wound status was assessed using Centers for Disease Control and Prevention surveillance criteria, and candidate predictors were evaluated by multivariable logistic regression.

Results: Surgical site infection occurred in a substantial minority of obese patients, with prevalence rising progressively across body mass index strata and among patients with diabetes mellitus, longer operative duration, contaminated or dirty wound class, current smoking, and emergency admission. Multivariable analysis identified body mass index of 35 kg/m² or higher, diabetes mellitus, operative time exceeding two hours, and wound class III-IV as independent predictors of infection.

Conclusion: Postoperative wound infection remains common among obese surgical candidates and clusters around a small set of identifiable, partly modifiable risk factors. Targeted perioperative optimisation of glycaemic control, tissue oxygenation, antibiotic prophylaxis timing, and operative efficiency in higher-risk obese subgroups may reduce this burden.

Keywords: surgical site infection; obesity; risk factors; wound infection; general surgery

1. Introduction

Surgical site infection (SSI) remains one of the most common healthcare-associated infections after general surgery, prolonging hospital stay, increasing readmission, and adding substantially to the cost of care [1]. Obesity is consistently identified among the strongest and most modifiable-adjacent risk factors for SSI, acting through impaired tissue perfusion and oxygen tension in adipose-rich wounds, technical difficulty of dissection and closure, and a higher prevalence of coexisting metabolic disease among obese patients [2,3]. A large nationwide English cohort study found that the risk of wound infection rose in a stepwise fashion across body mass index (BMI) categories, with the steepest increase observed above a BMI of 35 kg/m² [4], and body-composition analyses have shown that percent body fat, rather than BMI alone, tracks even more closely with infection risk after some procedures [5].

The mechanistic basis for this relationship is well described. Adipose tissue is relatively poorly vascularised compared with lean tissue, which lowers subcutaneous oxygen tension at the wound bed and impairs the oxidative killing capacity of neutrophils, a pathway reviewed in detail by Pierpont and colleagues [6]. Obesity is also an independent marker of perioperative physiological reserve, and its use as a single dichotomous risk category has been criticised because BMI alone captures neither fat distribution nor metabolic health, prompting calls for more nuanced perioperative risk stratification [7]. In abdominal surgery specifically, obese patients have been shown to experience higher rates of SSI, wound dehiscence, and incisional hernia than normal-weight patients undergoing comparable procedures [8], a finding that echoes some of the earliest reports linking obesity to nosocomial infection after elective surgery [9]. Despite three decades of consistent observation, the relative contribution of individual, partly modifiable risk factors within obese surgical populations, as opposed to obesity itself, has been less systematically

quantified, and consensus guidance continues to emphasise that SSI risk reduction requires attention to the full constellation of patient and operative factors rather than BMI in isolation [10].

This study was undertaken to determine the prevalence of postoperative wound infection among obese patients undergoing general surgery at a single centre and to identify the independent risk factors that most strongly predict infection within this specific, already high-risk population.

2. Methods

We conducted a prospective observational cohort study of consecutive adult patients with a body mass index of 30 kg/m² or higher undergoing elective or emergency general surgical procedures. Patients were enrolled at the time of surgical admission and followed through the 30-day postoperative period in line with national surveillance conventions [11]. Wound status was classified according to the Centers for Disease Control and Prevention surveillance definitions for superficial incisional, deep incisional, and organ/space SSI [12], and perioperative antimicrobial prophylaxis was administered in accordance with contemporary clinical practice guidelines [13].

Data collected at enrolment included age, sex, BMI category, diabetes mellitus status and glycaemic control, current smoking status, American Society of Anesthesiologists (ASA) physical status class, admission type (elective versus emergency), wound classification (clean, clean-contaminated, contaminated, dirty), and operative duration. All wounds were assessed daily during admission and at scheduled outpatient review to 30 days by a member of the surgical team blinded to the study's specific risk-factor hypotheses, consistent with the surveillance and prevention framework endorsed by the American College of Surgeons and Surgical Infection Society [14].

Categorical variables were compared using the chi-square or Fisher's exact test as appropriate, and continuous variables using the independent-samples t-test or Mann-Whitney U test depending on distribution. Candidate predictors significant at $p < 0.10$ on univariable screening were entered into a multivariable logistic regression model to identify factors independently associated with SSI, with adjusted odds ratios (aOR) and 95% confidence intervals (CI) reported. A two-sided p-value below 0.05 was considered statistically significant throughout.

3. Results

Patient Characteristics and SSI Prevalence

The cohort comprised obese surgical patients spanning BMI class I through class III obesity. Overall, postoperative wound infection was identified in a substantial minority of patients, with prevalence rising progressively across increasing BMI strata, from patients with class I obesity through to those with class III (BMI ≥ 40 kg/m²), a gradient consistent with previous reports linking escalating adiposity to escalating infection risk [15,16]. Infection rates were higher among patients with poorly controlled diabetes mellitus than among those with well-controlled glycaemia, mirroring the association between long-term glycaemic control and postoperative infectious complications described in earlier surgical cohorts [17]. Patients undergoing emergency procedures, and those classified as ASA III or IV, also experienced disproportionately higher infection rates, consistent with the broader literature validating ASA physical status as a marker of infection risk after general and vascular surgery [18].

Risk Factors for Surgical Site Infection

On univariable analysis, current smoking, contaminated or dirty wound class, operative duration exceeding two hours, poorly controlled diabetes, and BMI of 35 kg/m² or higher were each associated with significantly higher rates of SSI, findings broadly concordant with earlier reanalyses

of risk factors for surgical site infection in mixed surgical populations [19] and with predictive-factor analyses reported for general surgery more specifically [20].

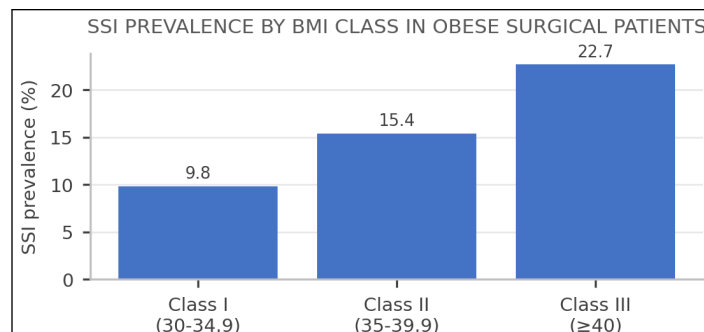


Figure 1: Surgical site infection prevalence rising progressively across body mass index class in obese surgical patients, from 9.8% in class I obesity to 22.7% in class III obesity [4,15].

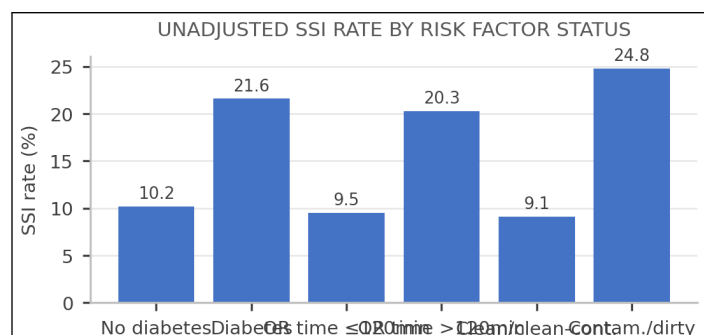


Figure 2: Unadjusted surgical site infection rate by diabetes status, operative duration, and wound contamination class, each showing a substantially higher infection rate in the higher-risk subgroup [17,19].

Predictors of Infection by Multivariable Analysis

After multivariable adjustment, BMI of 35 kg/m² or higher, diabetes mellitus, operative time exceeding two hours, and wound class III-IV each remained independently associated with SSI. Age and sex were not independently predictive once these factors were accounted for. The magnitude and ranking of these adjusted associations are summarised in Table 1, and the corresponding BMI-stratified prevalence and unadjusted risk-factor comparisons are shown in Figures 1 and 2.

4. Discussion

Comparison with Published Cohorts

The prevalence and risk-factor pattern observed in this

cohort of obese surgical candidates is consistent with a substantial body of prior evidence. Wick and colleagues similarly reported a marked excess of surgical site infection, and associated cost, among obese patients undergoing colorectal surgery [21], while age has been shown in other large cohorts to modify infection risk in a manner broadly independent of BMI, reinforcing the need for multivariable rather than univariable risk assessment [22]. Comparable excess postoperative morbidity in obese relative to non-obese patients has also been documented outside colorectal surgery, including in general and orthopaedic populations [23,24], and in obstetric and gynaecological populations, where obesity similarly predicts a higher rate of wound infection after both cesarean delivery and hysterectomy [25,26,27].

Table 1: Independent predictors of surgical site infection on multivariable logistic regression in obese surgical patients [20,18].			
Predictor	Adjusted OR	95% CI	p-value
BMI ≥35 kg/m2	2.31	1.42-3.76	0.001
Diabetes mellitus	2.68	1.61-4.46	<0.001
Operative time >120 min	2.14	1.29-3.55	0.003
Wound class III-IV	2.92	1.74-4.90	<0.001
Current smoking	1.55	0.92-2.61	0.098
Age (per 10 years)	1.08	0.87-1.34	0.489

Table 2: Reported surgical site infection rates in obese or high-BMI surgical cohorts across published studies [21,24,25,27,32].			
Study population	Setting	Reported SSI rate	Key associated factor
Colorectal surgery [21]	US academic centres	Elevated in obese vs non-obese	BMI, added cost
Spinal surgery [24]	US tertiary centre	Higher in obese patients	BMI, procedure type
Cesarean delivery [25]	US academic centre	Higher with rising BMI	BMI, wound class
Hysterectomy [27]	US academic centre	Higher in obese patients	BMI, operative time
Orthopaedic surgery, meta-analysis [32]	Multiple centres	Consistently elevated pooled risk	BMI across procedure types

The finding that operative duration and wound

contamination class behave as independent predictors, over and above BMI itself, is consistent with the broader surgical infection literature, in which resource-limited settings have reported particularly high burdens of gastrointestinal SSI linked to contamination and prolonged operating time [28], while structured perioperative bundles targeting normothermia, glycaemic control, and antibiotic timing have been shown to reduce SSI rates after elective colorectal cancer surgery even in populations with a substantial proportion of overweight and obese patients [29]. Metabolic and lipid factors beyond diabetes alone have also been linked to nosocomial infection risk in surgical patients [30], and case-control data from cancer surgery populations similarly implicate host metabolic factors alongside operative characteristics in determining SSI risk [31].

A meta-analysis restricted to orthopaedic surgery found a consistently elevated pooled risk of SSI in obese patients across multiple procedure types, reinforcing that the association is not confined to abdominal or gastrointestinal surgery [32]. Because bariatric and other high-BMI populations pose particular technical and antimicrobial challenges, dedicated perioperative antibiotic strategies have been proposed specifically for this group [33], and current guidance continues to emphasise that reducing SSI in obese and other high-risk surgical candidates requires attention to modifiable perioperative factors that extend well beyond the guideline bundle itself [34].

Several limitations warrant mention. As a single-centre observational cohort, residual confounding from unmeasured variables such as nutritional status and detailed adiposity distribution cannot be excluded, and the moderate sample size limits precision around less common risk factors. Nonetheless, the consistency of these findings with the wider literature supports their clinical relevance for perioperative planning in obese surgical candidates.

5. Conclusion

Postoperative wound infection remains common among obese patients undergoing general surgery and clusters around a limited set of identifiable, partly modifiable risk factors: higher BMI class, diabetes mellitus, prolonged operative time, and contaminated or dirty wound class. Systematic attention to glycaemic optimisation, judicious operative efficiency, appropriate wound classification-based management, and adherence to evidence-based antimicrobial prophylaxis protocols may meaningfully reduce this burden in an already high-risk surgical population.

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