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COMPARISON OF SURGICAL SITE INFECTION IN OBSTETRICS AND GYNAECOLOGY WITH HIGH BMI AND LOW BMI

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Abstract

Objective: *To assess the frequency, type, microorganism involvement, and risk factors related to the occurrence of SSI among patients undergoing CS surgery in females with BMIs of less than 27 kg/m² and more than 27 kg/m² at the Gynaecology Ward of Jinnah Postgraduate Medical Center, Karachi.*

Research Design: *Comparative Observational Research.*

Setting & Duration: *Obstetrics and Gynecology Department, JPMC Karachi. 12 months .*

Methods: *Two equal groups of two hundred pregnant women undergoing cesarean section surgery were selected: Patients having a body mass index of less than 27 kg/m² were included in Group B (n = 100), while those with a body mass index of ≥27 kg/m² were included in Group A (n = 100). The follow-up period was thirty days following surgery. Surgical site infections were categorized as superficial, deep, and organ/space infections based on CDC criteria.*

Results: *Thirteen (13%) patients from the low BMI group and thirty-two (32%) from the high BMI group had SSI ($p = 0.002$). The most prevalent kind in both groups was incisional SSI. The high BMI group had far greater rates of chorioamnionitis, emergency CS, and diabetes mellitus. E. coli was the most common isolate in both groups. The group with a high BMI had a much greater need for surgery (21.9% vs. 15.4%).*

Conclusion: *Following a Caesarean section, the high BMI group is a separate risk factor for SSI. For obese patients giving birth, the use of particular preoperative therapies, adherence to aseptic procedures, and postoperative monitoring are required.*

1. INTRODUCTION

A caesarean delivery is a very common major surgery practiced across the world among obstetrics patients. The CS rate on a global level has reached above 21% in terms of delivery, with Pakistan showing CS rates of 72% recorded in 2021, nearly double from 52% observed in 2014.[1] With such tremendous increases in the prevalence of CS rates, there also comes another complication that cannot be ignored SSIs, or surgical site infections, are a common cause of adverse effects for pregnant women.[2]

The CDC defines SSI as an infection at the site of the surgical incision that occurs within 30 days after CS. Organ-space infections (such endometritis and peritonitis), deep incisional infections (like fascia or muscle), and superficial incisional infections (like skin and subcutaneous tissue) are the three types of SSI infections.[3] According to published data, the probability of SSI infection after CS varies between 3% and 18% in different situations..[4]

Obesity (defined as a Body Mass Index (BMI) of ≥30 kg/m²) and overweight (defined as a BMI of ≥25–29.9 kg/m²) are two modifiable risk factors associated with post-surgical wound infections. Surgical challenges, increased subcutaneous fat that produces dead space, avascular adipose tissue that impedes the efficient diffusion of antibiotics, and compromised immune responses that all lead to wound infections are additional complications associated with obesity in the obstetric population. Additionally, studies conducted in Pakistan showed that BMI ≥27 kg/m² was a major risk factor for SSI following CS.

Even Nevertheless, data from Pakistani tertiary hospitals indicates that BMI is a predictor of greater SSI incidence, especially when comparing groups with different BMI levels in a prospective design. Many CS deliveries for obese women from low-income households are performed at Jinnah Postgraduate Medical Centre (JPMC) in Karachi, one of Pakistan's biggest tertiary care facilities.Patients with a high body mass index (BMI ≥27 kg/m2) and low body mass index (BMI <27 kg/m2) will be prospectively compared in this study with regard to the frequency, type, time of occurrence, microbiological profile, risk factors, and management outcomes of SSI.

RESEARCH METHODOLOGY

Study Design and Setting

Over a 12-month period, in the Department of Obstetrics & Gynecology at Jinnah Postgraduate Medical Centre (JPMC), Karachi, Pakistan, undertook this prospective, comparative, observational study. Jinnah Postgraduate Medical Centre is one of the biggest public tertiary care referral hospitals in Karachi.

Sample Size and Sampling Technique

200 women who had either elective or emergency cesarean sections were identified using consecutive purposive sampling. Two groups of 100 patients each were created from the participants: Patients with a high body mass index (BMI ≥27 kg/m²) comprised Group A, while those with a low body mass index (BMI <27 kg/m²) comprised Group B. Using OpenEpi software version 3 (95% confidence interval, 80% power), the number of samples for each group was determined based on the incidence of surgical site infections, which was 29.6% in the high BMI group and approximately 16.9% in the low BMI group. This resulted in 90 patients per group.

Requirements for inclusion:

Female participants between the ages of 18 and 45. Based on early ultrasonography, gestation ranges from 28 to 42 weeks. Lower transverse CS delivery at JPMC, either electively or in an emergency. Willing to participate in the trial for 30 days following surgery.

Exclusion criteria

History of prior skin infections or sores in the vicinity of CS. Women who are nursing and on any kind of long-term immune suppressor. Women who are nursing and have been diagnosed with cancer or immunodeficiency diseases like HIV. Patients with CS infections who were referred from other hospitals. Midline incisions are made during the surgical procedure.

Perioperative Protocol

A standardized perioperative protocol was adopted for all patients as per WHO/CDC guidelines:[8]

Antibiotic prophylaxis: Administration of intravenous Cefazolin 2g 30-60 minutes before skin incision.

Skin antisepsis: Application of povidone-iodine 10% scrub and paint at the site of operation; vaginal irrigation with aqueous iodine before CS.

Hair preparation: Use of clippers instead of razors to avoid micro-abrasions.

Normothermia: Maintenance of core body temperature ≥ 37°C using warming blankets during operation.

Wound healing: Preference given to subcutaneous sutures for skin closure; use of drainage tubes in cases of significant dead space (especially high BMI individuals).

Post-operative dressings: Sterile dressings should be used at the moment of closure and removed 48 hours later, along with a wound evaluation and patient education.

Data Gathering and Monitoring

The following parameters were collected using structured proformas: demographic profile (age, parity, education level, residence), BMI at delivery and the existence of diabetic mellitus (FBS >7.0 mmol/L), chorioamnionitis, hemoglobin, mode of CS (elective/emergency), length of labor, length of surgery, blood loss, and prior history of CS. Before discharge (days 3–5), during outpatient follow-up (days 7–10), and on days 28–30 following surgery, patients were tested for SSI. Patients who were unable to visit the hospital for a physical examination were followed up with over the phone. SSI was diagnosed using CDC standards.[3] For every instance of SSI, aseptic wound swab cultures were performed.

Measures of Results • The incidence of SSI (both overall and type-specific) in high versus low body mass index categories is the main outcome measure.

• Measures of secondary outcomes include the makeup of microbial flora, the existence of risk factors, timing, treatment strategy, and the necessity of secondary surgery.

Analytical Statistics

Data entry and analysis were done using SPSS software version 26. Descriptive statistics (mean ± standard deviation for quantitative data, frequency and percentage for qualitative data) were obtained. To compare categorical data between groups, the Chi-square test was employed. Continuous data was examined using the Independent Samples t-test. For statistical significance, a p-value of less than 0.05 was selected. Binary logistic regression analysis was utilized to determine the independent predictors of SSI using odds ratios (OR) and 95% confidence intervals (CI).

RESULTS

Baseline characteristics and demographics

There were 200 women in the sample, 100 from Group A (BMI ≥27 kg/m²) and 100 from Group B (BMI <27 kg/m²). Group A's average age was 27.8 ± 4.2 years, while Group B's was 26.5 ± 3.9 years (p = 0.08). Group A's mean BMI was 31.4 ± 2.9 kg/m², whereas Group B's was 23.6 ± 2.1 kg/m². Group A had a higher rate of emergency CS (55 out of 100 patients) compared to Group B (40 out of 100 patients) (p=0.038).

Table 1: Study Group Demographics and Baseline Features (n=200)

Variable	Group with a high BMI (n=100)	Low BMI Group (n = 100)	p-value
Average Age (years)	27.8 ± 4.2	26.5 ± 3.9	0.08
Mean BMI (kg/m²)	31.4 ± 2.9	23.6 ± 2.1	<0.001
Mean Gestational Age (weeks)	37.2 ± 1.8	37.6 ± 1.6	0.12
Primigravida	28 (28%)	31 (31%)	0.64
Multipara (parity ≥2)	72 (72%)	69 (69%)	0.64
Emergency CS	55 (55%)	40 (40%)	0.038*
Repeat CS	48 (48%)	44 (44%)	0.57
Diabetes Mellitus	48 (48%)	24 (24%)	0.001*
Chorioamnionitis	65 (65%)	38 (38%)	<0.001*
Mean Hb (g/dl)	9.3 ± 1.1	10.4 ± 1.2	<0.001*
Anaemia (Hb <11 g/dl)	78 (78%)	52 (52%)	<0.001*

Duration of Operation >1 hour	24 (24%)	11 (11%)	0.018*
Blood Loss >1000 ml	21 (21%)	9 (9%)	0.021*

*Statistically significant (p<0.05)

Surgical Site Infection Incidence

In the high BMI group, SSI was seen in 32 out of 100 patients (32%) as opposed to 13 out of 100 patients (13%) in the low BMI group. There was a statistically significant difference (p=0.002; OR=3.12, 95% CI=1.52–6.41). The combined cohort's overall SSI rate was 22.5%. Figure 1 displays these findings.

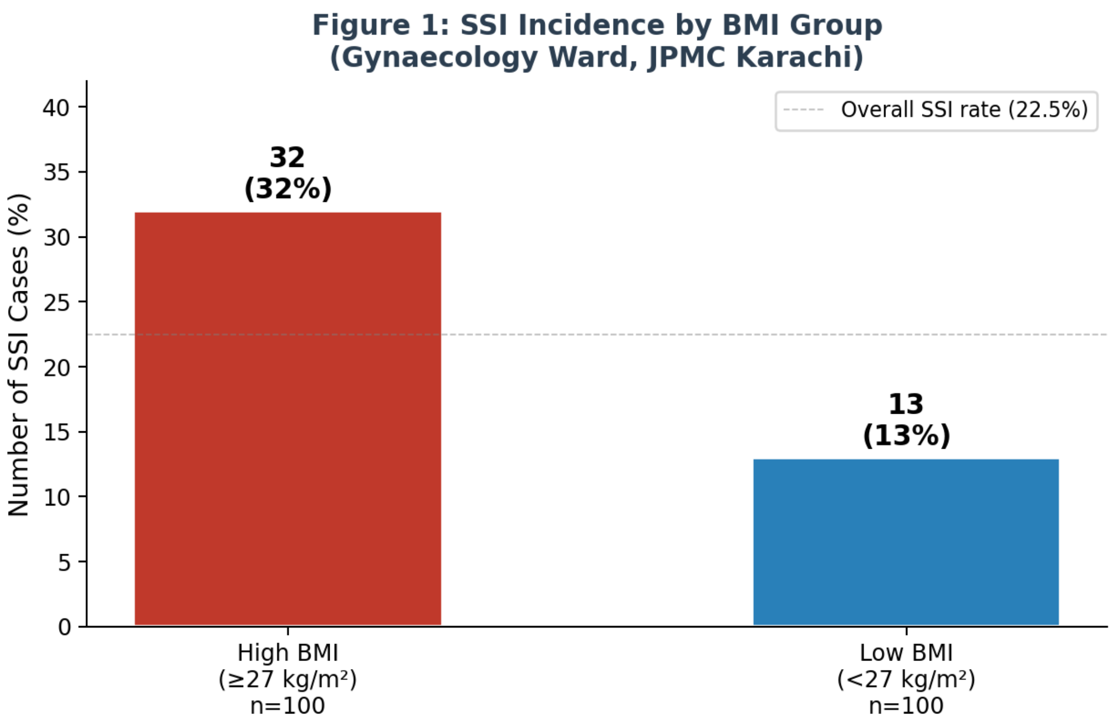

Figure 1: The incidence of SSI in groups with high and low BMIs is displayed. Patients with high BMIs had a significantly higher incidence of SSI (32% vs. 13%, p = 0.002).

Types of Surgical Site Infections

Superficial incisional infection was the most common kind of SSI among the high BMI group, affecting 16 out of 32 patients, or 50% of all SSI cases. Deep incisional infections (9/32, 28.1%) were the second most common kind of infection in this group, followed by organ/space infections (7/32, 21.9%). The predominance order in the low BMI category was superficial (7/13, 53.8).

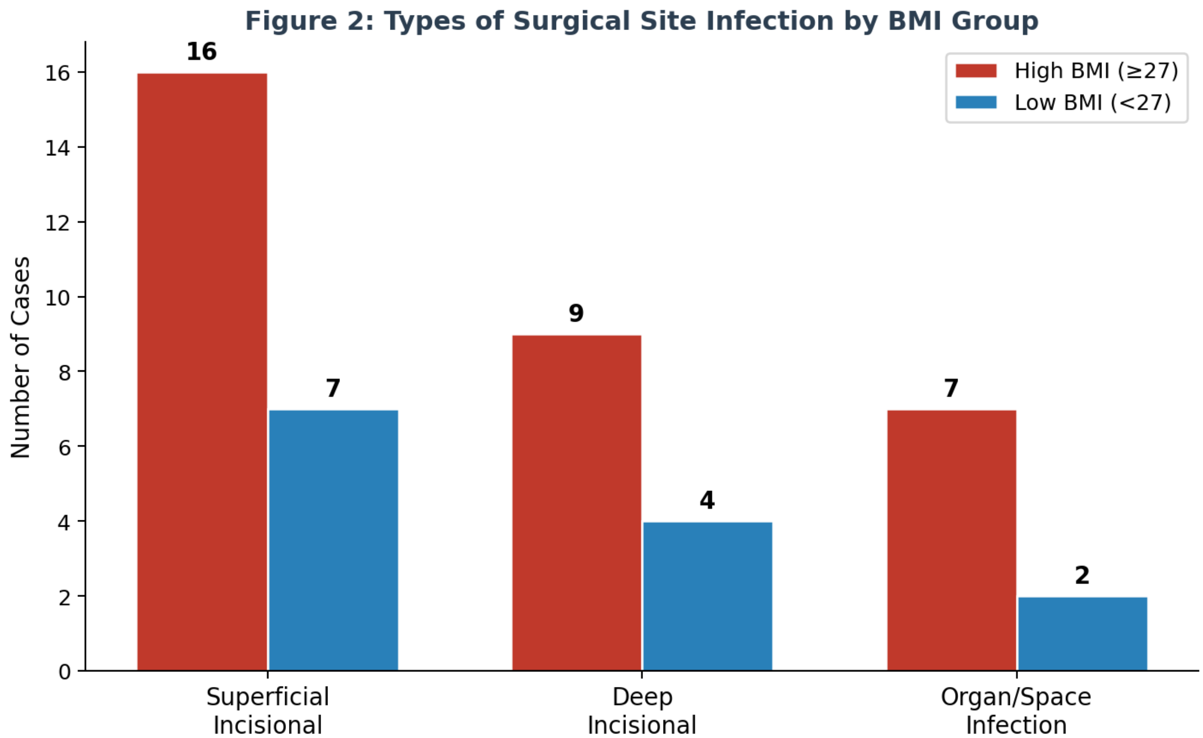

Figure 2: Distribution of SSI Types by BMI Categories. The most common kind in both groups was incisional superficial SSI. Patients with greater BMIs had higher overall counts of all three categories of SSIs.

Table 2: Distribution of SSI Types by BMI Group

Type of SSI	High BMI (n=32)	Low BMI (n=13)	OR (95%CI)	p-value
Superficial Incisional	16 (50.0%)	7 (53.8%)	1.16 (0.32–4.22)	0.82
Deep Incisional	9 (28.1%)	4 (30.8%)	1.14 (0.28–4.67)	0.85
Organ/Space Infection	7 (21.9%)	2 (15.4%)	1.53 (0.27–8.66)	0.63
Total SSI	**32 (32%)**	**13 (13%)**	**3.12 (1.52–6.41)**	**0.002***

Risk Elements Associated with SSI

It was discovered that people with high BMIs were substantially more likely than those with low BMIs to have numerous risk factors. In participants with high BMI, the prevalence of diabetes mellitus was 48%, while in those with low BMI, it was 24% (p=0.001). In people with low BMI, the prevalence of chorioamnionitis was 38%, whereas in those with high BMI, it was 65% (p<0.001). Patients with a high BMI (78%) were more likely to have anemia than those with a low BMI (52%; p<0.001).

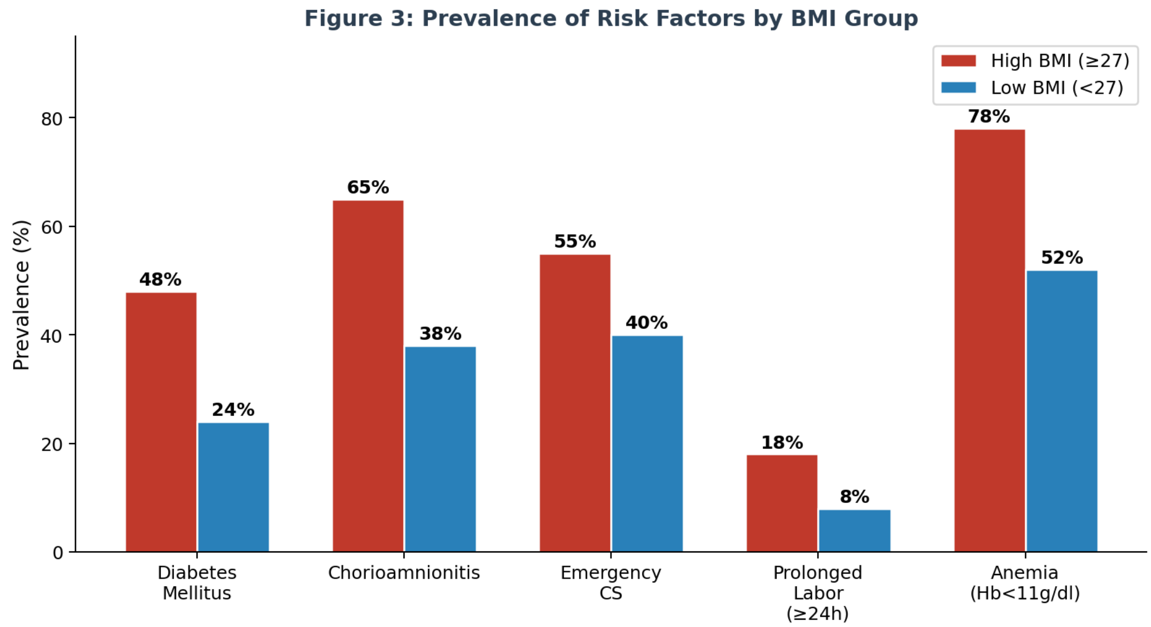

Figure 3 shows the frequency of major risk factors by BMI category. Diabetes mellitus, chorioamnionitis, emergency CS, protracted labor, and anemia were all considerably more common in patients with high BMI.

Table 3: Risk Factors' Relationship to SSI by BMI Group

Risk Factor	High BMI + SSI (n=32)	High BMI - SSI (n=68)	Low BMI + SSI (n=13)	Low BMI - SSI (n=87)	p-value*
Diabetes Mellitus	18 (56.3%)	30 (44.1%)	4 (30.8%)	20 (23.0%)	0.001*
Chorioamnionitis	22 (68.8%)	43 (63.2%)	5 (38.5%)	33 (37.9%)	<0.001*
Emergency CS	20 (62.5%)	35 (51.5%)	6 (46.2%)	34 (39.1%)	0.038*
Prolonged Labour ≥24h	8 (25.0%)	10 (14.7%)	1 (7.7%)	8 (9.2%)	0.005*
Anaemia (Hb <11g/dl)	27 (84.4%)	51 (75.0%)	7 (53.8%)	45 (51.7%)	<0.001*
Blood Loss >1000 ml	9 (28.1%)	12 (17.6%)	2 (15.4%)	7 (8.0%)	0.021*
Duration of Op >1h	8 (25.0%)	16 (23.5%)	2 (15.4%)	9 (10.3%)	0.018*

Chi-square test-derived p-value; statistical significance at $p<0.05$.

SSI's Microbial Profile

Microorganisms were detected in wound cultures from 28 out of 32 SSI patients with high BMI (87.5%) and 11 out of 13 SSI patients with low BMI (84.6%). The most common organism cultured in patients with high BMI was E. coli (9 out of 28 patients, 32.1%), followed by S. aureus (7 out of 28 patients, 25%), K. pneumoniae (6 out of 28 patients, 21.4%), P. aeruginosa (5 out of 28 patients, 17.9%), and MRSA (3 out of 28 patients, 10.7%).

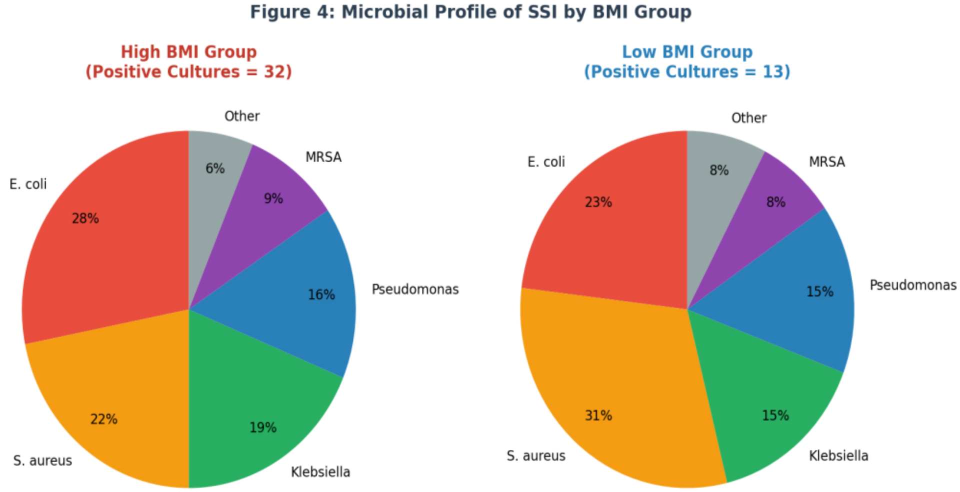

Figure 4: Distribution of Microorganisms in SSI Isolates. In the high BMI category, the predominant isolates were gram-negative bacteria (E. coli, Klebsiella, and Pseudomonas), while in the low BMI category, S. aureus predominated.

Similar to findings from other regions, 20% of isolates had MDR and 3% had XDR.[9] Both the use of beta-lactam prophylaxis during surgeries and increased exposure to healthcare-acquired infections are responsible for the higher percentage of gram-negative isolates in the group with a high BMI.

The instant SSI was implemented

The majority of SSIs occurred between days 6 and 10 after surgery in the high and low BMI groups, respectively. SSIs happened in 8 out of 13 (61.5%) cases in the low BMI group and 18 out of 32 (56.3%) cases in the high BMI group over this period. The high BMI group (8/32, 25%) exhibited a higher incidence of SSIs (day 3-5) than the low BMI group (2/13, 15.4%), which could indicate an organ/space infection or deep SSI.

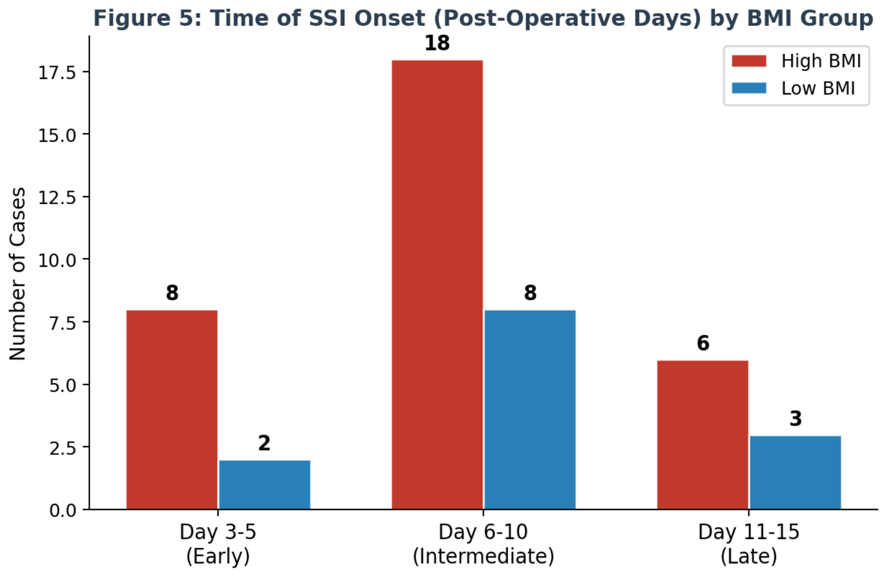

Figure 5: Time of SSI Occurrence by BMI Category. In all groups, most SSIs occurred between days 6 and 10. Organ space and deep The high BMI group had a greater prevalence of early onset infections (days 3-5) and SSIs.

Results of Management

Medical care (application of wound dressings and antibiotics based on culture sensitivity) was the main form of treatment for 20 out of 32 (62.5%) patients with high body mass index and 9 out of 13 (69.2%) patients with low body mass index SSI. Reoperation using wound debridement, wound drainage, or delayed primary closure was necessary for two (15.4%) patients with low body mass index and seven (21.9%) patients with high BMI. After wound dehiscence, three (23.1%) patients with low BMI and ten (31.3%) patients with high BMI needed surgery.

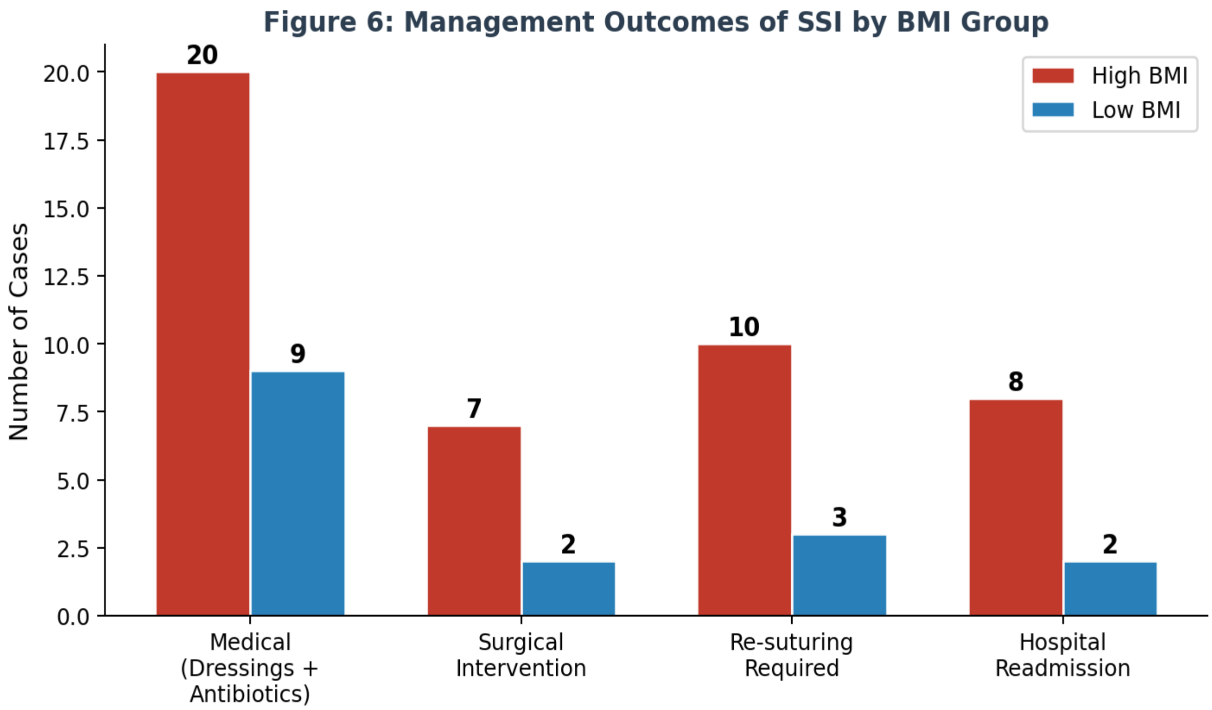

Figure 6: SSI Management Results for Patients Based on BMI Classification. Compared to patients with low BMI, individuals with high BMI had increased rates of surgery, suturing, and hospitalization.

DISCUSSION

The current study found that the prevalence of SSI after CS was significantly higher in people with high BMI (32% versus 13%), with an odds ratio of 3.12 (95% CI: 1.52-6.41, p=0.002). Consistent with recent research findings, high BMI has been shown to be an independent risk factor for infections associated with CS.

Our total SSI incidence of 22.5% is higher than both the 8.66% rate reported by Salman et al. in Cairo and the 8.8% rate reported by Ahmed et al.[11] in Fauji Foundation Hospital Rawalpindi, where a care bundle approach was implemented. [12]However, compared to the 24.3% rate reported by Jabbar et al. at Civil Hospital Karachi, our total SSI rate is comparable. It is consistent with the broader range of rates (3% to 18%) observed in research conducted internationally.[13]

Because JPMC is one of the main facilities where complex pregnancy cases are referred, our research sample had a higher incidence of SSI. It is also due to the high percentage of co-morbid illnesses and the fact that the majority of cesarean procedures were performed as emergencies (55% in patients with high body mass index.

Diabetes mellitus was more common in obese patients (48% versus 24%, p=0.001) and was found to be a significant predictor of SSI in both populations. This outcome is in line with what Jabbar et al. found. (p=0.049)[12] and Salman et al. (OR=3.2, p=0.01,).[7] The pathophysiology of diabetes mellitus as a risk factor is linked to poor wound healing, decreased collagen synthesis, and neutrophil dysfunction brought on by hyperglycemia. Chorioamnionitis was another significant predictor of SSI that was quite common in the population with high BMI (65% versus 38%, p<0.001). Other investigations have shown that chorioamnionitis increases the likelihood of having an SSI three times after cesarean delivery.[12]

Because anemia affects wound perfusion, macrophage activity, and healing, it further increases the risk of SSI in 78% of the high BMI participants in our study. This outcome aligns with the findings of Salman et al., who found that low hemoglobin levels before to surgery were independent predictors of SSI with odds ratios of 5.53 (P < 0.001).[12] " The challenges faced during surgery on obese patients are responsible for the higher percentage of high BMI persons with operation periods longer than one hour (24% vs. 11%; P = 0.018). People are known to be predisposed to SSI by this factor.[12,15]

Microbiologically, patients with a high BMI were more likely to have E. coli bacteria, whereas those with a low BMI were more likely to have S. aureus bacteria. Gram-negative rods were found to have a positive correlation (OR=1.679) with SSIs, especially those caused by endocrine and metabolic disorders, according to Zeeshan et al.[1]."This outcome is consistent with research showing that the high BMI group had a higher incidence of gram-negative bacteria due to GI flora and selective antibiotic pressure from cephalosporins.[1]

In a similar sample of Pakistani obstetric patients, the use of Ahmed et al.'s care bundle strategy, involving preoperative antibiotic prophylaxis, skin antisepsis, normothermia, and early dressing removal, yielded an incidence rate of only 8.8%, highlighting the immense possibility of reducing the burden of SSI through organized, research-based protocols. Based on a systematic review done in 2020, the implementation of care bundles in developing countries led to a significant reduction of 45% in the SSI rate.[11]

Regarding clinical management, the overweight and obese patients involved in our study required more surgical interventions (21.9% versus 15.4%), more suture removals (31.3% versus 23.1%), and greater hospital readmissions (25% versus 15.4%) than normal weight participants. These findings suggest the necessity of adopting specific preventative strategies among obese obstetric patients, resulting in increased health costs, hospital days, and significantly affecting the quality of life of mothers.

CONCLUSION

According to the current study, BMI ≥27 kg/m² is a significant and independent risk factor for SSIs after C-section, with a significantly higher risk of infection (32% versus 13%, OR = 3.12) than those with a low BMI. DM, chorioamnionitis, anemia, emergency CS delivery, and long surgical times were important co-factors associated with high frequency in patients with high BMI. individuals with low BMI were more likely to have S. aureus infections, whereas individuals with high BMI were more likely to have Gram-negative bacteria like E. coli.

These results necessitate the prompt adoption of organized protocols for the use of care bundles, appropriate optimization of preoperative modifiable risk variables (e.g., hemoglobin correction and glycaemia management), strict adherence to antimicrobial prophylaxis, and post-discharge surveillance. Further multicenter studies with a bigger sample size should be carried out in the future to validate these results and evaluate the effect of employing interventional measures to avoid infections.

Limitations

A single-center study carried out at JPMC Karachi; results may not be entirely applicable to all Pakistani medical facilities.

The pre-pregnancy BMI may have been inflated because the BMI was determined using birthweight.

Not every patient's precise time of antibiotic prophylaxis delivery was noted.

Since there was no follow-up after 30 days, some cases of late SSIs may not have been reported.

Due to resource constraints, a thorough investigation of the resistance pattern was not possible.

Recommendations

All obstetric departments of Pakistani government tertiary care hospitals should employ evidence based SSI care bundles.

To address the issues of diabetes, anemia, and malnutrition, establish distinct pre-operative optimization clinics for obese pregnant women.

Implement uniform post-discharge follow-up protocols and mandated SSI monitoring programs.

Due to the rise in MDR pathogen cases, implement antimicrobial stewardship initiatives.

Compare different SSI prevention strategies in Pakistani pregnant women with high BMI by conducting multicenter prospective RCTs.

Authors contribution

Author: L.G. was one of the authors who designed it, gathered the data, and drafted the report. N.F. Data gathering, statistical analysis, editing, and critical evaluation. The authors examined and approved the final paper.

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