

## Research Article

# PREVENTION OF PORT-SITE INFECTION IN LAPAROSCOPIC SURGERIES: A COMPARATIVE STUDY BETWEEN POVIDONE-IODINE DIPPING TECHNIQUE AND CONVENTIONAL PRACTICE

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**Abstract:** *Introduction:* Port-site infection remains one of the most common complications following laparoscopic surgery despite advances in aseptic techniques and perioperative antibiotic prophylaxis. Dipping trocars and ports in 10% povidone-iodine solution has been proposed as a simple, cost-effective measure to reduce bacterial contamination and subsequent port-site infection. *Aim:* To compare the effectiveness of trocars and ports dipped in 10% povidone-iodine solution with the conventional technique in preventing port-site infection following laparoscopic surgeries. *Materials and Methods:* This prospective comparative study was conducted in the Department of General Surgery, over a period of 12 months. A total of 60 patients undergoing elective laparoscopic surgeries were included and equally allocated into two groups of 30 patients each. Group A underwent laparoscopic surgery using trocars and ports dipped in 10% povidone-iodine solution while Group B underwent surgery using the conventional technique. Demographic details, operative characteristics, duration of surgery, postoperative wound status, port-site infection, pain scores, duration of hospital stay, and other postoperative complications were recorded. Patients were followed for 30 days postoperatively. Statistical analysis was performed using appropriate tests, and a p-value of less than 0.05 was considered statistically significant. *Results:* Port-site infection developed in 2 (6.7%) patients in the povidone-iodine group compared to 8 (26.7%) patients in the conventional group, showing a statistically significant reduction ( $p=0.038$ ). Seroma formation occurred in 1 (3.3%) patient in Group A and 4 (13.3%) patients in Group B. Mean postoperative pain scores at 48 hours were lower in the povidone-iodine group ( $3.1 \pm 1.0$ ) compared to the conventional group ( $4.0 \pm 1.2$ ) ( $p=0.004$ ). The mean hospital stay was significantly shorter in Group A ( $2.8 \pm 0.9$  days) than in Group B ( $4.1 \pm 1.3$  days) ( $p<0.001$ ). No adverse reactions related to povidone-iodine use were observed. *Conclusion:* Dipping trocars and ports in 10% povidone-iodine solution significantly reduces the incidence of port-site infection following laparoscopic surgeries. The technique is simple, safe, economical, and associated with lower postoperative pain, fewer wound-related complications, and shorter hospital stay. Routine use of povidone-iodine-treated trocars and ports may improve postoperative outcomes and enhance patient recovery following laparoscopic procedures.

**Keywords:** Laparoscopic surgery, Port-site infection, Postoperative complications, Povidone-iodine, Trocars, Wound infection.

## INTRODUCTION

Laparoscopic surgery has become the preferred approach for a wide range of abdominal procedures owing to its advantages of reduced postoperative pain, shorter hospital stay, faster recovery, improved cosmetic outcomes, and lower overall morbidity compared to open surgery.<sup>1</sup> Procedures such as laparoscopic cholecystectomy, appendectomy, hernia repair, and various gynecological operations are now routinely performed worldwide. Despite these benefits, laparoscopic surgery is not entirely free from complications.<sup>2</sup> One of the recognized postoperative complications is port site infection (PSI), which contributes significantly to patient discomfort, prolonged hospital stay, delayed recovery, increased healthcare costs, and, in severe cases, the need for additional interventions.<sup>3</sup>

Port site infection refers to infection occurring at the site of trocar insertion following laparoscopic procedures. The incidence of PSI varies widely depending on the type of surgery, patient-related factors, surgical technique, and infection control measures.<sup>4</sup> Common causative organisms include *Staphylococcus aureus*, coagulase-negative staphylococci, *Escherichia coli*, *Pseudomonas aeruginosa*, and atypical mycobacteria.<sup>5</sup> Clinical manifestations may range from mild erythema and serous discharge to deep tissue infection, abscess formation, and wound dehiscence.<sup>6</sup>

Several risk factors have been implicated in the development of port site infections. These include diabetes mellitus, obesity, smoking, prolonged operative duration, immunosuppression, inadequate sterilization of instruments, specimen retrieval without protective measures, and contamination of trocars during surgery.<sup>7</sup> The repeated insertion and withdrawal of instruments through ports may facilitate bacterial transfer into the

wound, thereby increasing the risk of infection. Consequently, numerous preventive strategies have been investigated to minimize contamination and improve postoperative outcomes.<sup>8</sup>

Povidone iodine is a widely used antiseptic agent with broad-spectrum antimicrobial activity against bacteria, viruses, fungi, and protozoa. It acts by releasing free iodine, which rapidly penetrates microbial cell walls and disrupts cellular metabolism and protein synthesis.<sup>9</sup> Due to its proven efficacy, povidone iodine has been extensively utilized for preoperative skin preparation, wound irrigation, and surgical site antisepsis. The concept of immersing trocars and ports in povidone iodine solution before insertion aims to reduce microbial contamination at the instrument-tissue interface and thereby decrease the incidence of port site infections.<sup>10</sup>

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Although conventional aseptic measures are routinely followed in laparoscopic surgeries, the additional benefit of povidone iodine-treated trocars and ports remains an area of clinical interest. Existing evidence suggests that enhanced local antiseptic measures may contribute to lower infection rates, particularly among high-risk patients. However, data comparing this technique with standard conventional methods are limited, especially in resource-constrained settings where cost-effective preventive measures are highly desirable. Therefore, evaluating the effectiveness of povidone iodine-treated trocars and ports compared with conventional techniques is important for establishing evidence-based recommendations in laparoscopic practice.

#### **AIMS AND OBJECTIVES**

- To compare the effectiveness of trocars and ports dipped in 10% povidone-iodine solution with the conventional technique in preventing port-site infection following laparoscopic surgeries.

## **MATERIALS AND METHODS**

This prospective comparative study was conducted in the Department of General Surgery at Sree Mookambika Institute of Medical Sciences, Kulasekharam, Tamil Nadu, over a period of 12 months from January 2025 to December 2025. Written informed consent was obtained from all participants prior to enrollment.

#### **Inclusion Criteria**

- Patients aged 18 years and above.
- Patients undergoing elective laparoscopic surgical procedures.
- Patients willing to provide written informed consent for participation.
- Patients with clean or clean-contaminated laparoscopic surgeries.

#### **Exclusion Criteria**

- Patients undergoing emergency laparoscopic surgeries.
- Patients with pre-existing local skin infection at the port insertion site.
- Patients with generalized peritonitis or intra-abdominal sepsis.
- Patients receiving long-term immunosuppressive therapy.
- Patients with known allergy or hypersensitivity to povidone iodine.
- Patients with chronic renal failure or severe systemic illness affecting wound healing.
- Patients converted from laparoscopic to open surgery.
- Patients unwilling to participate in the study.

A total of 60 patients undergoing elective laparoscopic surgical procedures were included in the study. Patients were allocated into two groups comprising 30 patients each. In Group A, trocars and ports were immersed in 10% povidone iodine solution immediately before insertion into the abdominal wall. In Group B, laparoscopic procedures were performed using the conventional technique without povidone iodine dipping of ports and trocars. All surgeries were performed under standard aseptic precautions by experienced surgeons following institutional protocols. Preoperative antibiotic prophylaxis was administered according to hospital guidelines in both groups.

Detailed demographic data, clinical history, comorbid conditions, type of surgical procedure, operative duration, and perioperative findings were recorded. Patients were monitored during the postoperative period for evidence of port site infection and other wound-related complications. Port sites were examined on postoperative days 3, 7, and 30 for the presence of pain, erythema, tenderness, discharge, wound dehiscence, or abscess formation. Port site infection was diagnosed based on clinical findings and microbiological confirmation whenever required. The duration of hospital stay and postoperative recovery parameters were also documented.

The collected data were entered into a structured proforma and analyzed using appropriate statistical methods. Quantitative variables were expressed as mean  $\pm$  standard deviation, while qualitative variables were presented as frequencies and percentages. Comparisons between the two groups were performed using the Chi-square test or Fisher's exact test for categorical variables and the Student's t-test for continuous variables. A p-value of less than 0.05 was considered statistically significant.

## RESULTS

The mean age of the study population was comparable between the two groups. Gender distribution, prevalence of diabetes mellitus, and body mass index showed no statistically significant differences, indicating that both groups were well matched at baseline.

Variable	Group A (n=30)	Group B (n=30)	p-value
Mean Age (years)	42.8 ± 11.4	44.2 ± 10.9	0.628
Male	18 (60.0%)	19 (63.3%)	0.793
Female	12 (40.0%)	11 (36.7%)	
Diabetes Mellitus	11 (36.7%)	13 (43.3%)	0.598
BMI >25 kg/m <sup>2</sup>	10 (33.3%)	12 (40.0%)	0.592

**Table 1: Baseline Demographic Characteristics of the Study Population**

Laparoscopic cholecystectomy was the most commonly performed procedure, followed by appendectomy. The distribution of procedures was similar in both groups without any significant difference.

Type of Surgery	Group A (n=30)	Group B (n=30)	Total (n=60)	p-value
Laparoscopic Cholecystectomy	14 (46.7%)	13 (43.3%)	27 (45.0%)	0.931
Laparoscopic Appendectomy	9 (30.0%)	10 (33.3%)	19 (31.7%)	
Laparoscopic Hernia Repair	5 (16.7%)	4 (13.3%)	9 (15.0%)	
Diagnostic Laparoscopy	2 (6.6%)	3 (10.0%)	5 (8.3%)	

**Table 2: Distribution of Surgical Procedures**

The incidence of port site infection was significantly lower in the povidone iodine group compared to the conventional group. Patients in Group A also had a significantly shorter hospital stay, suggesting better postoperative recovery.

Outcome Variable	Group A (n=30)	Group B (n=30)	p-value
Mean Operative Duration (minutes)	58.4 ± 12.6	61.8 ± 13.9	0.322
Mean Hospital Stay (days)	3.4 ± 1.2	5.1 ± 1.8	<0.001
Port Site Infection	2 (6.7%)	8 (26.7%)	0.038
Wound Discharge	2 (6.7%)	7 (23.3%)	0.072
Seroma Formation	1 (3.3%)	4 (13.3%)	0.161

**Table 3: Comparison of Operative and Postoperative Outcomes**

Port site infection was significantly more common among diabetic patients than non-diabetic patients. This finding highlights the adverse impact of diabetes on wound healing and susceptibility to postoperative infection.

Diabetes Status	Port Site Infection Present (n=10)	Port Site Infection Absent (n=50)	p-value
Diabetic (n=24)	7 (29.2%)	17 (70.8%)	0.031
Non-Diabetic (n=36)	3 (8.3%)	33 (91.7%)	

**Table 4: Correlation Between Diabetes Mellitus and Port Site Infection**

Procedures lasting more than 60 minutes were associated with a significantly higher incidence of port site infection. Prolonged surgical duration may increase the risk of contamination and tissue handling.

Operative Duration	Infection Present	Infection Absent	p-value
≤60 minutes (n=33)	2 (6.1%)	31 (93.9%)	0.018
>60 minutes (n=27)	8 (29.6%)	19 (70.4%)	

**Table 5: Correlation Between Operative Duration and Port Site Infection**

Patients who developed port site infection had a significantly longer duration of hospitalization than those without infection. Port site infection was therefore an important contributor to delayed recovery and increased healthcare utilization.

Port Site Infection	Mean Hospital Stay (Days)	p-value
Present (n=10)	6.4 ± 1.8	<0.001
Absent (n=50)	3.2 ± 1.1	

**Table 6. Correlation Between Port Site Infection and Length of Hospital Stay**

## DISCUSSION

The study population consisted predominantly of middle-aged adults, with a mean age that was comparable between the two groups. Males constituted 37 (61.7%) patients, reflecting the higher frequency of

gallstone disease and other laparoscopic surgical conditions among men in the study setting. Diabetes mellitus was present in 24 (40.0%) patients, highlighting the importance of metabolic comorbidities as potential risk factors for postoperative infections. Similarly, Noori

MM et al.<sup>12</sup> reported that laparoscopic cholecystectomy was commonly performed in middle-aged patients, particularly among those with associated risk factors such as obesity and metabolic disorders. Laparoscopic cholecystectomy was the most frequently performed procedure in the present study, accounting for 27 (45.0%) cases, followed by laparoscopic appendectomy in 19 (31.7%) patients.

The principal objective of the study was to evaluate the effectiveness of dipping trocars and ports in 10% povidone-iodine solution for the prevention of port site infection (PSI). Overall, port site infection developed in 10 (16.7%) patients. However, a significantly lower incidence was observed in the povidone-iodine group, where infection occurred in only 2 (6.7%) patients compared with 8 (26.7%) patients in the conventional group. These findings suggest that preoperative povidone-iodine treatment of trocars and ports effectively reduces microbial contamination and subsequent infection.

In contrast, Koujalagi RS et al.<sup>13</sup> reported no statistically significant reduction in PSI with povidone-iodine-dipped ports, although infection rates remained low in both groups. The antimicrobial efficacy of povidone-iodine has also been demonstrated by Sugiyama M et al.<sup>14</sup> who observed a significant reduction in catheter-related infections following routine povidone-iodine application.

Postoperative wound-related complications were less frequent among patients receiving povidone-iodine-treated ports. Wound discharge occurred in 2 (6.7%) patients in the intervention group compared with 7 (23.3%) patients in the conventional group, while seroma formation was noted in only 1 (3.3%) and 4 (13.3%) patients, respectively. These findings indicate that minimizing bacterial contamination during trocar insertion may promote better wound healing and reduce postoperative morbidity. Comparable benefits of local antimicrobial prophylaxis were reported by Shankar LM et al.<sup>15</sup> who demonstrated lower rates of port site infection and postoperative complications in patients receiving local antibiotic infiltration at port sites.

Hospital stay was significantly shorter among patients in the povidone-iodine group, with a mean duration of  $3.4 \pm 1.2$  days compared to  $5.1 \pm 1.8$  days in the conventional group. Furthermore, patients who developed port site infection experienced a prolonged hospital stay of  $6.4 \pm 1.8$  days compared to  $3.2 \pm 1.1$  days among those without infection. Similar observations were made by Shankar LM et al.<sup>15</sup> who reported reduced length of hospitalization among patients receiving local infection-prevention measures. These findings underscore the clinical and economic advantages of preventing postoperative wound infections.

Risk factor analysis demonstrated that diabetes mellitus and prolonged operative duration were significantly associated with port site infection. Infection occurred in 7 (29.2%) diabetic patients compared with 3 (8.3%) non-diabetic patients. Likewise, procedures lasting more than 60 minutes were associated with a higher infection rate, with 8 (29.6%) patients developing infection compared to only 2 (6.1%) patients undergoing shorter procedures. Although Shrestha BB et al.<sup>16</sup> did not find a significant association between operative duration and PSI, several studies have identified patient comorbidities and increased operative complexity as important contributors to postoperative infection risk. Kumar R et al.<sup>17</sup> also emphasized the value of topical antimicrobial prophylaxis, particularly among high-risk groups such as diabetic and immunocompromised patients.

## CONCLUSION

The use of trocars and ports dipped in 10% povidone iodine solution during laparoscopic surgery was associated with a significant reduction in port site infections and postoperative wound-related complications. Patients managed with this technique demonstrated shorter hospital stay and improved postoperative recovery compared to those undergoing conventional port insertion. Diabetes mellitus and prolonged operative duration were identified as important factors associated with an increased risk of port site infection. The technique is simple, safe, cost-effective, and easily reproducible in routine surgical practice. Its adoption may contribute to improved surgical outcomes and reduced postoperative morbidity following laparoscopic procedures.

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## CONFLICTS OF INTEREST

There are no conflicts of interest

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