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Original Research Article

An Observational Study to Assess Impact of Implementing 'Prevention Care Bundle' to Reduce Surgical Site Infection in Elective Gynecological Surgeries

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Abstract

Background: Surgical site infections (SSIs) remain important postoperative complications following elective gynecological surgery, increasing morbidity, hospital stay, treatment burden, and healthcare expenditure. Prevention care bundles integrate evidence-based perioperative measures and may provide a practical strategy for minimizing infection risk.

Aims & Objectives: To assess SSI rates following implementation of a prevention care bundle during the perioperative period and compare SSI rates before and after bundle implementation.

Material & Methods: This observational study included 300 patients undergoing elective gynecological surgery at Vani Vilas Hospital, BMCRI, and Bengaluru. SSI occurrence after implementation of the prevention care bundle was evaluated and compared with baseline pre-implementation data. Age, education, comorbidities, body mass index, hemoglobin, incision type, blood transfusion, and microbiological findings were assessed. Statistical analysis was performed using Microsoft Excel and SPSS, with data presented in percentages.

Results: SSI incidence was significantly lower after bundle implementation (7.00%) than in the non-bundle group (13.67%; p=0.016). Marked benefit was observed among diabetic patients, with SSI declining from 83.33% to 16.67% (p=0.00007), and among patients with comorbidities, from 48.39% to 20.97% (p<0.001). Significant reductions were also observed with transverse incisions (p=0.00235) and blood transfusion (p=0.0001). Higher BMI and lower hemoglobin were associated with greater SSI risk, although bundle adherence mitigated this risk.

Conclusion: Structured prevention care bundle implementation effectively reduced SSIs in elective gynecological surgeries, supporting consistent perioperative protocol adherence, particularly for high-risk patients, and offers a feasible framework for improving overall surgical outcomes.

Keywords: Surgical Site Infection; Prevention Care Bundle; Gynecological Surgery; Infection Control; Perioperative Care; Comorbidities.

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Introduction

Surgical site infections (SSIs) remain an important cause of postoperative morbidity following gynecological surgery and may adversely affect recovery, prolong hospitalization, increase antimicrobial exposure, and impose additional financial demands on patients and healthcare systems. [1,2] Despite improvements in operative techniques, sterilization, antimicrobial prophylaxis, and perioperative surveillance, prevention of SSI continues to be an essential component of quality surgical care. [1,3] The reference thesis similarly identifies SSI as a persistent postoperative challenge in gynecological procedures. The development of SSI is multifactorial and reflects interactions between patient characteristics, microbial contamination, surgical factors, and perioperative practices. [4,5] Advanced age, obesity, diabetes mellitus, nutritional impairment, anemia, comorbid illnesses, prolonged procedures, inappropriate antimicrobial prophylaxis, and deficiencies in aseptic technique may increase susceptibility to infection. [1,4,5] Importantly, SSI has consequences extending beyond wound infection, including delayed healing, pain, additional interventions, readmission, and deterioration in overall postoperative outcomes. [6] These considerations highlight the importance of systematic prevention rather than reliance on isolated measures.

Evidence increasingly supports multimodal interventions incorporating several proven practices into a standardized care pathway. [3,7] A prevention care bundle combines complementary evidence-based measures that are implemented consistently across preoperative, intraoperative, and postoperative periods. [8] Such strategies may include appropriate antimicrobial prophylaxis, optimized skin preparation, glycemic control, maintenance of normothermia, careful surgical technique, and standardized postoperative wound care. [3,7] The study thesis specifically emphasizes these preventive measures and the potential advantage of bundled implementation.

Enhanced Recovery after Surgery (ERAS) principles further demonstrate how coordinated perioperative protocols can improve surgical recovery and standardize evidence-based care. [9-11] Integrating SSI-prevention measures within such structured pathways offers a practical opportunity to strengthen infection control. Therefore, the present study evaluates the impact of implementing a prevention care bundle on SSI rates in elective gynecological surgeries, with particular emphasis on comparing infection rates before and after bundle implementation.

Literature Review: Surgical site infection (SSI) continues to represent a clinically important postoperative complication in obstetric and gynecological surgery, with consequences including delayed recovery, prolonged hospitalization, additional antimicrobial therapy, readmission, and increased healthcare expenditure. [12,17]

The Surgical Care Improvement Project emphasized standardized perioperative practices, particularly appropriate antimicrobial prophylaxis and evidence-based infection-control measures, to minimize preventable postoperative infections. [12]

Recent evidence increasingly favors a multicomponent prevention care bundle rather than isolated preventive interventions. Priya et al. demonstrated that systematic implementation of an SSI-prevention bundle in gynecological surgery provides a practical quality-improvement strategy for strengthening perioperative infection control. [13] Similarly, Petca et al. highlighted the value of adapting surgical bundles to obstetric and gynecological practice through coordinated preoperative, intraoperative, and postoperative measures. [14] The reference study likewise recognizes bundled interventions as a comprehensive approach for improving surgical safety.

The risk of SSI is influenced by patient characteristics, operative approach, comorbidities, obesity, diabetes, wound contamination, operative duration, and adherence to aseptic practices. [15,16,18] Appropriate surveillance and standardized diagnostic criteria are therefore essential for reliable identification and comparison of SSI outcomes. [19-23] Evidence-based recommendations further emphasize timely antimicrobial prophylaxis, meticulous surgical technique, appropriate skin preparation, and structured postoperative wound care. [24-26] Collectively, available evidence supports prevention bundles as a rational, reproducible strategy for reducing SSI and improving postoperative outcomes following elective gynecological surgery.

Aims & Objectives:

The aim of this study is to-

1. To assess SSI rates following implementation of a prevention care bundle during the perioperative period.
2. To compare SSI rates before and after bundle implementation.

Methodology

Study Design: The present study was designed as a hospital-based descriptive observational study to assess the impact of implementing a structured prevention care bundle on the occurrence of surgical site infection (SSI) among women undergoing elective gynecological surgery. The study was conducted at Vani Vilas Hospital, Bangalore Medical College and Research Institute (BMCRI), Bengaluru, Karnataka, over 12 months from May 2023 to April 2024.

Study Type: This was a descriptive study with prospective assessment following prevention care bundle implementation and comparison with baseline SSI data from May 2022 to April 2023, obtained from hospital records.

Study Population: The study included 300 patients admitted to the Department of Obstetrics and Gynaecology and undergoing major elective gynecological surgery for benign conditions. The principal procedures included abdominal hysterectomy, ovarian cystectomy, and myomectomy.

Inclusion and Exclusion Criteria:

Inclusion Criteria: Women aged 18–75 years, planned for major elective gynecological surgery for benign conditions, and willing to provide informed consent were included**.**

Exclusion Criteria: Patients with diagnosed malignancy, those undergoing laparoscopic or vaginal procedures, women unwilling to complete follow-up, and those unwilling to provide informed consent were excluded.

Data Collection Methods: Following institutional ethical approval and informed consent, demographic characteristics, clinical diagnosis, surgical indication, comorbidities, BMI, hemoglobin level, incision type, blood transfusion, SSI occurrence, and relevant microbiological findings were systematically recorded using a standardized study format.

Procedure: A structured prevention care bundle checklist was implemented. Patients received education regarding hand hygiene, preoperative bathing, and postoperative wound care. Preoperative measures included bathing, appropriate hair clipping, incision-site preparation and vaginal douching using 7.5% povidone-iodine, and antimicrobial prophylaxis one hour before surgery. Intraoperatively, normothermia and oxygen supplementation were maintained. Postoperative dressing was removed after 72 hours. Patients were examined daily during hospitalization and reassessed at 30 days after surgery. Any SSI was documented along with wound management, antibiotic modification, resuturing, culture and sensitivity findings, and associated complications.

Data Analysis: All collected data were entered, organized, and analyzed using Microsoft Excel and SPSS. Descriptive findings were expressed as frequencies, percentages, means, and standard deviations where appropriate. Comparative statistical tests, including the Chi-square test and independent t-test, were applied according to variable type, with $p < 0.05$ considered statistically significant.

Observations & Results:

Demographic and Clinical Characteristics

Table 1: Association between Prevention Care Bundle and Surgical Site Infection (n = 300)

SSI Status	Bundle Care (n=300)	Non-Bundle Care (n=300)	p-value
SSI Present	21 (7.00%)	41 (13.67%)	**0.016***
SSI Absent	279 (93.00%)	259 (86.33%)	
Total	**300 (100%)**	**300 (100%)**	

Statistically Significant at p < 0.05

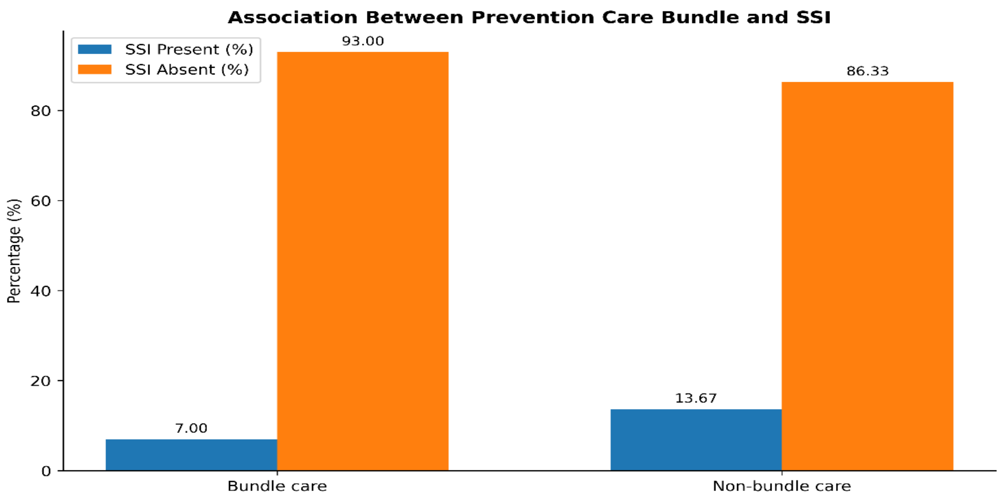

Figure 1: Association between prevention care

Interpretation: The occurrence of surgical site infection was substantially lower following implementation of the prevention care bundle, declining from 13.67% in the non-bundle group to 7.00% in the bundle group. The difference was statistically significant (p=0.016). Correspondingly, 93.00% of bundle-care patients remained free from SSI compared with 86.33% without bundle care. These findings strongly support structured perioperative bundle implementation for improving infection prevention and postoperative surgical outcomes.

Table 2: SSI Incidence According to Age Group and Bundle Care Compliance (n = 300)

Age Group	Non-Bundle: Total	Non-Bundle: SSI	Bundle: Total	Bundle: SSI	p-value
≤24 years	6	0	5	1	**0.02***
25–30 years	23	0	32	1	
31–35 years	26	3	34	1	
>35 years	245	38	229	18	
Total	**300**	**41**	**300**	**21**	

Statistically Significant at p < 0.05

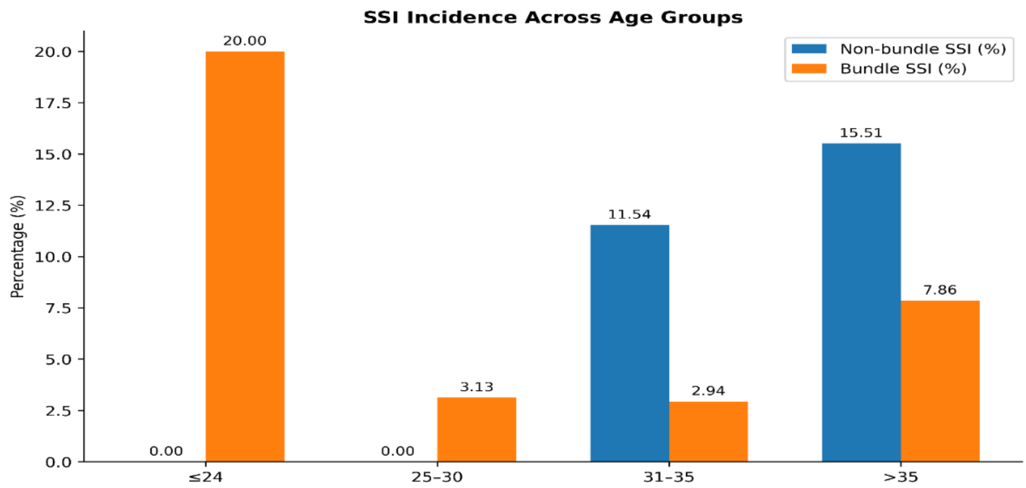

Figure 2: SSI incidence across age groups

Interpretation: SSI burden was concentrated predominantly among women older than 35 years. Within this age category, infection occurred in 38 of 245 non-bundle patients compared with 18 of 229 bundle-care patients, demonstrating a clinically meaningful reduction following bundle implementation. The age-group association was statistically significant (p=0.02). The findings indicate that standardized preventive care is particularly valuable among older surgical patients, who may have greater baseline susceptibility to postoperative wound infection.

Table 3: Effect of Bundle Care on SSI According to Co-morbidity Status (n = 300)

Bundle Care	Co-morbidity	Total	No SSI	SSI Present	p-value
No	Not present	167	156	11	**0.016***
No	Present	133	103	30	
Yes	Not present	169	161	8	
Yes	Present	131	118	13	
Total		**600**	**538**	**62**	

Statistically Significant at p < 0.05

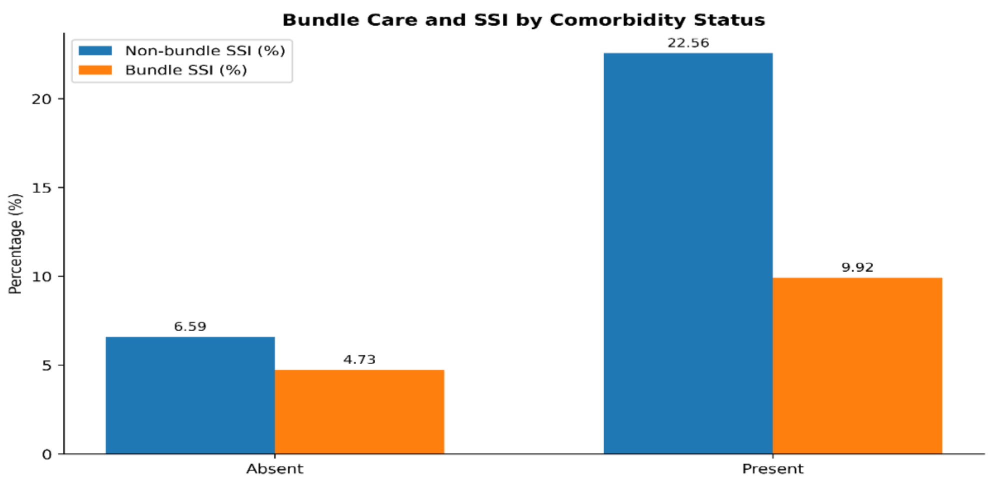

Figure 3: Bundle care and SSI by comorbidity status

Interpretation: Pre-existing co-morbidities were associated with a greater burden of postoperative SSI, particularly without prevention bundle implementation. Among patients with co-morbidities, 30 infections occurred in the non-bundle group compared with only 13 among bundle-care recipients. The association was highly statistically significant (p<0.001). This substantial reduction demonstrates that structured perioperative infection-prevention practices may provide particular benefit to clinically vulnerable patients and supports rigorous bundle adherence in women with underlying medical conditions.

Table 4: Impact of Prevention Care Bundle on SSI among Patients with Diabetes Mellitus (n = 300)

Bundle Care	Diabetic Patients	No SSI	SSI Present	SSI among diabetic subgroup	p-value
Yes	39	36	3	7.69%	0.00007
No	30	15	15	50.00%	
Total	**69**	**51**	**18**	—	

Statistically Significant at p < 0.05

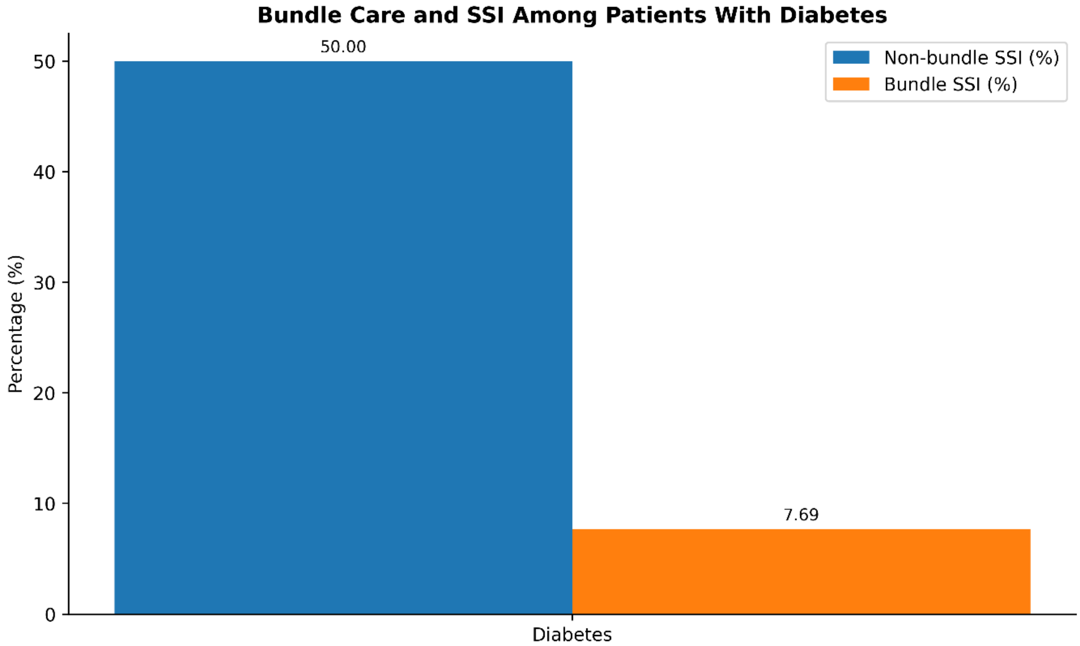

Figure 4: Bundle care and SSI among patients with diabetes

Interpretation: The protective association of bundle care was especially pronounced among diabetic patients. Only 3 of 39 diabetic women receiving bundle care developed SSI, compared with 15 of 30 diabetic women without bundle care. Thus, the within-group SSI incidence was approximately 7.69% versus 50.00%, respectively. The highly significant association (p=0.00007) emphasizes the clinical importance of meticulous perioperative infection-prevention protocols among diabetic patients, who represent an important high-risk surgical subgroup.

Table 5: Influence of Bundle Care on SSI According to Type of Surgical Incision (n = 300)

Bundle Care	Incision Type	No SSI	SSI Present	Total	p-value
No	Transverse	246	39	285	0.009*
No	Vertical	13	2	15	
Yes	Transverse	264	17	281	
Yes	Vertical	15	4	19	
Total		**538**	**62**	**600**	

Statistically Significant at p < 0.05

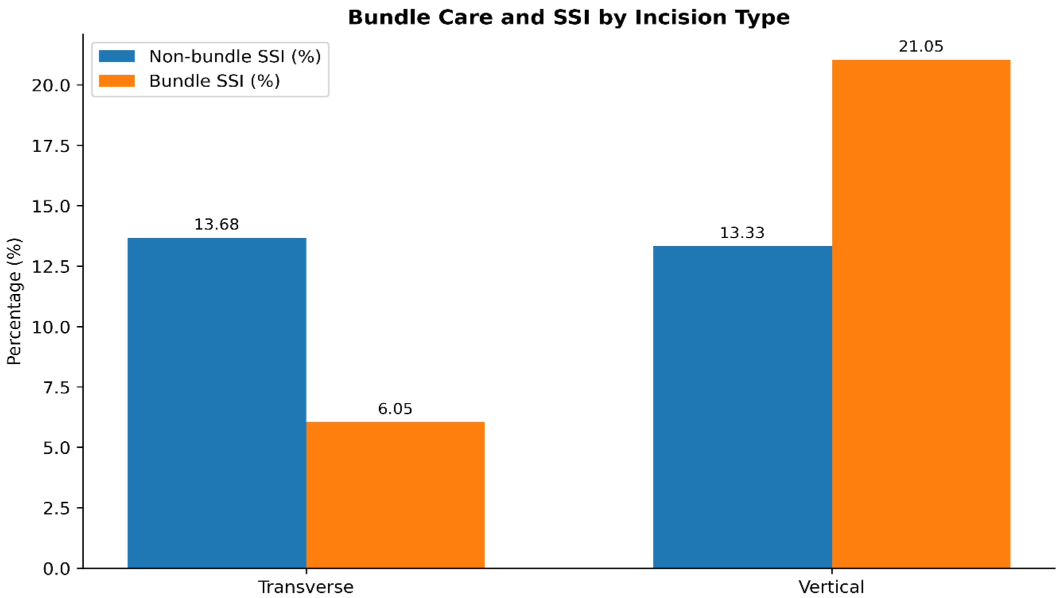

Figure 5: Bundle care and SSI by incision type

Interpretation: A marked reduction in SSI was evident among patients with transverse incisions following bundle implementation. SSI occurred in 39 of 285 transverse-incision patients without bundle care compared with 17 of 281 receiving bundle care. The overall association between incision type, bundle compliance, and SSI was statistically significant (p=0.009). These results suggest that consistent application of the prevention care bundle can substantially strengthen infection control, particularly in the more frequently employed transverse surgical approach.

Discussion

The present study evaluated the effectiveness of a structured prevention care bundle in reducing surgical site infections (SSIs) among women undergoing elective gynecological surgery. A significant reduction in overall SSI incidence was observed following bundle implementation, from 13.67% in the non-bundle group to 7.00% in the bundle group (p=0.016). This finding supports the principle that SSI prevention is most effective when multiple evidence-based perioperative measures are applied consistently rather than as isolated interventions. Anderson et al. emphasized coordinated practices involving antimicrobial prophylaxis, skin preparation, asepsis, perioperative optimization, and surveillance as essential elements of SSI prevention. [27]

Age appeared to modify infection risk, with women older than 35 years accounting for the largest proportion of SSI cases. Importantly, infection frequency in this age group was lower following bundle implementation, suggesting that structured preventive measures may partially offset age-related vulnerability. Advancing age, impaired tissue perfusion, altered inflammatory responses, and delayed cellular repair may adversely influence postoperative healing. [28-32]

The beneficial effect of bundle care was particularly evident among women with co-morbidities. SSI occurred in 30 patients with co-morbidities without bundle care compared with 13 receiving bundle care, demonstrating a statistically significant association. Diabetes demonstrated an even stronger relationship: only 3 of 39 diabetic women receiving bundle care developed SSI compared with 15 of 30 without bundle implementation. Hyperglycemia, impaired microvascular circulation, altered leukocyte function, and delayed collagen synthesis may collectively increase infection susceptibility and compromise wound repair. [29-32] Nutritional status and tissue oxygenation are also critical determinants of wound healing. Adequate protein and caloric availability support collagen synthesis, immune competence, angiogenesis, and tissue regeneration; deficiencies may therefore increase postoperative wound complications. [33] These mechanisms provide biological support for optimizing modifiable patient factors alongside SSI prevention protocols.

Incision type also influenced outcomes. Among transverse incisions, SSI occurred in 39 of 285 patients without bundle care compared with 17 of 281 receiving bundle care. This reduction reinforces the importance of meticulous surgical technique, aseptic practice, antimicrobial prophylaxis, wound surveillance, and coordinated perioperative care. [30,34] Overall, the findings demonstrate that prevention care bundles offer a practical and clinically effective strategy for reducing SSI burden, especially among high-risk gynecological surgical patients.

Implications for Clinical Practice: The findings support routine integration of a structured prevention care bundle into perioperative protocols for elective gynecological surgery. The observed reduction in SSI from 13.67% to 7.00% indicates meaningful potential for improving postoperative safety. Standardized antimicrobial prophylaxis, skin preparation, glycemic optimization, maintenance of normothermia, aseptic practices, and systematic wound surveillance should be consistently reinforced. Particular attention to patients with diabetes, comorbidities, anemia, obesity, and other risk factors may further reduce preventable infections and promote safer recovery.

Limitations: The study was conducted at a single tertiary-care institution, which may limit the broader generalizability of its findings. The observational design and comparison with historical baseline data may introduce temporal and unmeasured confounding factors. Additionally, the study primarily included elective surgeries for benign gynecological conditions, limiting applicability to emergency, malignant, laparoscopic, or vaginal procedures. Nevertheless, the findings provide clinically valuable evidence supporting standardized prevention care bundle implementation for reducing surgical site infections.

Conclusion

The present study demonstrates that implementation of a structured prevention care bundle can substantially improve infection-control outcomes following elective gynecological surgery. Surgical site infection decreased significantly from 13.67% without bundle care to 7.00% following bundle implementation (p=0.016). The benefit was particularly evident among patients with diabetes and other comorbidities, highlighting its relevance in higher-risk groups. Consistent application of standardized preoperative, intraoperative, and postoperative measures provides a practical approach to minimizing preventable infections. Incorporating such bundles into routine gynecological surgical practice may enhance patient safety, promote uncomplicated wound healing, strengthen perioperative quality standards, and improve overall postoperative recovery.

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