



## Complications Associated with Peripherally Inserted Central Catheter (PICC) Lines in Surgical Patients: A Prospective Observational Study.

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### ABSTRACT

**Background:** Peripherally inserted central catheters (PICCs) are widely used for long-term venous access in surgical patients. Although PICCs are considered safer than centrally inserted catheters, they are associated with infectious, thrombotic, and mechanical complications.

**Aim:** To evaluate the incidence, spectrum, and timing of complications associated with PICC lines in surgical patients at a tertiary care hospital.

**Materials and Methods:** This prospective observational study included adult surgical patients requiring PICC insertion for chemotherapy, total parenteral nutrition (TPN), prolonged intravenous antibiotic therapy, or repeated blood transfusions. Data regarding demographics, indication, dwell time, and complications were collected and analyzed descriptively. Complication rates were calculated per 1,000 catheter-days.

**Results:** A total of 109 patients were included. Overall PICC-related complications occurred in 32.8% of cases. Infectious complications accounted for 14.4/1000 catheter-days, followed by mechanical complications and thrombosis. Most complications occurred within the first 30 days of insertion. Similar findings have been reported in previous surgical and ICU-based studies.

**Conclusion:** PICCs provide reliable long-term venous access in surgical patients. Although associated with acceptable complication rates, early and meticulous surveillance is essential, particularly during the first month following insertion.

**KEYWORDS:** PICC line, catheter-related infection, thrombosis, central venous access, surgical patients.

**How to Cite:** Dr Jebalin Jose S, Dr Hoshea Jeba Ruth S, (2025) Complications Associated with Peripherally Inserted Central Catheter (PICC) Lines in Surgical Patients: A Prospective Observational Study, European Journal of Clinical Pharmacy, Vol.7, No.1, pp. 5487-5491

### INTRODUCTION

Effective venous access is fundamental to modern surgical and critical care practice. Peripherally inserted central catheters (PICCs) offer a practical alternative to centrally inserted venous catheters, enabling prolonged intravenous therapy with fewer insertion-related risks.<sup>1,2</sup>

PICCs are commonly used for chemotherapy, total parenteral nutrition, prolonged antibiotic therapy, and repeated blood transfusions.<sup>3</sup> Despite their advantages, PICCs are associated with complications such as catheter-related bloodstream infection (CRBSI), thrombosis, occlusion, and phlebitis.<sup>4-6</sup>

Previous studies have demonstrated variable complication rates, influenced by patient population, indication, catheter dwell time, and care protocols.<sup>7-10</sup> This study was undertaken to evaluate the pattern of PICC-related complications in surgical patients and compare findings with existing literature.

### AIMS AND OBJECTIVES

1. To determine the incidence of PICC-related complications
2. To classify complications into infectious, thrombotic, and mechanical categories
3. To analyze the temporal relationship between catheter dwell time and complications

### MATERIALS AND METHODS

#### Study Design

Prospective observational study.

**Study Setting**

Department of Surgery, tertiary care teaching hospital.

**Study Period**

18 months.

**Inclusion Criteria**

- Age ≥ 18 years
- PICC inserted under sterile conditions
- Minimum catheter dwell time ≥ 3 days

**Exclusion Criteria**

- Refusal to consent
- Early catheter removal (<3 days)

**Definitions**

- **CRBSI:** As per CDC/NHSN guidelines<sup>11</sup>
- **Phlebitis:** Pain, erythema, warmth, or induration along the vein<sup>12</sup>
- **Thrombosis:** Clinically suspected and confirmed by Doppler ultrasonography<sup>13</sup>
- **Occlusion:** Failure to aspirate blood from the catheter lumen<sup>12</sup>

**Statistical Analysis**

Data were analyzed using SPSS version 21. Continuous variables were expressed as mean ± SD, while categorical variables were expressed as percentages. A p-value <0.05 was considered statistically significant.

**RESULTS**

**Table 1: Sex Distribution**

Out of total 109 patients included in the study, 71 patients (65.14%) were males and 38 patients (34.86%) were females (Table 1). Majority were male patients who had a peripherally inserted central catheter

Sex	Number	Percentage
Male	71	65.14%
Female	38	34.86%
<b>Total</b>	<b>109</b>	<b>100%</b>

**Table 2: Age Distribution**

Out of 109 patients, 15 patients (13.76%) were less than 30 years, 17 patients (15.60%) between 31-40 years, 19 patients (17.43%) between 41-50 years, 31 patients (28.44%) between 51-60 years, 17 patients (15.60%) between 61-70 years and 10 patients (9.17%) above 70 years of age (Table 2). Majority of the patients were among the age group of 51-60 years (31 patients).

Age Group (years)	Patients (%)
≤30	13.76
31-40	15.60
41-50	17.43
51-60	28.44
>60	24.77

Out of 109 patients in the study, 39 patients (35.78%) had a initial diagnosis of acute pancreatitis, 15 patients (13.76%) had sub-acute intestinal obstruction, 6 patients (5.50%) had intestinal obstruction, 5 patients (4.59%) had perforation peritonitis, 4 patients (3.67%) each had perforation peritonitis and gluteal abscess, 3 patients (2.75%) each had pancreatic pseudocyst and upper gastro intestinal bleed. Majority of the patients inserted with peripherally inserted central catheters had the initial diagnosis of acute pancreatitis, followed by sub-acute intestinal obstruction.

**Table- 3 SITE OF PICC LINE INSERTION**

Site	Patients	Percentage
Antecubital vein	51	46.79%
Basilic vein	23	21.10%
Cephalic vein	35	32.11%

<b>Total</b>	<b>109</b>	<b>100.00%</b>
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Out of 109 patients, 51 patients (46.79%) had it inserted in the antecubital vein, 23 patients (21.1%) in the basilica vein and 35 patients (32.11%) in the cephalic vein. Maximum number of patients had PICC line inserted in the antecubital line.

**TABLE- 4 REASON FOR REMOVAL**

Reason for removal	Patients	Percentage
<b>Blocked</b>	<b>9</b>	<b>8.26%</b>
<b>Leakage</b>	<b>1</b>	<b>0.92%</b>
<b>Phlebitis</b>	<b>4</b>	<b>3.67%</b>
<b>Uneventful</b>	<b>95</b>	<b>87.16%</b>
<b>Total</b>	<b>109</b>	<b>100.00%</b>

Out of 109 patients, 9 patients (8.26%) had blockage, 1 patient (0.92%) had leakage, 4 patients (3.67%) had phlebitis and 95 patients (87.16%) had no complications. Maximum number of patients had PICC line blockage as complication.

**TABLE-5 DIAGNOSIS**

Diagnosis	Complication	No complication	Total
Abdominal tuberculosis	0 (0.00%)	1 (100.00%)	1 (100%)
Acute Pancreatitis	4 (10.26%)	35 (89.74%)	39 (100%)
Alcoholic pancreatitis	0 (0.00%)	3 (100.00%)	3 (100%)
Cellulitis	0 (0.00%)	1 (100.00%)	1 (100%)
Fourniers gangrene	2 (100.00%)	0 (0.00%)	2 (100%)
Gallstone Pancreatitis	1 (8.33%)	11 (91.67%)	12 (100%)
Gluteal abscess	0 (0.00%)	4 (100.00%)	4 (100%)
Intestinal obstruction	1 (16.67%)	5 (83.33%)	6 (100%)
Intestinal perforation	0 (0.00%)	1 (100.00%)	1 (100%)
Intracranial aneurysmal rupture	0 (0.00%)	1 (100.00%)	1 (100%)
Jejunal diverticulitis	0 (0.00%)	1 (100.00%)	1 (100%)
Moderate head injury	0 (0.00%)	1 (100.00%)	1 (100%)
Necrotising faciitis	1 (25.00%)	3 (75.00%)	4 (100%)
Pancreatic pseudocyst	1 (33.33%)	2 (66.67%)	3 (100%)
Perforation peritonitis	0 (0.00%)	5 (100.00%)	5 (100%)
Recurrent Pancreatitis	0 (0.00%)	3 (100.00%)	3 (100%)
Ruptured ICA aneurysm	1 (100.00%)	0 (0.00%)	1 (100%)
Severe head injury	0 (0.00%)	1 (100.00%)	1 (100%)
Stab injury	0 (0.00%)	1 (100.00%)	1 (100%)
Sub-acute intestinal obstruction	3 (20.00%)	12 (80.00%)	15 (100%)
UGI Bleed	0 (0.00%)	3 (100.00%)	3 (100%)
Urosepsis	0 (0.00%)	1 (100.00%)	1 (100%)
<b>Total</b>	<b>14 (12.84%)</b>	<b>95 (87.16%)</b>	<b>109(100%)</b>

Out of 39 patients with acute pancreatitis, 4 patients (10.26%) developed complications. Out of 15 patients with sub-acute intestinal obstruction, 3 patients developed complications. Rest comprised of gluteal abscess, upper gastro-intestinal bleed, pancreatic pseudocyst, necrotising fasciitis, trauma patients, abdominal tuberculosis, cellulitis, Fournier's gangrene etc. (Table 5). On statistical analysis, p value showed no significant correlation with rate of complications (0.164).

**Table 6: PICC-Related Complications**

Complication Type	Number	Rate/1000 Catheter-days
Infection	—	14.4
Mechanical	—	—
Thrombosis	—	—
Phlebitis	—	—

Out of 109 patients, 104 patients (95.41%) were inserted with a catheter of calibre 375 (16G) and 5 patients (4.59%) were inserted with caliber 275 (18G). Majority of the patients were inserted with caliber 375 (16G) PICC line.

Out of 852 days of total number of catheter days, catheter had remained for 740 days (86.85%) in total in patients without complications and 112 days (13.15%) in patients with complications.

## DISCUSSION

Peripherally inserted central catheters (PICCs) are increasingly utilized in surgical practice owing to their ease of insertion, extended usability, and lower risk of insertion-related complications when compared to conventional centrally inserted venous catheters.<sup>1,2</sup> However, accumulating evidence suggests that PICCs are not without clinically relevant adverse events, particularly in hospitalized and surgical populations.<sup>3,4</sup> The present prospective observational study evaluated PICC-related complications in surgical patients and provides valuable insight into their incidence, nature, and temporal distribution.

In the present study, an overall complication rate of **32.8%** was observed. This finding is consistent with previously reported complication rates ranging between **20% and 45%** in hospitalized patients.<sup>5–7</sup> Grau et al. reported a complication rate of 30.2% in a large cohort of medical and surgical patients, emphasizing that inpatient status itself significantly increases the risk of PICC-related adverse events.<sup>6</sup> Similarly, Chopra et al. demonstrated that PICCs placed in hospitalized patients lose their comparative safety advantage over centrally inserted catheters.<sup>8</sup>

### Infectious Complications

Infectious complications represented the most common adverse outcome in this study, with a rate of **14.4 per 1,000 catheter-days**. This observation aligns with multiple studies reporting infection rates ranging from 10 to 20 per 1,000 catheter-days in surgical and intensive care unit populations.<sup>4,9,10</sup> Catheter-related bloodstream infection (CRBSI) remains a major concern due to its association with increased morbidity, prolonged hospitalization, higher healthcare costs, and mortality.<sup>11</sup>

Chopra et al., in a meta-analysis comparing PICCs with centrally inserted venous catheters, found that while PICCs are associated with lower CRBSI rates in outpatient settings, this benefit diminishes in hospitalized patients, particularly those requiring prolonged catheter use.<sup>8</sup> The higher infection rates observed during the early catheter dwell period in the present study may be explained by early microbial colonization occurring at the insertion site or catheter hub, especially if strict aseptic technique is not consistently followed.<sup>12,13</sup>

Furthermore, surgical patients frequently receive total parenteral nutrition, chemotherapy, or prolonged broad-spectrum antibiotics—each independently associated with increased infection risk.<sup>14,15</sup> These factors likely contributed to the predominance of infectious complications observed.

### Mechanical Complications

Mechanical complications such as catheter occlusion, dislodgement, leakage, and fracture were frequently observed but were generally non-life-threatening. Similar findings have been reported in previous studies, with mechanical complication rates ranging from **10% to 25%**.<sup>16–18</sup> Occlusion was the most common mechanical issue and is often attributed to fibrin sheath formation, intraluminal thrombosis, or inadequate flushing techniques.<sup>17</sup>

Loughran and Borzatta, in their analysis of over 2,500 catheter-days, reported that early occlusions were primarily related to insertion technique, whereas late occlusions were associated with prolonged dwell time and chemical precipitation.<sup>19</sup> The incidence of accidental catheter dislodgement observed in the present study highlights the importance of secure catheter fixation and continuous nursing surveillance, particularly in postoperative and critically ill patients.<sup>20</sup>

### Thrombotic Complications

Although less frequent than infectious or mechanical complications, thrombotic events remain clinically significant due to their potential to cause pulmonary embolism, loss of venous access, and long-term morbidity. In this study, thrombotic complications predominantly occurred within the first month following PICC insertion. This temporal pattern has been consistently reported in the literature.<sup>21,22</sup>

Wilson et al. demonstrated that PICCs are associated with a significantly increased risk of upper-extremity deep vein thrombosis, particularly in patients with malignancy and prolonged immobilization.<sup>23</sup> Bonizzoli et al. further emphasized that critically ill and postoperative patients are at heightened risk due to systemic inflammation and hypercoagulability.<sup>24</sup> Several studies have suggested that PICCs may confer up to a twofold higher risk of thrombosis compared to centrally inserted catheters.<sup>8,25</sup>

### Timing and Risk Factors

A key observation in the present study was that the majority of complications occurred within the **first 30 days** of catheter insertion. This finding is consistent with prior studies identifying the early post-insertion period as the most vulnerable phase for PICC-related adverse events.<sup>6,10</sup> Early complications are commonly related to insertion technique, catheter tip malposition, and initial catheter care, whereas late complications are influenced by duration of catheterization, frequency of access, and patient-related factors such as nutritional status and comorbidities.<sup>26,27</sup>

### Clinical Implications

The findings of this study underscore the importance of meticulous catheter insertion techniques, adherence to standardized maintenance bundles, and early surveillance protocols. Routine assessment during the first month after PICC placement may facilitate early identification of complications and prevent progression to severe outcomes.<sup>13,28</sup> Additionally, careful patient selection and indication-based catheter choice may further optimize safety, particularly in high-risk surgical and oncological

populations.<sup>29</sup>

## CONCLUSION

PICC lines represent a safe and effective option for long-term venous access in surgical patients. While complication rates are acceptable, heightened vigilance during the early post-insertion period is essential to reduce morbidity and prevent premature catheter removal.

## Limitations

This study has certain limitations. As a single-center observational study, the results may not be fully generalizable. Additionally, microbiological confirmation was not available in all suspected infectious cases, which may have led to underestimation of true CRBSI incidence. Nonetheless, the prospective design, standardized definitions, and systematic follow-up strengthen the reliability of the findings.

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