BMC Women's Health

RESEARCH Open Access

Surgical care bundle: effect on post-caesarean wound infection

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Abstract

Background Surgical site infections, resulting from surgical procedures, can significantly impact healthcare systems and individual patients, necessitating the implementation of a surgical care bundle to reduce their incidence.

Aim To investigate the effect of surgical care bundle on post-cesarean wound infection.

Design The research design was quasi-experimental.

Settings The study was conducted at the obstetrics and gynecology departments of University Hospital and Shebin El-Kom Teaching Hospitals, Menoufia Governorate, Egypt.

Sample A sample of one hundred women was chosen as convenient for the study.

Instruments A structured interview questionnaire and surgical checklist were utilized.

Results The results showed that 100% of the intervention group had healthy wound status after 48 h compared to 80.0% of the control group.

Conclusion The surgical care bundle application pre-, during, and post-cesarean section significantly reduces the risk of cesarean section wound infection. The incorporation of these surgical care bundles into comprehensive surgical quality programs for women undergoing cesarean section.

Keywords Post-cesarean, Wound infection, Surgical care bundle

Introduction

Surgical site infections (SSIs) are a common infection linked to healthcare caused by surgical procedures, affecting 2.5–7.7% of people worldwide. Despite advancements in infection control, SSIs cause longer hospital stays and higher costs, with incidence rates varying between low- to middle-income countries and higher-resource countries [1–3]. The fetus is surgically removed through the mother's abdominal wall during a cesarean section, posing risks of pregnancies, infection, postpartum bleeding, and bladder injury [4–6].

Egypt's cesarean section rates have surged to 72% in 2021, up from 52% in 2014, based on the Central Agency

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for Public Mobilization and Statistics (CAPMAS). Cesarean births can cause SSIs, with estimates ranging from 3 to 16% [38]. As a result, compared to vaginal births, maternal morbidity, and postpartum mortality may increase five to twenty times [7–10].

Post-cesarean section SSIs occur after surgery within 48 h, with risk factors including inadequate prenatal care, poor nutrition, anemia, extreme BMI, diabetes mellitus during pregnancy, CS, rupture of membrane, obstructed labor, repeated infections, incorrect methods [11–13]. Postpartum SSIs after cesarean section (CS) are a major cause of extended hospital stays and readmissions, linked to increased mortality and morbidity in women, despite advancements in clinical obstetric care. Clinical studies show that a surgical care bundle, consisting of various therapies, can reduce infections due to cesarean Sects [14–17].

To evaluate the effect of a surgical care bundle on the prevention of SSIs associated with CS, a one-year randomized clinical trial was conducted. Initially, it proved the efficacy of a commercially viable quality improvement package in which a modification to the conventional procedure meant to enhance results was not linked to any negative consequences. Second, the evidence-based bundle dramatically decreased the incidence of SSIs by 50% ($P = 0.02$), confirming its effectiveness. In the control and intervention groups, the incidence of SSIs was 28 (19.4%) and 14 (9.8%) and ($P = 0.02$), respectively. According to hospital infection control and surveillance protocols, the incidence rates of SSIs vary globally from 3.0 to 15.0% in various contexts [18, 19].

Preventative surgical care bundles for sepsis management in high-income nations reduce mortality and improve patient outcomes, promoting evidence-based practice and preventing healthcare delays [20] [21],. A study found that physician awareness of patient outcomes leads to effective infection prevention practices in surgery, particularly in the perioperative environment [22]. A study conducted on women with SSIs involved wound culture and sensitivity tests, hemoglobin investigation before and post-surgery, and chlorhexidine scrubbing of surgical sites. The incidence of SSIs within six weeks after giving birth was the main outcome, and chlorhexidine-based antiseptic treatments outperformed other options [23, 24].

Despite the high prevalence of post-cesarean wound infections, there is limited research on the effectiveness of surgical care bundles in reducing these infections, particularly in the context of low- and middle-income countries like Egypt. Existing studies often focus on individual infection prevention measures rather than a comprehensive, evidence-based bundle approach. Additionally, most research lacks standardized implementation and evaluation of such interventions within routine clinical practice. This study aims to address this gap by investigating the effect of a surgical care bundle on post-cesarean wound infection rates in Egypt, providing valuable insights into its clinical effectiveness and potential for broader application.

Methods

Study design

This investigation was carried out using a quasi-experimental design.

Study settings and sampling

The current study was conducted at the Shebin El-Kom Teaching Hospital and the Menoufia Governorate's University Obstetrics and Gynecology departments. A group of women undergoing cesarean sections were randomly assigned to one of two groups. To achieve this, a simple randomization method was used. Each participant was asked to draw a sealed, opaque envelope containing a pre-assigned number (either "1" or "2"). Those who drew "1" were allocated to the control group (G1), which received standard hospital care, while those who drew "2" were allocated to the intervention group (G2), which received an evidence-based surgical care package from the researchers. To ensure allocation concealment and minimize selection bias, the randomization sequence was generated in advance by an independent researcher who was not involved in participant recruitment or data collection. The allocation numbers were placed in identical, sealed, and opaque envelopes, ensuring that neither the participants nor the researchers could predict or influence group assignment before enrollment.

The researchers utilized Yamane's formula to determine the necessary sample size at 95% confidence interval (CI), moderate effect size and 80.0% power. It was decided that the sample size would consist of 100 women, with an equal distribution of 50 women in each group. The inclusion criteria were expectant mothers undergoing a cesarean section must not have premature rupture of membranes, diabetes mellitus during pregnancy, Hb < 7 g/dl, bleeding in late pregnancy, antibodies allergies, or be immunosuppressed.

Instruments for collecting data

Three primary instruments were used to collect the required information:

Instrument I: a questionnaire for structured interviews The researchers developed it after examining relevant literature [25]. The following components were included:

Characteristics of the women in the study, including their age, education level, job, earnings, and body mass index. Pregnancy history (e.g., number of times of being

pregnant, number of children born, number of live births, prenatal care during current pregnancy). Past medical history (diabetes, high blood pressure, thyroid issues, seizures, asthma, heart problems). Description of current CS characteristics (gestational age, type of C-section, and reason for C-section).

Instrument II: surgical checklist The adoption of the surgical checklist was from Aditya et al. (26). Its goal was to evaluate the effect of surgical care bundles on post-cesarean wound infection.
This tool was composed of the following components:

Part I care before, during, and after surgery. This entailed 10 tasks, including trimming pubic hair, using chlorhexidine gluconate (20%) to clean the skin before surgery in the labor or recovery room before moving to the operating room, scrubbing hands before surgery, administering antibiotics, applying betadine to the vaginal vault, using chlorhexidine gluconate (20%) as an antiseptic on the operating table, removing the placenta through controlled cord traction (CCT), closing deep subcutaneous fat if it is > 2 cm thick, suturing the skin with subcuticular stitches, and dressing the wound 48 h after surgery with no post-operative antibiotics given.

Part II Follow-up after surgery of the wound (condition of the wound 48 h later and indications of infection and inflammation). The total score extended from 8 to 16. The result was interpreted as follows: inflamed (8-13.6) and healthy > 85% (13.7–16).

Validity and reliability

The validity of the instruments was certified by five specialists, including two professors from the Faculty of Medicine's Obstetrics and Gynecology department and three professors from the Faculty of Nursing's Maternal and Newborn Health Nursing department. They evaluated the instruments' internal validity and content accuracy. They were also told to assess the items' content validity, or how comprehensive and understandable they were. The researchers used test-retest reliability to evaluate the instruments' internal consistency. The task was completed using the same tools and people in similar situations. Multiple tests were analyzed to assess the stability of the findings over two times within 2 weeks apart. The instrument's reliability was computed by the researcher to test its internal consistency. The researcher used to test-retest reliability. It took place through the administration of the same instrument to the same participants under similar conditions on two occasions. Scores from repeated testing were compared to the consistency of the results over time. All dimensions of the instrument were internally reliable, with Cronbach's α scores ranging from 0.80 to 0.95.

Procedure

The coordinators of the research settings received an official letter from the dean of the Faculty of Nursing outlining the goals and methods of data collection. The directors of the settings permitted the study to be carried out. Data was collected in the conditions throughout three months, from the beginning of August 2024 to the beginning of October 2024. For three days each week, specifically Monday, Tuesday, and Wednesday, women meeting the inclusion criteria were scheduled to participate from 9.30 a.m. to 12 p.m., with 5 to 10 women attending each day based on availability.

In the interview stage, the researchers welcomed the participants, provided their introduction, and clarified the research objectives to secure their consent and enlist them in the study while also seeking collaboration. Following verbal and written consent from eligible women, data on personal information, obstetric history, and details of the current cesarean section were gathered through interviews using Instrument I.

Additionally, the researchers evaluated women's anthropometric measurements by using an electronic scale to measure their weight and height. Next, the researchers computed the BMI and categorized the women based on their BMI into normal, underweight, overweight, or obese classifications. For each woman using the instrument, it took between 20 and 30 min to complete the questionnaire.

To prevent surgical site infection after surgery, the researchers administer preoperative care to the study group, including replacement of hygienic and surgical handwashing with chlorhexidine by washing and disinfection with hydroalcoholic solutions, replacement of surgical field shaving with a razor blade by removing hair from the surgical field with an electric razor and antisepsis of the surgical field with 2% alcoholic chlorhexidine instead of povidone-iodine, antibiotic injection, vaginal vault painting, chlorhexidine gluconate painting, placenta removal with controlled cord traction, subcutaneous fat closure if > 2 cm deep, skin closure with subcuticular sutures, and dressing after 48 h post-surgery.

Assessment of the implementation phase was completed by monitoring the wound for signs of infection on the second day following surgery and five to seven days post-operation. The assessment began by observing the control group to prevent bias.

Control group

The women who were assigned to the control group also were interviewed, and assessed for their personal information, obstetric history, and details of the current

cesarean section using Instrument I. They did not receive any intervention from the researchers. They received standard hospital intervention, which involved regular diagnostic tests, scrubbing and antibiotic treatment.

Statistical analysis

Data was verified before entry on the computer. The Statistical Package for Social Sciences (SPSS version 25) was used for that purpose, followed by data tabulation and analysis. Descriptive statistics were applied (e.g., mean, standard deviation, frequency, and percentages). The Kolmogorov–Smirnov normality assessment test confirmed the normality distribution data, and parametric tests were used. paired t-tests compare the score for each group before and after the intervention. A significant level value was considered when $p \leq 0.05$.

Results

Table 1 presents the personal characteristics of the study groups. The mean age was 28.22 ± 3.34 years in the intervention group and 29.46 ± 3.73 years in the control group. Most participants in both groups had completed secondary education. Regarding economic status, 68.0% of the intervention group reported insufficient income compared to 56.0% in the control group. The mean BMI was similar between groups, at 24.05 ± 1.50 for the intervention group and 23.68 ± 3.13 for the control group. The intervention group had a mean number of gravidities of 2.14 ± 0.881 compared to 2.64 ± 1.225 in the control group. The mean number of parties was 2.86 ± 0.783 in the intervention group and 1.69 ± 1.158 in the control group. Similarly, the mean number of live children was slightly higher in the intervention group (1.86 ± 0.783) compared to the control group (1.60 ± 1.069). The mean gestational age at delivery was 38.54 ± 0.613 weeks in the intervention group and 37.82 ± 1.173 weeks in the control group. Additionally, 50.0% of the intervention group and 62.0% of the control group received regular prenatal follow-up.

Table 2 demonstrates that neither the intervention nor the control groups had any heart disease, diabetes, epilepsy, or asthma, 60.0% of the study group compared to 74.0% of the control group underwent elective cesarean sections, and 62.0% had previous LSCS, compared to 46.0% of the control group.

Table 3 demonstrates that the intervention group complied with surgical care bundles, which included 100% pubic hair trimming, surgical hand and chlorhexidine gluconate washing, antibiotic injection, vaginal vault painting, placenta removal, skin closure, and 48-hour dressing after surgery.

The intervention and control groups' postoperative follow-up outcomes are displayed in Table 4. In comparison to the control group, it shows that 100% of the intervention group had a healthier wound condition after 48 h, with no fever, edema, discomfort, or discharge from the

Table 1 Characteristics of the study participants

Variables	Intervention Group ($n=50$)	Control Group ($n=50$)	Test	*P*-value
	Mean ± SD	Mean ± SD		
BMI	24.05 ± 1.507	23.68 ± 3.139	t = 0.755	> 0.05
Age (years)	28.22 ± 3.34	29.46 ± 3.73	t = 1.749	> 0.05
Number of Gravida,	2.14 ± 0.88	2.36 ± 1.06	t = 1.126	> 0.05ns
Number of Partus	1.86 ± 0.783	1.69 ± 1.158	t = 0.838	> 0.05ns
Number of Live Children	1.86 ± 0.783	1.60 ± 1.069	t = 1.388	> 0.05ns
Gestational Age (weeks)	38.54 ± 0.613	37.82 ± 1.173	t = 3.847	> 0.05ns
Level of Education				
Illiterate	2	0.0%	χ^2=2.574	> 0.05
Read and write	6	10.0%		
Secondary Education	52	56.0%		
University	28	28.0%		
Other	12	6.0%		
Occupation				
Employee	40	34.0%	χ^2=0.386	> 0.05
Housework	60	66.0%		
Income				
Enough	32	44.0%	χ^2=1.528	> 0.05
Not enough	68	56.0%		
Follow-up during Pregnancy				
Yes	50	50.0%	χ^2=1.461 > 0.05ns	
No	50	50.0%		

N.B.: ns non statistically significant

Table 2 Medical conditions and Cesarean characteristics

Variables	Intervention Group ($n=50$)	Control Group ($n=50$)	Test	*P*-value
Diabetes Mellitus	0%	0%	a	a
Hypertension	16.0%	20.0%	χ^2=0.271	>0.05ns
Thyroid Disorders	16.0%	20.0%	χ^2=0.271	>0.05ns
Epilepsy	0%	0%	a	a
Asthma	0%	0%	a	a
Cardiac Disease	0%	0%	a	a
Type of Cesarean Section				
Elective	60.0%	74.0%	χ^2=2.216	>0.05ns
Emergency	40.0%	26.0%		
Indications of Cesarean Section				
Fetal Distress	10.0%	6.0%	χ^2=4.847	>0.05ns
Previous LSCS	62.0%	46.0%		
Malpresentation	12.0%	22.0%		
Fetal Growth Restriction	6.0%	14.0%		
Uncontrolled Hypertension	10.0%	12.0%		

incision site. In addition, there was less edge separation and absence in the intervention group than in the control group. These results emphasize how crucial postoperative care is to the healing of wounds.

Figure 1 shows the effect of the surgical care bundle on post-cesarean wound infection incidence. It shows that 100% of the participants in the intervention group had healthy cesarean wounds while 80% in the control group had inflamed cesarean wounds.

Discussion

With a mean age of twenty-seven for the intervention group and a control group mean age of twenty-nine, the study's findings showed notable sociodemographic variations between the two groups, most likely because of childbearing. According to the study's findings, housewives and those with secondary education were the most prevalent groups in terms of occupation and education. The results of this study are consistent with those of Samuel Dessu et al. [27], who conducted a case-control

Table 3 Compliance of the study participants' post-cesarean wound infection surgical care bundle ($n=100$)

Variables	The study participants				χ^2	*P* value
	Intervention group		Control group			
	No.	%	No.	%		
Clipping of pubic hair						
Yes	50	100%	12	24.0%	61.290	≤0.001**
No	0	0.0%	38	76.0%		
Chlorhexidine gluconate (20%), scrubbing before surgery in the labor room or recovery room before the patient is shifted to the operating room.						
Yes	50	100%	15	30.0%	53.846	≤0.001**
No	0	0.0%	35	70.0%		
Surgical hand scrubbing						
Yes	50	100%	50	100%	a	A
Antibiotic injection						
Yes	50	100%	50	100%	a	A
Vaginal vault painting with betadine						
Yes	50	100%	10	20.0	66.667	≤0.001**
No	0	0.0%	40	80.0		
Painting parts with chlorhexidine gluconate						
Yes	50	100%	14	28.0	58.730	≤0.001**
No	0	0.0%	36	72.0		
Placenta removal by controlled cord traction (CCT)						
Yes	50	100%	12	24.0	61.290	≤0.001**
No	0	0.0%	38	76.0		
Closure of subcutaneous fat if subcutaneous fat is >2 cm deep						
Yes	32	64.0	13	26.0	14.586	≤0.001**
No	18	36.0	37	74.0		
Closure of skin by subcuticular sutures						
Yes	50	100%	17	34.0	49.254	≤0.001**
No	0	0.0%	33	66.0		
Dressing is done 48 h postoperatively.						
Yes	50	100%	16	32.0	51.515	≤0.001**
No	0	0.0%	34	68.0		

a No statistics are computed because Surgical hand scrubbing and Antibiotic injection is a constant

Table 4 The intervention and control groups' post-operative follow-up ($n = 100$)

Variables	The study participants				χ^2	*P* value
	Intervention group		Control group			
	No.	%	No.	%		
Status of the wound after 48 h.					66.667	≤ 0.001**
Unhealthy	0	0.0%	10	20.0%		
Healthy	50	100.0%	40	80.0%		
Redness at the incision site					66.667	≤ 0.001**
Yes	0	0.0%	40	80.0%		
No	50	100.0%	10	20.0%		
Pain at the incision site					11.111	≤ 0.001**
Yes	50	100.0%	40	80.0%		
No	0	0.0%	10	20.0%		
Swelling at the incision site					63.934	≤ 0.001**
Yes	0	0.0%	39	78.0%		
No	50	100.0%	11	22.0%		
Increase in temperature at the incision site						
Yes	0	0.0%	40	80.0%	66.667	≤ 0.001**
No	50	100.0%	10	20.0%		
Discharge from the incision site					25.000	≤ 0.001**
Yes	0	0.0%	20	40.0%		
No	50	100.0%	30	60.0%		
Pus from abscess					23.457	≤ 0.001**
Yes	0	0.0%	19	38.0%		
No	50	100.0%	31	62.0%		
Separation of edges at the incision site						
Yes	0	0.0%	18	36.0%	21.951	≤ 0.001**
No	50	100.0%	32	64.0%		
Fever with tenderness at the site of incision						
Yes	0	0.0%	39	78.0%	63.934	≤ 0.001**
No	50	100.0%	11	22.0%		

** highly statistically significant

study to examine the factors that influence surgical site infections following cesarean sections at public hospitals in the Dire Dawa administration of Eastern Ethiopia. The age range was discovered to be between twenty and thirty-four years old.

According to the study's findings, women who have had more deliveries are more likely to get surgical site infections, and there are notable disparities in obstetric history and follow-up during pregnancy. To prevent problems throughout pregnancy, childbirth, and the postpartum period, prenatal education and care are essential. The present results are in line with a study conducted in Nairobi, Kenya, by David Odada et al. [18], who investigated surgical site infections following cesarean sections and related risk factors. The study was a retrospective case-control study conducted at a tertiary hospital in Kenya, and it discovered that most participants went to prenatal visits. This clarifies the importance of follow-up during pregnancy.

According to Gan et al. [28], who examined the effect of an evidence-based bundle on surgical site infections related to cesarean sections: in a randomized clinical trial in India, where nearly half of women had elective C.S. The study's findings showed that women had elective C.S. and prior LSCS. Additionally, Odada et al. [29] found that elective and emergency surgeries were nearly equal, while Matthew et al. [30] found that over half of cesarean sections were elective in a UK study on the reduction of adverse outcomes from cesarean sections by surgical-site infection prevention care bundles in maternity. The mechanisms behind the effectiveness of the surgical care bundle could result from using hydroalcoholic solutions for cleaning and disinfection instead of chlorhexidine for hygienic and surgical handwashing. The reduction in infection primarily due to antibiotic prophylaxis, skin antisepsis, and wound dressing protocols.

The study highlights the importance of skin preparation before surgery to prevent SSI, as incisions expose tissue to endogenous flora contamination, leading to SSI. This includes scrubbing, antibiotic injection, vaginal vault painting, placenta removal, skin closure, and postoperative dressing. This is consistent with Gan et al.'s [28] discovery that evidence-based surgical care techniques dramatically lower the incidence of site infections.

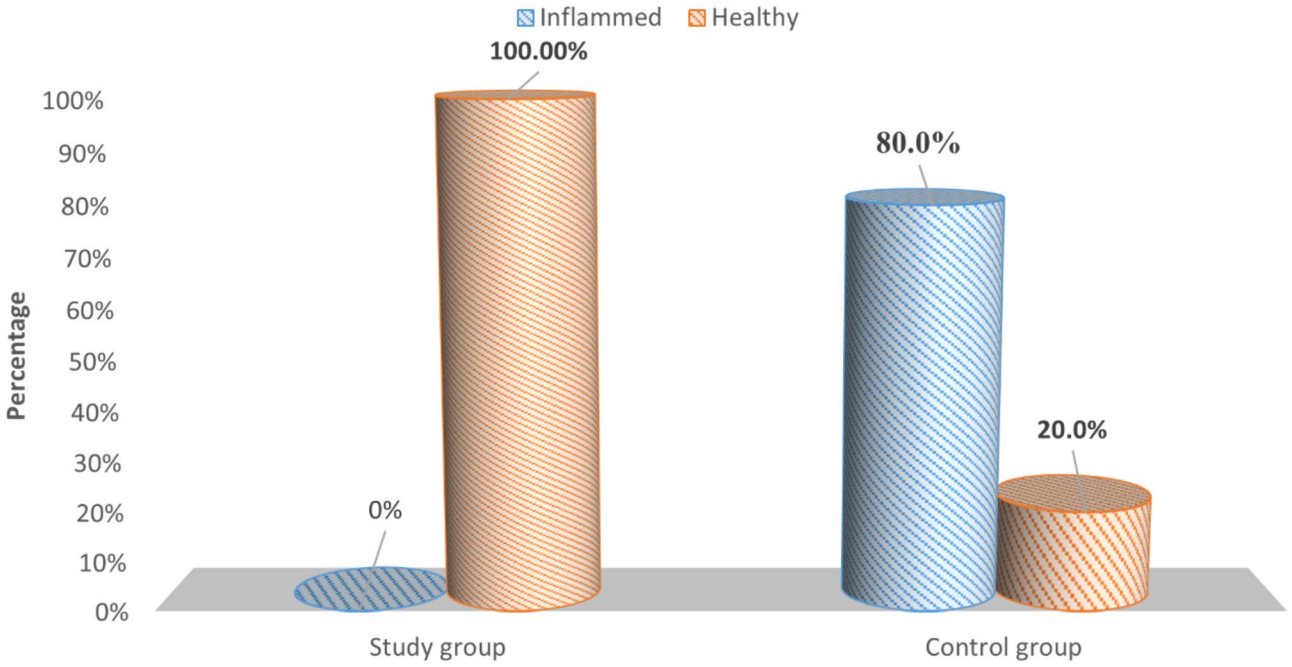

Fig. 1 Effect of the surgical care bundle on post-cesarean wound infection incidence

Chlorhexidine and povidone-iodine both have broad-spectrum antibacterial properties, but chlorhexidine acts in bodily fluids more quickly and persistently. Povidone iodine is used to reduce hematomas and treat vaginal infections. The fact that the effect of the surgical care bundle was not statistically significant may be due to the confounding effect of the improvement in antibiotic prophylaxis, the change of the oral cathartic, and increased use laparoscopy.

While the 48-hour follow-up period captures only early postoperative outcomes, it was selected to ensure standardized assessment during hospitalization, when monitoring is most consistent and data collection is most reliable. Although many surgical site infections (SSIs) typically manifest 7–10 days after surgery, early signs of infection often begin within the first 48 h and can be predictive of subsequent SSI development [31]. Prior studies have shown that early postoperative complications, even minor ones, are associated with an increased risk of later infection (32, 33). Therefore, while recognizing the limitation of a shorter follow-up, the early results presented may offer meaningful insights into the effectiveness of the surgical care bundle. Nonetheless, future research with extended follow-up periods is warranted to provide a more comprehensive understanding of infection rates over time.

The results of the study showed that employing an evidence-based surgical care bundle significantly improved the surgical wound site, resulting in a healthy wound 48 h following the procedure. This is consistent with a meta-analysis of perioperative surgical care bundles for the prevention of surgical site infections conducted by Niels Wolfhagen et al. [32], which found that the implementation of bundles in Amsterdam significantly reduced the incidence of surgical site infections. Additionally, these findings concurred with the Impact of a Surgical Site Infection Bundle on Cesarean Delivery Infection Rates study conducted in Houston, Texas, by Christina Davidson et al. [18]. The study found that high adherence to a surgical site infection bundle resulted in a notable decrease in SSI rates in cesarean deliveries.

Furthermore, Matthew Erritty et al.'s [30] study in the UK found that SSI rates decreased with the introduction of evidence-based surgical care bundle components, indicating their effectiveness in reducing cesarean section complications. Additionally, the results of the study disagree with Mengistu et al.'s [1] study in the UK found that SSI rates not decreased with the introduction of evidence-based surgical care bundle components. Appropriateness of antibiotic prophylaxis went from eighty-nine to ninety-seven, with timing of administration being the most frequent cause of inappropriateness.

Finally, given that the surgical care bundle consists of low-cost and easily implementable interventions, it holds strong potential for widespread adoption, particularly in low-resource settings. The simplicity and affordability of the bundle components make them highly scalable without requiring substantial additional infrastructure or specialized training. This cost-effectiveness is particularly important in settings where resource limitations often present significant barriers to improving surgical outcomes. Future studies could further explore the economic

impact of implementing such bundles on a larger scale, especially in low- and middle-income countries.

Limitations

This study has several limitations that should be considered when interpreting the findings. The follow-up period was limited to 48 h, which may not fully capture the incidence of surgical site infections (SSIs), as many develop within 7–10 days postoperatively. A longer follow-up period would provide a more comprehensive understanding of the true infection rates and the effectiveness of the surgical care bundle over time.

Additionally, the study was conducted at a single center, which may limit the generalizability of the findings to other hospitals with different patient populations, healthcare settings, and surgical protocols. Multicenter studies would be beneficial to confirm the effectiveness of the intervention across diverse clinical environments.

Another limitation is the sample size ($n = 100$), which, while appropriately calculated, remains relatively small for a clinical trial assessing infection outcomes. A larger sample size would enhance statistical power, improve the reliability of the results, and allow for subgroup analyses to identify specific patient populations that may benefit most from the intervention.

Furthermore, the study did not assess long-term maternal morbidity or cost-effectiveness. Evaluating long-term outcomes, such as complications, hospital readmissions, and healthcare costs, would provide a more comprehensive picture of the intervention's impact. Future research should explore these aspects to determine the broader clinical and economic benefits of implementing a surgical care bundle in cesarean sections.

Conclusion

The study's results show that surgical care bundle use significantly decreased the wound infection rate, underscoring their importance in promoting a safe recovery and preventing post-cesarean wound infection. A lower risk of wound infection could result from using hydroalcoholic solutions for cleaning and disinfection instead of chlorhexidine for hygienic and surgical handwashing. The surgical field was shaved with an electric razor to remove hair, and 2% alcoholic chlorhexidine was used to prevent surgical field infections rather than povidone-iodine. Surgical site infections are a significant issue in public health; they result in high rates of morbidity and mortality, extended hospital stays, and consequent financial consequences. Therefore, the decrease in SSIs is statistically significant regarding cost savings.

Acknowledgements

The authors extend their appreciation to Princess Nourah bint Abdulrahman University Researchers Supporting (PNURSP2025R844), Princess Nourah bint Abdulrahman University, Riyadh, Saudi Arabia.

Author contributions

Faten M; Hasan A performed the literature search, collected and interpreted the data. Roqaya F and Amira Abd. drafted the work and contributed to the writing of this manuscript. Al Rahbeni T; Majdi A; Jebril A. and Aseel G; edited and drafted the final version of this manuscript. Soliman A, Al-Mugged K; Eman S, and Sally MFA reviewed the final version to be published.

Funding

Princess Nourah bint Abdulrahman University Researchers Supporting Project number (PNURSP2025R844), Princess Nourah bint Abdulrahman University, Riyadh, Saudi Arabia.

Data availability

The data that support the findings of this study are available on request from the corresponding author.

Declarations

Ethics approval and consent to participate

The Faculty of Nursing at Menoufia University's Research and Ethics Committee gave its clearance to carry out the study, and the dean of Menoufia University's faculty of nursing issued an official letter that was to be addressed to the directors of the university and teaching hospitals (10/37/2024). The supervisors of the places gave their approval for the research to be conducted. The researchers met with the women participating in the study, introduced themselves, and outlined the study's purpose and requirements to gain their consent and cooperation. Methods were employed to address ethical concerns, specifically pertaining to privacy and obtaining consent. Every woman gave her written informed consent. They were informed participation was optional, and each woman had the choice to leave whenever she wanted. Every woman had the chance to decline participation without restrictions. They were free to inquire about any specific information regarding the research. The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review at all sites.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Received: 5 February 2025 / Accepted: 5 May 2025
Published online: 26 May 2025

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