Clinical and Economic Outcomes of Prolonged Postoperative Ileus in Patients Undergoing Hysterectomy and Hemicolecotomy

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ABSTRACT

Purpose: To determine the incidence, cost, and clinical characteristics of prolonged postoperative ileus (PPOI) in hysterectomy or total abdominal hysterectomy patients at an academic hospital.

Methods: This was a retrospective cohort study of patients who underwent left or right hemicolecotomy or hysterectomy at Thomas Jefferson University Hospital between July 1, 2001, and June 30, 2002. PPOI-associated International Classification of Diseases (ICD-9) diagnosis codes were used to identify patients. Diagnoses were confirmed by a medical record review. Diagnostic criteria for PPOI included documentation of PPOI in the medical record, confirmation through radiological tests, and delayed return of gastrointestinal function. Inpatient cost-accounting system records for patients with PPOI were compared with those of patients without PPOI who underwent similar surgical procedures.

Results: Charts were reviewed for 83 patients. Among the 43 hysterectomy patients, the incidence of PPOI was 18.2%; PPOI was diagnosed at a mean of 3.1 days after surgery and 3.8 days from PPOI diagnosis to discharge. PPOI patients had a mean of 1.2 days of abdominal distention, 4.1 days to the first flatus, and 5.3 days to the first bowel movement. The mean length of hospital stay (LOS) was 3.2 days longer for hysterectomy patients with PPOI than for hysterectomy patients without PPOI, and the total mean cost was $4,512 higher.

For the 40 hemicolecotomy patients, the incidence of PPOI was 24.5%; PPOI was diagnosed at a mean of 2.6 days after surgery and 15.6 days from PPOI diagnosis to discharge. PPOI patients had a mean of four days of abdominal distention, 5.4 days to the first flatus, and 5.6 days to the first bowel movement.

The mean LOS for hemicolecotomy patients with PPOI was eight days longer than that for hemicolecotomy patients without PPOI, and the total mean cost was $12,416 higher.

Conclusion: PPOI can greatly increase hospital LOS following hysterectomy or hemicolecotomy, resulting in additional medical care and costs.

INTRODUCTION

Postoperative ileus (POI) is a temporary impairment of gastrointestinal (GI) motility that commonly occurs after abdominal surgery. Although POI occurs in every patient to some extent, there is no consensus on the definition of POI as a disease state. Symptoms commonly associated with POI include abdominal distention and pain, nausea, vomiting, an absence of bowel sounds, and delayed passage of flatus or stool.

POI that exceeds three days in duration has been referred to as paralytic POI or prolonged POI (PPOI). In clinical practice, the distinction between paralytic or prolonged POI is less clear. Many physicians consider these terms to represent different degrees of the same condition.

Although the literature regarding the incidence of POI is limited, the incidence rates appear to vary by type of surgery. For example, POI has been reported in 10% to 25% of patients who undergo gastric surgery and in 32% of patients in laparoscopy-assisted proctocolectomy. The resolution of POI varies within segments of the GI tract. The small intestine usually recovers after several hours, the stomach after 24 to 48 hours, and the colon after three to five days.

The etiology of POI is multifactorial. Potential causes include inflammation from surgical manipulation, inhibitory neural reflexes, and the use of opioids. Conventional therapies for POI, such as nasogastric suction and prokinetic agents, are not completely effective in decreasing the duration of symptoms. Newer techniques, such as minimally invasive procedures (e.g., laparoscopy), the use of epidural local anesthesia, and early oral feeding, have demonstrated some success in reducing POI at specialized surgical centers. However, no technique has been consistently effective to date in shortening the duration of POI, and no therapies or approaches for the management of POI have been approved by the U.S. Food and Drug Administration (FDA). More recently, clinical trials have demonstrated that peripherally active mu opioid receptor antagonists can accelerate GI recovery and decrease the length of hospital stay.

POI has important clinical, humanistic, and economic implications. It is often associated with postsurgical discomfort, a delayed return to a normal diet, and a prolonged length of stay (LOS) in the hospital.

Clinically, POI is associated with complications such as GI perforation, nosocomial infections, malnourishment, and mus-

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cular atrophy.\textsuperscript{1,6} From a humanistic perspective, delayed GI recovery contributes to prolonged LOS and a reduced quality of life because of discomfort, anxiety, additional pain, and the inability to eat liquid or solid foods.

A study by Premier Healthcare Informatics in Charlotte, North Carolina, analyzed the costs of POI in 160 hospitals. The cost associated with surgical procedures increased by $6,300 from a mean of $11,700 to a mean of $18,000 in patients with International Classification of Diseases (ICD-9) diagnostic codes associated with POI.\textsuperscript{11} In addition, there was a four-day increase in LOS for patients with a diagnosis of POI (9.3 days) compared with patients without the POI code (5.3 days).\textsuperscript{11}

According to earlier research, POI was the most common cause of prolonged LOS after radical cystectomy,\textsuperscript{12} and the overall annual costs of POI were estimated to be approximately $1 billion nationally.\textsuperscript{13} These findings provide a rationale for treating POI for providers, patients, and payers interested in decreasing health care costs while maintaining the highest quality of care.

Our objective was to examine the clinical and economic implications of POI (specifically, PPOI) within a patient population undergoing surgery at a major urban academic tertiary medical center. We selected hemicolectomy and hysterectomy for analysis because these procedures are common and we suspected that they might result in a high incidence of PPOI. We focused on PPOI because minor cases of POI are generally not well documented in medical and administrative records.

**METHODS**

**Study Design and Methods**

A retrospective cohort study was conducted at Thomas Jefferson University Hospital, an urban tertiary academic medical center in Philadelphia, Pennsylvania. We used the hospital’s inpatient cost-accounting system (Eclipsys; Eclipsys Corporation, Boca Raton, Fla.) as the primary data source to identify all patients undergoing left or right hemicolectomy and hysterectomy who were discharged from July 1, 2001, through June 30, 2002. Information extracted from this data set included ICD-9 diagnosis and procedure codes, patient LOS, payer, charges, costs (total and by revenue center), diagnosis-related group (DRG) assignment, and all patient demographics.

The patients were divided into two groups according to the presence or absence of one of the following ICD-9 diagnosis codes: 564.4 (postoperative functional disorder) or 997.4 (GI complications) (Figure 1). The ICD-9 code for paralytic ileus (560.1) was not used because (1) some patients could have had a primary ICD-9 code of 560.1 without having undergone surgery (i.e., patients with opioid-induced bowel dysfunction, neurological disorders, or digestive causes) and (2) surgery was a criterion for inclusion.

Patients who had undergone hysterectomy and hemicolectomy were randomly selected from the entire population. We reviewed their medical charts to determine whether a PPOI diagnosis could be ascertained by the medical record and to

![Figure 1](https://example.com/figure1.png)

**Figure 1**  Sample breakdown of a patient population undergoing hysterectomy at Thomas Jefferson University Hospital in fiscal year 2002. ICD = International Classification of Diseases; PPOI = prolonged postoperative ileus.
obtain additional information, including clinical characteristics of each PPOI case, comorbidities, and patient demographics.

**Diagnosis**

Patients were considered to have PPOI if they met one or more of the following criteria:

- documentation of PPOI in the narrative section of the chart
- confirmation or discovery of PPOI by radiological obstruction series, abdominal scans, or pelvic computed tomography (CT) scans
- prolonged return of GI function, including lack of bowel sounds, delayed flatus, and bowel movement
- abdominal distention, nausea, or vomiting

To confirm the diagnosis, a second investigator reviewed the patients who met one or more of these criteria.

**Analysis**

Chart review results were entered into Excel spreadsheets and were imported for analysis into Statistical Package for the Social Sciences (11.0.1, SPSS, Inc., Chicago). We used sampling fractions to calculate the weighted incidence, LOS, and total costs for each group. The analysis compared descriptive statistics, clinical characteristics, and economic outcomes for patients with and without PPOI.

**RESULTS**

**Patients**

A total of 31,990 patients were admitted to the facility for any reason between July 1, 2001, and June 30, 2002. Of these, 331 patients underwent hysterectomy and 141 patients underwent hemicolectomy. Nine hemicolectomy and 12 hysterectomy patients had at least one of the two PPOI-associated codes, and 132 hemicolectomy and 319 hysterectomy patients had neither. A combined total of 83 hemicolectomy and hysterectomy patients were included in the analysis (Table 1).

**Hysterectomy**

The demographics for patients undergoing hysterectomy were similar for patients with and without PPOI. The mean age of the patients with PPOI was 58 years. Most of the PPOI patients (46.7%) were Caucasian. Demographics for patients without PPOI were similar, but the mean age was lower (53 years).

**Hemicolectomy**

The hemicolectomy patients were older, primarily male, and of African-American heritage. The mean age of the patients with PPOI was higher (64 years), compared with patients without PPOI (62 years). A higher proportion (60%) were male, compared with patients without PPOI (33% male).

**Analysis**

**Hysterectomy**

Forty-three medical charts were reviewed for the presence of PPOI. Of the 331 patients who underwent a hysterectomy during the study period, 12 had at least one of the PPOI-associated ICD-9 codes, and 10 of these patients were randomly selected for inclusion in this analysis. Thirty-five of 319 hysterectomy patients without either of the PPOI-associated ICD-9 codes were sampled; of these patients, 33 were randomly included in this analysis.

A chart review confirmed the presence of PPOI in the 10 patients with PPOI-associated ICD-9 codes. In addition, five of the 33 patients without either of the PPOI-associated ICD-9 codes had symptoms consistent with PPOI. Therefore, the weighted incidence of PPOI after hysterectomy was 18.2% (Figure 1).

For patients with PPOI, the mean time to first flatus was approximately 4.1 days (median, 4 days), and the mean time to the first bowel movement was 5.3 days (median, 5 days) (Table 2). Typically, these patients presented with abdominal distention for a mean duration of 1.2 days. The mean time to PPOI diagnosis was approximately 3.1 days after surgery (median, 3 days).

The mean time from the PPOI diagnosis to hospital discharge was approximately 3.8 days (median, 4 days).

The mean LOS was 6.9 days (median, 7 days) for patients with PPOI, compared with the mean LOS of 3.7 days (median, 3.5 days) for patients without PPOI.

The total cost for patients with PPOI was $12,502 (median, $12,161); the total cost for patients without PPOI was $7,990 (median, $7,375) (Figure 2).

**Hemicolectomy**

We reviewed 40 medical charts for the presence of PPOI. Of the 141 hemicolectomy patients, nine had at least one of the ICD-9 codes associated with PPOI, and seven records were randomly sampled and reviewed. We randomly sampled records for 35 of 132 patients without PPOI-associated ICD-9 codes and reviewed 33. A chart review confirmed the PPOI diagnosis in only two of the seven patients with PPOI-associated ICD-9 codes.
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codes; this review also revealed that eight of the 33 patients without either of the PPOI-associated ICD-9 codes met one or more of our study criteria for the presence of PPOI. Therefore, the weighted incidence of PPOI after hemicolectomy was 24.5% (Figure 3).

The mean time to first flatus was 5.4 days (median, 5 days), and the mean time to a first bowel movement was 5.6 days (median, 5.5 days) (Table 2). Patients with PPOI typically presented with abdominal distention that lasted for four days.

The mean time to PPOI diagnosis was approximately 2.6 days after surgery (median, 3 days). The mean time from the PPOI diagnosis to patient discharge was 15.6 days (median, 15.8 days). For patients with PPOI, the mean LOS was 16.6 days (median, 15.8 days). For patients without PPOI, the mean LOS was 8.6 days (median, 6.8 days).

For PPOI patients, the total mean cost was $28,823 (median, $26,669). For non-PPOI patients, the total mean cost was $16,407 (median, $11,765) (Figure 4).

One PPOI patient who was included in our hemicolectomy analysis represented a statistical outlier. The LOS for this patient was 69 days, with hospital costs totaling $108,827. The duration of ileus for this patient—24 days—comprised multiple episodes that began and resolved multiple times. Complications that might have been attributed to the LOS included obstruction of the small bowel and a suspicion of colorectal cancer. Comorbidities included anemia, peripheral vascular disease, and coronary arterial disease. Although this individual experienced a LOS and cost that far exceeded population averages, we elected to keep him in our analysis rather than censor or omit this case.

DISCUSSION

We found that the development of PPOI added significantly to inpatient LOS and to the cost of care for patients undergoing common surgical procedures at our hospital.

Hemicolectomy patients with PPOI were slightly older (64 years of age) than hysterectomy patients with PPOI (58 years of age), but this was consistent with the age differences in the overall patient populations. The incidence of PPOI also appeared to be higher after hemicolectomy than after hysterectomy.

One possible reason might be that hemicolectomy involves more extensive handling of the bowel during the surgical procedures; such involvement has been documented as a cause of POI in experimental and clinical studies. In addition, the anatomical location of surgery (i.e., the colon) may cause or contribute to more prolonged ileus. In our study, PPOI resulting from hemicolectomy also resulted in a longer LOS and in higher overall inpatient costs.

The chart review identified a large number of cases of PPOI that were not identified by the more readily available ICD-9 diagnosis codes in the electronic cost-accounting system. These findings suggest that PPOI is significantly underreported and that efforts are needed to improve recognition.

Table 2  Clinical Comparisons for Hysterectomy and Hemicolectomy Patients with Prolonged Postoperative Ileus (PPOI)

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<tr>
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<th>Hysterectomy</th>
<th>Hemicolectomy</th>
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<td>Time to first event, mean days ± SD (median days)</td>
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<tr>
<td>First flatus</td>
<td>4.1 ± 1.8 (4.0)</td>
<td>5.4 ± 1.4 (5.0)</td>
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<td>First bowel movement</td>
<td>5.3 ± 1.4 (5.0)</td>
<td>5.6 ± 2.3 (5.5)</td>
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<td>Event duration, mean days ± SD Abdominal distention</td>
<td>1.2 ± 2.4</td>
<td>4 ± 3.5</td>
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<td>PPOI diagnosis, mean days ± SD (median days) From surgery to diagnosis</td>
<td>3.1 ± 1.6 (3.0)</td>
<td>2.6 ± 1.0 (3.0)</td>
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<tr>
<td>From diagnosis to hospital discharge</td>
<td>3.8 ± 2.1 (4.0)</td>
<td>15.6 ± 22.7 (6.5)</td>
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<td>Comorbidities, mean ± SD</td>
<td>2.4 ± 1.7</td>
<td>2.0 ± 2.0</td>
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<td>SD = standard deviation.</td>
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Figure 2  Clinical and economic outcomes for hysterectomy patients with prolonged postoperative ileus (PPOI), compared with hysterectomy patients without PPOI. For this study, PPOI and non-PPOI categories were based on a chart review, not on International Classification of Diseases (ICD-9) codes. A, Mean and median length of stay. B, Mean and median total hospital cost. USD = U.S. dollars.
STUDY LIMITATIONS

A primary limitation of our study was the relatively small sample size. In addition, despite our best efforts, PPOI was not always well documented. Further, we did not use matching to ensure that PPOI and non-PPOI cases were comparable in terms of relevant demographics and clinical severity—which might have led to exaggerated differences between PPOI and non-PPOI groups.

Figure 3 Sample breakdown of a patient population undergoing hemicolec tomy at Thomas Jefferson University Hospital in fiscal year 2002. ICD = International Classification of Diseases; PPOI = prolonged postoperative ileus.

Figure 4 Clinical and economic outcomes for hemicolec tomy patients with prolonged postoperative ileus (PPOI) compared with hemicolec tomy patients without PPOI. For this study, PPOI and non-PPOI categories were based on a chart review, not International Classification of Diseases (ICD-9) codes. A, Mean and median length of stay. B, Mean and median total hospital cost. USD = U.S. dollars.
Finally, this study failed to capture the humanistic impact of PPOI on patients, who experience pain and discomfort because of this condition. These patients may also experience psychosocial difficulties resulting from prolonged hospitalization and impairment of routine daily functions, such as eating and normal bowel movements. Lost work productivity is another relevant endpoint that was excluded because of our provider perspective, but is important from the perspectives of patients, employers, and society.

CONCLUSION

Despite the limitations mentioned earlier, this study demonstrated that PPOI is underrecognized and underreported; it is common in the hysterectomy and hemicolectomy populations; it can impede postoperative recuperation; and it can add significantly to inpatient LOS and cost of care. P&T committees can become more active in evaluating the extent to which pharmacotherapies are associated with an increased incidence of ileus and in developing guidelines to ensure appropriate postoperative medication management.

As new drug therapies become available for preventing and treating PPOI, such as \( \mu \) receptor antagonists, formulary decision-makers need to become aware of the potential clinical, economic, and humanistic consequences of PPOI and should factor this information into their reviews.

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REFERENCES