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Maternal obesity and cesarean surgical wound infection: An evidence-based reassessment of risk

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Abstract

Background: Obesity during pregnancy has been associated with impaired immune response and delayed wound healing, leading to a higher risk of surgical site infection (SSI) after caesarean section (CS). Previous studies have reported that obese women undergoing CS have a 31% increased risk of developing SSI.
Purpose: To analyze the correlation between maternal obesity and the incidence of SSI following CS deliveries.
Method: This observational analytic study applied a cross-sectional design and involved 100 patients who underwent CS between January and December 2024. Participants were selected using purposive sampling. Obesity was considered the independent variable, while SSI was the dependent variable. Data were collected from medical records and analyzed using Fisher's exact test, with statistical significance set at $p < 0.05$.
Results: Among the participants, 66% (n = 66) were classified as obese, while the majority, 95% (n = 95), did not experience SSI. The Fisher's exact test yielded $p = 0.163$, which exceeded the significance threshold. These findings indicate no statistically significant association between maternal obesity and SSI following CS.
Conclusion: Although the prevalence of obesity among the study participants was high, obesity was not significantly correlated with the incidence of SSI after CS. Further research is recommended to identify other contributing factors that may influence postoperative infections.

Keywords: Body Mass Index; Caesarean Section; Obesity in Pregnancy; Surgical Site Infection.

INTRODUCTION

Obesity is a health problem that is increasing in number throughout the world. On a global scale, the World Health Organization (WHO) reports that approximately 15–20% of pregnant women are obese. Similarly, at the national level, data from the Basic Health Research 2020 indicates that the prevalence of obesity in women of reproductive age in Indonesia is 21.8%, with elevated figures observed in specific districts, underscoring the need for heightened attention in maternal and child health services. A study of data from the Riskesdas in 2018 at Surabaya revealed a 16.01% prevalence of obesity among women (East Java Health Service, 2018). A preliminary study of obesity cases in pregnancy at dr. M. Soewandhie Hospital in 2023 revealed a 25.01% increase compared to the data reported for Surabaya by the 2018 Riskesdas. Obesity during pregnancy has been demonstrated to have a detrimental effect on maternal health and to present risks to the fetus and the birth process, necessitating more intensive medical treatment. Furthermore, obesity in patients undergoing CS has been demonstrated to increase the risk of surgical wound infection due to decreased immune system factors and impaired wound healing. Fat tissue is characterized by a paucity of adequate blood supply, which compromises its capacity to resist bacterial infections and deliver nutrients and cellular elements necessary for healing. In the absence of immediate provision of nutrients to the damaged tissue, the

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wound healing process is likely to be impeded (Kartikasari & Apriningrum, 2020).

Several studies have also highlighted that maternal education level plays an important role in shaping nutritional behavior during pregnancy, which indirectly influences the risk of obesity and its complications (Pamungkas & Nurlaili, 2024). This is in line with national health guidelines that emphasize the importance of balanced nutrition and lifestyle management as outlined in *Peraturan Menteri Kesehatan Republik Indonesia Nomor 41 Tahun 2014 tentang Pedoman Gizi Seimbang* (Ministry of Health of the Republic of Indonesia, 2014). Moreover, psychological factors such as stress can also contribute to obesity-related complications, as stress may trigger hormonal imbalances that exacerbate risks like preeclampsia (Husaidah, Putri, & Harlina, 2022).

Surgical site infection (SSI) is a prevalent problem, with a global incidence rate of up to 18% (Wahyuningsih, 2020). The mortality rate directly related to SSI ranges from 3% to 75% in hospitals worldwide. The incidence of SSI in hospitals worldwide has increased from 21.2 cases per 100 surgical procedures to 23.6 cases per 100 surgical procedures (Iskandar, 2023). In Indonesia, the incidence of SSI has increased significantly, from 14.8% in the 2013 Riskesdas data to 21.8% in the 2018 Riskesdas. A subsequent investigation at the Wonosari Regional General Hospital determined the incidence of SSI following CS to be 5.5%. Concurrently, preliminary studies conducted at dr. M. Soewandhie Hospital, Surabaya, during the 2023 period, revealed an 2% prevalence of SSI in CS deliveries, amounting to 19 cases. Obesity was identified as the predominant cause of SSI, accounting for 31% of cases, with a total of 6 cases.

Midwives working in hospitals are obligated and empowered to identify the risk of complications experienced by pregnant women, during childbirth, or in the postpartum period. The objective of monitoring and early detection of pregnant women is to provide guidance, encouragement, and convenience to the families of pregnant women. The aim is to facilitate the recognition, prevention, and overcoming of problems related to pregnancy, childbirth, and neonatal services. The objective of monitoring pregnant women is to identify those who are at high risk. High-risk pregnancies are defined as those that pose a greater risk of mortality for the infant, the mother, or the occurrence of complications during childbirth, including congenital disabilities (Danur Azissah & Wulandari, 2018). The role of midwives in the early detection of the risk of SSI is of great significance in reducing the mortality and morbidity of postpartum mothers in Indonesia. The objective of this study is to ascertain the correlation between obesity in pregnancy and the prevalence of surgical site infections in caesarean deliveries.

RESEARCH METHOD

This study employed an observational analytic design with a cross-sectional approach (research conducted at a certain time to see the relationship between variables). The research was carried out at dr. Mohamad Soewandhie Hospital in Surabaya during the period from January to December 2024. The study population included all patients who underwent caesarean section (CS) deliveries within that time frame, amounting to 669 individuals. From this population, a total of 100 participants were selected using the purposive sampling technique (i.e. sample selection based on certain criteria determined by the researcher).

The independent variable in this study was maternal obesity, which was assessed through body mass index (BMI), while the dependent variable was the incidence of surgical site infection (SSI), defined as an infection that occurred at the surgical incision site within 30 days after surgery. Data were obtained from hospital medical records, complemented by direct BMI assessments. The procedure involved coordination with medical record officers to access the necessary data, followed by the application of inclusion criteria. To ensure data accuracy, a worksheet format was developed for systematic recording. In order to protect confidentiality, patient identity codes were applied.

The data collected included BMI, preoperative laboratory results, surgical data, as well as medical history of postoperative infection, diabetes, hypertension, and other comorbidities that could potentially influence wound healing. Data analysis was performed in two stages: univariate analysis to describe the distribution of patient characteristics, and bivariate analysis using Fisher's exact test (a statistical test to see the relationship between

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categorical variables in small samples). The significance level was set at $p < 0.05$, meaning that results with values below this threshold were considered statistically significant. The present study has adhered to the ethical principles and data collection procedures established by the Director of dr. M. Soewandhie Hospital, Surabaya, and has obtained approval from the Ethics Committee of Dr. M. Soewandhie Hospital, Surabaya, with an ethical certificate number 008/KE/KEPK/2025.

RESEARCH RESULTS

Table Characteristics of the Respondents (N=100)

Variable	Results	p-value
Age (n/%)		
15–20 years	4/4	
21–35 years	76/76	
>35 years	20/20	
Education (n/%)		
Elementary School	14/14	
Junior High School	22/22	
Senior High School	59/59	
College	5/5	
Occupation (n/%)		
Housewife	75/75	
Private	20/20	
Self-employed	3/3	
Civil Servant	2/2	
Parity (n/%)		
Nulliparous	31/31	
Primipara	28/28	
Multipara	39/39	
Grand Multipara	2/2	
History of Caesarean Section (n/%)		
Yes	32/32	
No	68/68	
Surgical Site Infection (SSI) (n/%)		
No Infection	95/95	
Infection	5/5	
Nutritional Status (n/%)		
Normal	19/19	
Overweight	15/15	0.163
Obesity	66/66	

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The table above shows that the majority of respondents were within the reproductive age of 21–35 years (76%), while a smaller proportion were aged above 35 years (20%), and only a few were adolescents aged 15–20 years (4%). In terms of education, most respondents had completed senior high school (59%), followed by junior high school (22%) and elementary school (14%), with only 5% attaining college-level education. Regarding occupation, three-quarters of the participants were housewives (75%), while others worked in the private sector (20%), were self-employed (3%), or civil servants (2%). From an obstetric perspective, multiparous women comprised the largest group (39%), followed by nulliparous (31%) and primipara mothers (28%), while only 2% were classified as grand multipara. A majority of the respondents had no previous history of caesarean section (68%), whereas 32% reported having undergone the procedure before.

Nutritional status assessments indicated that obesity was the most prevalent condition, affecting 66% of respondents. In comparison, 19% were in the normal category, 15% were overweight, and none were underweight. This finding highlights obesity as the dominant nutritional profile among pregnant women undergoing caesarean delivery in this study population. Finally, surgical site infection was found in a small proportion of participants. Most respondents (95%) did not experience SSI following caesarean section, while only 5% (n = 5) developed an infection. These results suggest that although the prevalence of obesity was high, the overall incidence of SSI in this sample remained relatively low.

Statistical analysis using Fisher's exact test produced a p value of 0.163, indicating no significant relationship between maternal obesity and the incidence of SSI after caesarean section ($p > 0.05$). These results suggest that although obesity was prevalent in the study population, it did not significantly increase the risk of SSI.

DISCUSSION

The present study demonstrates that there is no statistically significant relationship between obesity in pregnancy and the incidence of SSI in caesarean section delivery. This finding suggests that obesity, within the context of this study, is not a primary contributing factor to SSI. This finding is at odds with one of the research which stated that obesity significantly increases the risk of SSI (Puspita, Ayu, IKusumaningtiar, Nitami, & Sangaji, 2024). However, this finding aligns with the conclusions one of the research, which determined that there was no direct relationship between nutritional status and the incidence of postoperative infection (Pape, Tuuli, Neal, Haas, Shanks, Rouse, Ibrahim, Harper, Carter, & Poythress, 2021). This finding suggests that SSI is multifactorial in nature and cannot be explained solely by the patient's nutritional status.

Researchers hypothesize that a multitude of additional factors contributed to the occurrence of IDO in this study, including, but not limited to: (1) Fetal Distress. Two out of five cases of SSI studied were observed in patients exhibiting signs of fetal distress. This condition frequently necessitates emergency surgical intervention and is often accompanied by other complications, including prolonged rupture of membranes and maternal metabolic disorders, such as hypertension and diabetes, which can compromise the immune system (Li, & Cui, 2021). (2) Emergency Operation. It is noteworthy that all cases of SSI occurred during emergency operations. Emergency operations are often executed in a time-constrained manner, which can compromise the sterilization process, antisepsis, and the administration of prophylactic antibiotics. This finding aligns with the conclusions of a study that reported an increased risk of SSI in cases of emergency CS with a magnitude up to three times greater than that of non-emergency CS (Martin, Auboyer, Boisson, Dupont, Gauzit, Kitzis, Leone, Lepape, Mimoz, Montravers, & Pourriat, 2019). (3) Preoperative Rupture of Membranes: It was observed that all cases of SSI exhibited rupture of membranes prior to surgical intervention. Rupture of membranes that has persisted for more than 12 hours provides access for microorganisms to enter the uterine cavity and surgical area (Wojcieszek, Bonet, Portela, Althabe, Bahl, Chowdhary, Dua, Edmond, Gupta, Rogers, Souza, & Oladapo, 2023). This results in an elevated risk of infection, including endometritis and surgical wounds (Bortolotti, Faure, & Kipnis, 2018). (4) The present study found that repeated internal examinations were observed in 20% of SSI patients. Patients with prolonged labor processes and vaginal examinations ≥5 times have elevated risk of infection due to bacterial colonization

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from the genital tract to the surgical area, particularly in cases where there are immunosuppression factors or emergency conditions (American College of Obstetricians and Gynecologists, 2021). (5) The investigation revealed that in four out of five instances of SSI patients, a prolonged duration of labor was observed. A prolonged labor process has been shown to result in increased tissue damage, prolonged exposure to the hospital environment, and an elevated risk of postoperative contamination and infection (Supriyatin, Melani, Jubaedah, Susanti, & Susiarno, 2025).

Obesity during pregnancy is a condition influenced by various factors, including but not limited to age, education level, occupation, and parity (Caesarridha, Wintoko, Mustofa, & Soleha, 2024; Khairani, Saputri, Syavani, & Effendi, 2024.). The results indicated that 66% of pregnant women who underwent Sectio Caesarea had obesity nutritional status, which is consistent with the findings of previous studies. Obesity during pregnancy is predominantly attributable to an energy imbalance between intake and expenditure, primarily attributable to unhealthy eating patterns (Vadila, Izhar, & Nasution, 2021). Hormonal and genetic factors also play a role (Moyce Gruber, & Dolinsky, 2023). Additionally, the mother's level of education has been shown to play a crucial role in shaping dietary habits and health awareness during pregnancy, which may influence obesity-related risks and postoperative outcomes (Pamungkas & Nurlaili, 2024). National nutritional policies, as outlined by the Ministry of Health, emphasize the importance of balanced nutrition and lifestyle modifications to prevent maternal complications linked to poor dietary patterns (Ministry of Health of the Republic of Indonesia, 2014). Moreover, psychosocial stress has also been reported as a contributing factor that may exacerbate obesity and pregnancy-related complications such as preeclampsia (Husaidah, Putri, & Harlina, 2022).

The prevailing evidence indicates that women demonstrate a higher propensity for obesity in comparison to men. A multitude of factors have been identified as contributing to an elevated risk of obesity, including multiparity, a high-calorie diet, and a low-fiber diet. Additionally, genetic factors have been identified as significant contributors to this elevated risk. Furthermore, obesity has been demonstrated to be a significant predictor of post-Cesarean SSI. The pathogenesis of SSI is characterized by the entry of bacteria into the incision wound and the subsequent interaction between bacterial virulence and the patient's immune system. These findings underscore the significance of promotive and preventive measures, such as nutritional education, increased physical activity, and monitoring of nutritional status during pregnancy, with the aim of reducing the prevalence of obesity and its associated complications, including SSI (Lubis, Wintoko, Ismunandar, & Windarti, 2024)

In contrast, the protective factors observed in this case are believed to be attributable to the implementation of rigorous clinical procedures. These procedures include, but are not limited to, stringent surgical sterility management, timely administration of prophylactic antibiotics, adherence to postoperative wound care standards, and patient education. Regulations such as the labeling of "SSI risk" for certain patients and the strict supervision of delivery procedures also support the low incidence of infection. Consequently, it can be concluded that obesity in pregnancy is not the sole risk factor for SSI. A multifaceted strategy is imperative to prevent surgical site infections. This strategy should encompass the identification of risk factors, operative management, and comprehensive postoperative monitoring.

It must be acknowledged that this study is not entirely immune to the limitations that are inherent to the research process. The limitations of this study are rooted in the utilization of secondary data, which introduces the possibility of errors during data entry into medical records. Researchers found themselves unable to control other factors that may influence the incidence of surgical site infections. These factors include patient factors (e.g., immunosuppression, smoking, age, obesity); surgical factors (e.g., length of surgical procedure, prophylactic antimicrobials, instrument sterilization, operating room ventilation); and postoperative factors (e.g., presence of Staphylococcus Aureus colonization, postoperative wound care).

CONCLUSION

The incidence of Surgical Site Infection (SSI) is not solely influenced by obesity but by multiple interacting factors such as fetal distress, emergency

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surgery, rupture of membranes, frequent vaginal examinations, and prolonged labor. These factors contribute to infection through microbial contamination and reduced aseptic conditions. Therefore, SSI prevention should focus on comprehensive measures, including early risk identification, strict adherence to standard operating procedures, appropriate antibiotic prophylaxis, and controlled internal examinations, especially in cesarean deliveries. Further research with larger samples and control of confounding variables is recommended to validate these findings.

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