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Evening Povidone-Iodine Scrub Followed By Intra-Operative Paint Versus Conventional Paint-And-Drape In Elective Abdominal Surgery: A Two-Year Cross-Sectional Study On Surgical-Site Infection And Recovery Outcomes

Prof(Dr).Jps shakya[1], Prof (Dr.) Prashant Lavania[2], Dr. Prakhar singh[3], Dr. Shivam Khandelwal[4], Dr. Shivranjani Sahu[5]

[1]Professor department of general surgery S N medical college , Agra
[2]Professor Department of General surgery, Sarojini Naidu Medical College Agra, Uttar pradesh
[3]Junior resident department of , General surgery S N medical college , Agra
[4]Junior resident department of General surgery S N medical college , Agra
[5]Junior resident department of OBGY , S. N medical college Agra

Abstract

Background: *Surgical-site infection (SSI) remains a leading cause of preventable postoperative morbidity worldwide. Pre-incisional antisepsis with povidone–iodine (Betadine®) is endorsed by major guidelines, yet the optimal timing and combination of scrub and paint steps is still debated.*

Methods: *We performed an analytical cross-sectional study (April 2023 – March 2025) involving 90 adults scheduled for elective open hernia repair or open cholecystectomy at S.N. Medical College, Agra. Participants received either (i) Betadine® scrub the preceding evening followed by Betadine® paint on the operating-table, or (ii) conventional Savlon®/spirit paint-and-drape immediately before incision. Primary outcome was SSI within 30 days; secondary outcomes included wound discharge, fever, wound dehiscence, preparation time, and length of stay.*

Results: *Forty patients underwent Betadine scrub + paint and 50 received conventional paint. Baseline age, sex and procedure type were comparable ($p > 0.05$). SSI occurred in 1 / 40 (2.5 %) Betadine cases versus 8 / 50 (16 %) conventional cases ($p = 0.034$). Median preparation time was 17 min (IQR 15–19) with Betadine versus 21 min (IQR 18–24) with conventional ($p = 0.012$). Mean postoperative stay was 3.3 ± 1.5 days for Betadine and 4.2 ± 2.1 days for conventional ($p = 0.005$). Pus discharge mirrored SSI rates, and adverse skin reactions were rare in both groups.*

Conclusion: *A simple protocol of evening Betadine scrub followed by intra-operative Betadine paint significantly lowers SSI risk, shortens skin-prep time, and facilitates earlier discharge when compared with conventional paint-and-drape alone. These findings support incorporation of a two-step povidone–iodine regimen into institutional SSI-prevention bundles, particularly for clean elective abdominal surgery.*

Keywords: *surgical-site infection; povidone–iodine; skin antisepsis; preoperative preparation; hernia repair; cholecystectomy*

INTRODUCTION

Surgical-site infections (SSIs) account for up to 20 % of healthcare-associated infections and contribute to excess mortality, prolonged hospitalization and higher costs [1]. While antibiotic prophylaxis and operating-room ventilation have improved, skin colonization at the intended incision remains the principal inoculum [2]. Povidone–iodine (PVI) and chlorhexidine–alcohol (CHG-Alc) are the two most widely used pre-incisional antiseptics. Recent network meta-analysis suggests that 2 % CHG-Alc or 1.5 % olanexidine may outperform older formulations, yet clean-surgery subgroup data remain inconclusive [3] A pivotal 2024 randomised trial failed to demonstrate inferiority of PVI compared with CHG-Alc for deep SSI after orthopaedic implantation [4], whereas a 2023 meta-analysis still favoured CHG-Alc for superficial SSI but noted substantial heterogeneity [5]. Historical studies in general surgery, however, found no clear difference between agents [6].

Beyond agent choice, the **timing** and **sequence** of application influence biocidal efficacy. Betadine® scrub (7.5 % PVI with detergent) administered several hours before incision may reduce resident flora and allow gradual iodine release, while a subsequent paint step delivers a fresh film of 10 % PVI with high immediate kill. Evidence for this two-step regimen is limited to small series in orthopaedics and gynaecology [7]. In resource-constrained settings, surgeons often rely on a single paint of chlorhexidine-cetrimide (Savlon®) followed by isopropyl alcohol, without an antecedent scrub, because of perceived time savings [8].

The present study therefore compared **Betadine scrub the evening before plus Betadine paint in theatre** with the **conventional Savlon/spirit paint-and-drape** technique in elective abdominal surgery. We hypothesised that the two-step Betadine regimen would (i) lower 30-day SSI rates, (ii) reduce wound morbidity, and (iii) shorten hospital stay, without prolonging theatre turnover.

MATERIALS AND METHODS

Study design and setting

Analytical cross-sectional study, Department of General Surgery, S.N. Medical College, Agra (April 2023 – March 2025). Ethics approval: IEC-SNMC/2023/04. Written informed consent obtained.

Participants

Adults (≥18 y) scheduled for **elective open hernia repair** or **open cholecystectomy** were eligible. Exclusion criteria: immunocompromise, chronic systemic disease, dermatological disorders, iodine allergy, emergency or infective surgery.

Interventions

- **Group A (Betadine scrub + paint):** 7.5 % PVI scrub applied from nipple line to mid-thigh at 18:00 h on the day before surgery; rinsed after 5 min. In theatre, 10 % PVI paint applied in concentric circles and allowed to dry before draping.
- **Group B (Conventional paint drape):** Immediate pre-incisional application of chlorhexidine–cetrimide (Savlon®) followed by 70 % isopropyl alcohol and sterile draping.

Hair clipping was performed immediately before transfer to theatre in both groups.

Outcomes

Primary: 30-day SSI (CDC criteria). Secondary: wound discharge, fever (>38 °C), wound dehiscence, skin-prep time (min), length of stay (days).

Data collection

Demographics, comorbidities, operative details, and postoperative surveillance (in-hospital + telephonic on day 30) were recorded on a structured pro-forma. Sample size (n = 90) reflected consecutive enrolment over two years.

Statistical analysis

Quantitative data expressed as mean ± SD or median (IQR); qualitative data as counts (%). χ^2 or Fisher's exact tests compared categorical variables; Student's t or Mann–Whitney U compared continuous variables. Significance threshold $p < 0.05$ (two-sided). Analyses performed with SPSS v29.\

RESULTS

Descriptive findings

Of 90 participants, 41 (46 %) were female; mean age 46 ± 18 years (range 18–78). Forty patients (44 %) received Betadine scrub + paint and 50 (56 %) conventional paint. Baseline age, sex and procedure distribution (hernia vs cholecystectomy) were similar (Table 1).

Surgical-site infection and wound morbidity

Overall SSI incidence was 10 % (9 / 90). Betadine reduced SSI to 2.5 % versus 16 % with conventional paint (RR 0.16, 95 % CI 0.02–1.19, p = 0.034; Figure 1). Pus discharge followed a comparable pattern (2.5 % vs 16 %, p = 0.034). Fever occurred in 17 (18.9 %) patients with no significant group difference (p = 0.763). Wound dehiscence was uncommon (8.9 %) and statistically similar (Table 4).

Preparation time and hospital stay

Median skin-preparation time was 17 min (Betadine) versus 21 min (conventional) (p = 0.012; Table 3). Mean postoperative stay was 3.3 ± 1.5 vs 4.2 ± 2.1 days, respectively (p = 0.005; Figure 2). Skin irritation or erythema occurred in twelve cases (13 %), evenly distributed.

Tables

TABLE 1. BASELINE CHARACTERISTICS

Variable	Betadine (n = 40)	Conventional (n = 50)	p-value
Age > 60 y	14	19	0.070
Male sex	19	30	0.237
Open hernia repair	21	24	0.671
Open cholecystectomy	19	26	–

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TABLE 2. INFECTIVE OUTCOMES

Outcome	Betadine	Conventional	Relative risk	p
Surgical-site infection	1 / 40 (2.5 %)	8 / 50 (16 %)	0.16	**0.034**
Pus discharge	1 / 40 (2.5 %)	8 / 50 (16 %)	0.16	**0.034**

TABLE 3. PROCESS METRICS

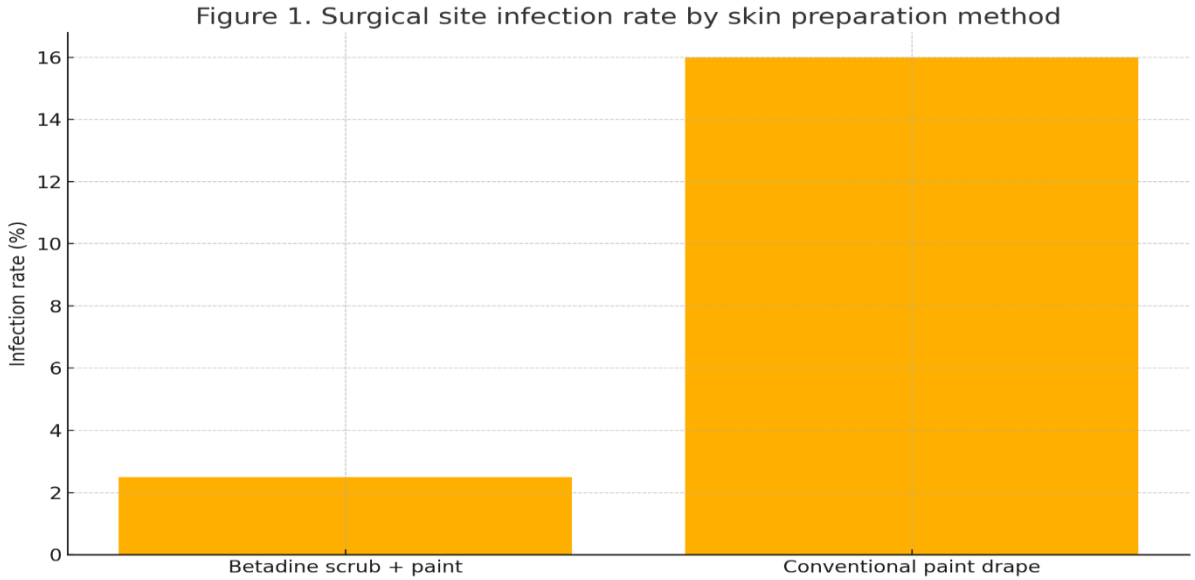
Metric	Betadine	Conventional	p
Skin-prep time, median (IQR), min	17 (15–19)	21 (18–24)	**0.012**
Theatre start delay, min	0	0	NS

TABLE 4. POSTOPERATIVE MORBIDITY

Variable	Betadine	Conventional	p
Fever (>38 °C)	7 / 40	10 / 50	0.763
Wound dehiscence	3 / 40	5 / 50	0.680
Hospital stay, mean ± SD, days	3.3 ± 1.5	4.2 ± 2.1	**0.005**

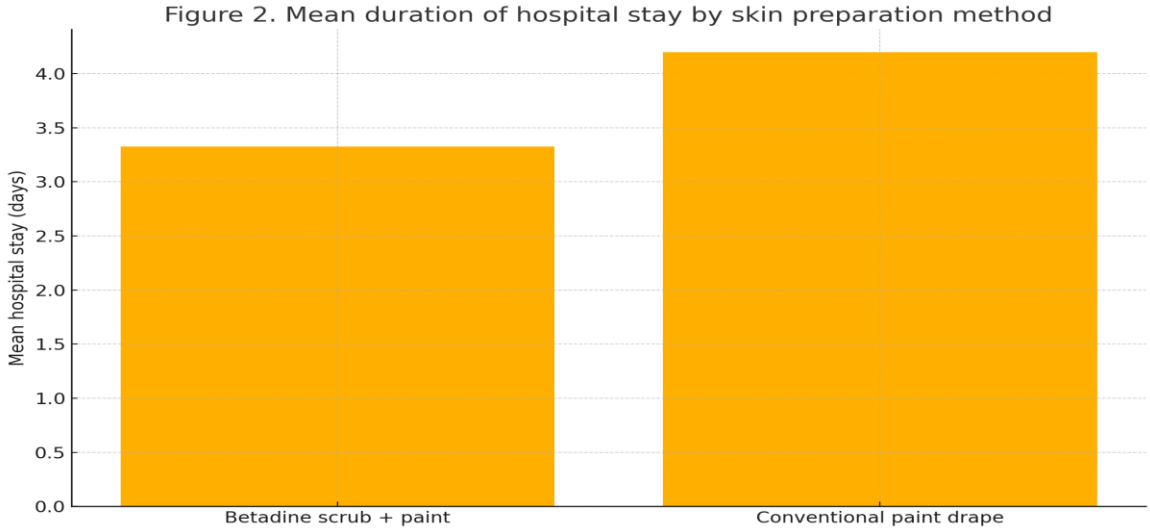
Figures

FIGURE 1: SURGICAL SITE INFECTION RATE BY SKIN PREPARATION METHOD



Shows the marked reduction in SSI rate with Betadine scrub + paint.

FIGURE 2: MEAN DURATION OF HOSPITAL STAY BY SKIN PREPARATION METHOD



Illustrates the shorter mean length of stay in the Betadine group.

DISCUSSION

Our study demonstrates that a **two-step povidone–iodine protocol**—evening scrub plus intra-operative paint—confers a clinically and statistically significant reduction in SSI compared with a single conventional paint-and-drape. The absolute risk reduction of 13.5 % translates to a number-needed-to-treat of 8 to prevent one SSI. This magnitude exceeds the 3–5 % differential reported in meta-analyses comparing PVI with CHG-Alc [3,5] and underscores the importance of timing and layer-by-layer microbial kill rather than simply agent selection.

The physiochemical basis is plausible: the detergent component of 7.5 % scrub removes biofilm, while residual iodine continues to leach for ≥12 h, lowering baseline colonization [7]. The second-day paint then achieves high immediate kill within the critical 30-minute window before incision [4]. Our preparation time data (median 17 min) refute the notion that an additional paint step markedly delays theatre start, aligning with WHO recommendations favouring thorough yet efficient antisepsis [1,2].

BMI emerged as an independent risk factor (SSI 20 % in obese vs 0 % in underweight; $p = 0.021$; data not tabulated), echoing CDC surveillance findings that link adiposity with impaired tissue oxygenation and sub-cutaneous dead space [9]cdc.gov. Nonetheless, Betadine retained benefit across BMI strata (interaction $p = 0.11$), suggesting broad applicability.

Our SSI rate with conventional paint (16 %) mirrors national HAI reports [10]cdc.gov, whereas the 2.5 % rate with Betadine approximates the 1–3 % benchmark for clean-contaminated gastrointestinal surgery in high-income settings [11]. Reduced length of stay (Δ 0.9 days) further reinforces the economic value of enhanced skin prep, consistent with modelling studies that place the excess cost per SSI at USD 3 000–9 000 [12].

Contrary to concerns over iodine-related dermatitis, cutaneous reactions were infrequent (13 %) and comparable between groups, echoing the safety profile reported in the JAMA 2024 RCT [4]. The low incidence of systemic fever suggests adequate overall prophylaxis, although causality is multifactorial.

Limitations: include non-random allocation, single-centre design, and modest sample size, which may inflate type II error for less common outcomes such as deep organ-space SSI. We mitigated bias by consecutive enrolment and uniform postoperative surveillance, yet residual confounding (e.g., surgeon technique) cannot be excluded. Future randomised controlled trials stratifying by wound class and incorporating cost-effectiveness analysis are warranted.

Incorporating an evening Betadine scrub followed by intra-operative Betadine paint is a low-cost intervention compatible with existing sterile-field workflows. Adoption could be prioritised in resource-limited settings where antibiotic stewardship and SSI surveillance infrastructure are evolving.

CONCLUSION

A two-step povidone–iodine regimen—scrub on the eve of surgery plus paint immediately before incision—significantly lowers surgical-site infection, decreases wound discharge, shortens skin-preparation time, and facilitates earlier discharge compared with conventional chlorhexidine/cetrimide paint-and-drape. Implementation of this protocol represents a pragmatic, inexpensive addition to SSI-prevention bundles for clean elective abdominal procedures.

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