Risk Factors for Postoperative Ileus Following Orthopedic Surgery: The Role of Chronic Constipation

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Background/Aims

Distinction is vague between severe constipation and postoperative ileus (POI) in terms of pathogenesis, clinical features, and treatment options. However, no data are available regarding their associations.

Methods

After retrospective review of data from patients who underwent orthopedic surgery during the first 6 months of 2011, a total of 612 patients were included. Severe constipation was defined as symptoms of constipation requiring treatment using at least 2 laxatives from different classes for at least 6 months. POI was defined as paralytic ileus lasting more than 3 days post-surgery and associated with 2 or more of the following: (1) nausea/vomiting, (2) inability to tolerate an oral diet over a 24-hour period, and (3) absence of flatus over a 24-hour period. The subjects were divided into non-POI and POI groups, and we compared patient-, surgery-, and pharmaceutical-related factors.

Results

Thirteen (2.1%) out of 612 experienced POI. In comparisons between the non-POI and POI groups, univariate analysis showed significant differences in the mean age (51.4 vs 71.6 years), mean body mass index (24.1 vs 21.8 kg/m²), severe constipation (5.8% vs 76.9%), co-morbidities (33.2% vs 84.6%), type of orthopedic surgery (spine/hip/limb: 19.4/11.0/65.6% vs 23.1/61.5/15.4%), and estimated blood loss (50 vs 300 mL). Multivariate logistic regression analysis, after adjustment for age, body mass index, co-morbidities, type of orthopedic surgery, and estimated blood loss, showed that severe constipation was an independent risk factor for POI (OR, 35.23; 95% CI, 7.72-160.82; P < 0.001).

Conclusions

Severe constipation is associated with POI after orthopedic surgery.

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Key Words

Ileus; Orthopedics; Risk factors
Introduction

Postoperative ileus (POI) is defined as temporarily impaired gastrointestinal motility following surgery. The adverse effects of POI include increased postoperative pain, nausea and vomiting, delay in enteral nutrition, poor wound healing, delay in postoperative mobilization, increased risk of other postoperative complications, prolonged hospitalization, decreased patient satisfaction, and increased health care costs. Although the incidence of POI is highest for intra-abdominal surgery cases, it can also develop after orthopedic surgery. The incidence of POI after lower extremity reconstruction ranges from 0.3% to 2.0%, with an even higher incidence (5.6%) following revision total hip arthroplasty.

Colonic dysfunction is the most critical factor limiting the resolution of POI. Dysmotility of the colon is the cause of slow transit constipation. Despite a lack of strong evidence for their clinical utility, laxatives or prokinetics have been used to treat POI in clinical practice. There are similarities in the pathogenesis, clinical features, and treatment options between severe constipation and POI. In this context, the relationship between severe constipation and POI needs to be elucidated. This study aimed to evaluate severe constipation as a potential independent risk factor for POI in patients undergoing orthopedic surgery.

Materials and Methods

Consecutive patients (n = 677) who had undergone orthopedic surgery during the first 6 months of 2011 were reviewed retrospectively. Those patients with no available data on their postoperative outcomes (n = 9), who underwent repeated orthopedic surgery within the same period (n = 13), or who underwent concurrent bowel, brain or thorax surgery (n = 43) were excluded. After applying these exclusion criteria, 612 patients were included in the study. Most of the patients were administered a standard anesthesia regimen, consisting of 2 mg/kg propofol, 20 μg/min remifentanil infusion, and 0.6 mg/kg rocuronium. Anesthesia was maintained using desflurane, 50% nitrous oxide and 5-20 μg/min remifentanil infusion. The patients also received 0.2-mg glycopyrrolate intramuscularly as premedication 30 minutes prior to surgery. Approximately 10 minutes before finishing surgery, a 50-100 μg bolus dose of fentanyl and 30-mg ketorolac were administered intravenously. Simultaneously, 8-mg ondansetron was injected intravenously to prevent postoperative nausea and vomiting. For postoperative pain control, 523 (85.5%) patients received intravenous patient-controlled analgesia (PCA) using a bolus dose of 15-μg fentanyl, a lockout interval of 5 minutes, and no basal infusion for 48 hours after orthopedic surgery. All patients were managed using a similar postoperative management plan. Nasogastric tubes were not used routinely unless there was a significant amount of postoperative nausea, vomiting, and/or abdominal distention. All patients were offered a clear liquid diet orally on postoperative day 1 and were progressively advanced to a solid diet as tolerated. The study protocol was approved by the Institutional Review Board of Soon-chunhyang University Seoul Hospital, College of Medicine, Seoul, Korea.

Data Collection

We evaluated the following variables: (1) patient-related factors (age, gender, body mass index, severe constipation, and co-morbidities); (2) surgery-related factors (type of anesthesia; ie, general vs spinal vs brachial plexus block; type of orthopedic surgery; ie, spine vs hip vs limb surgery; operative time; and estimated blood loss; and (3) pharmaceutical-related factors (use of opioids or PCA). The definition of severe constipation was based on all of the following: (1) onset of constipation symptoms at least 6 months prior to orthopedic surgery, (2) previous treatment with at least 2 laxatives from different classes for at least 6 months, and (3) no evidence of organic diseases causing constipation. POI was defined as paralytic ileus lasting more than 3 days post-surgery and associated with two or more of the following: (1) nausea/vomiting, (2) inability to tolerate an oral diet over a 24-hour period, and (3) absence of flatus over 24-hour period.

Statistical Methods

A preliminary analysis using Fisher’s exact test was conducted to determine if there were any differences in severe constipation between patients with (POI group) and without POI (non-POI group). The patient-, surgery-, and pharmaceutical-related factors were also compared between the POI and non-POI groups using the Student’s t test, Wilcoxon rank sum test, Chi-square test, or Fisher’s exact test.

Multivariate logistic regression analysis, after adjusting for significant variables determined from the univariate analyses, was performed to assess the adjusted OR for constipation in the POI group.
**Table 1. Comparison of Patients With and Without Postoperative Ileus**

|                          | Non-POI (n = 599) | POI (n = 13) | P-value   |
|--------------------------|-------------------|-------------|-----------|
| **Age (mean ± SD, yr)**  | 51.4 ± 20.0       | 71.6 ± 19.3 | < 0.001*  |
| < 65 (n [%])             | 420 (70.12)       | 4 (30.77)   | 0.004b    |
| ≥ 65 (n [%])             | 179 (29.88)       | 9 (69.23)   |           |
| **Body mass index (mean ± SD, kg/m²)** | 24.1 ± 3.7       | 21.8 ± 5.1   | 0.025c    |
| **Gender (n [%])**       |                   |             | 0.381d    |
| Male                     | 304 (50.75)       | 5 (38.46)   |           |
| Female                   | 295 (49.25)       | 8 (61.54)   |           |
| **Severe constipation (n [%])** | 35 (5.84)   | 10 (76.92)   | < 0.001b  |
| **Comorbidities (n [%])**|                   |             |           |
| Hypertension             | 199 (33.22)       | 11 (84.62)  | 0.001b    |
| Diabetes                 | 70 (11.69)        | 7 (53.85)   | 0.001b    |
| Liver diseases           | 17 (2.84)         | 2 (15.38)   | 0.058b    |
| Tuberculosis             | 7 (1.17)          | 0 (0.00)    | > 0.999d  |
| Kidney diseases          | 10 (1.67)         | 1 (7.69)    | 0.212b    |
| Cardiovascular diseases  | 27 (4.51)         | 2 (15.38)   | 0.122b    |
| Lung diseases            | 13 (2.17)         | 1 (7.69)    | 0.262b    |
| Miscellaneous            | 29 (4.84)         | 3 (23.08)   | 0.026b    |
| History of abdominal surgery (n [%]) | 19 (3.17)   | 1 (7.69)    | 0.354b    |
| **Types of orthopedic surgery (n [%])** |                   |             | < 0.001b  |
| Spine                    | 116 (19.40)       | 3 (23.08)   |           |
| Hip                      | 66 (11.04)        | 8 (61.54)   |           |
| Limb                     | 416 (69.57)       | 2 (15.38)   |           |
| **Types of anesthesia (n [%])** |                   |             | 0.604e     |
| General                  | 459 (76.63)       | 9 (69.23)   |           |
| Spinal                   | 129 (21.54)       | 4 (30.77)   |           |
| Brachial plexus block    | 11 (1.84)         | 0 (0.00)    |           |
| Operation time median [IQR] | 90 (55-140)     | 90 (60-140) | 0.531e    |
| Estimated blood loss median [IQR] | 50 (10-300) | 300 (200-400) | 0.001e    |
| Patient-controlled analgesia (n [%]) | 511 (85.31) | 12 (92.31)   | 0.704e    |
| Postoperative opioid (n [%]) | 523 (87.31) | 13 (100.00) | 0.387f    |

POI, postoperative ileus; IQR, interquartile range.

*P-value by Student’s t test, P-value by Chi-square test, **P-value by Fisher’s exact test, ****P-value by Wilcoxon rank sum test.

POI, postoperative ileus; IQR, interquartile range.

Results

POI was documented in 13 (2.1%) out of the 612 patients. Table 1 shows the comparisons between the POI and non-POI groups. Patients in the POI group were significantly older (mean age 71.6 ± 19.3 years) than those in the non-POI group (mean age 51.4 ± 20 years) (P < 0.001). BMI was significantly lower in the POI group (21.8 ± 5.1 kg/m²) compared with the non-POI group (24.1 ± 3.7 kg/m²) (P = 0.025). There was no significant gender difference between the 2 groups. Ten (76.92%) patients in the POI group had severe constipation, while 35 (5.84%) did in the non-POI group, revealing a significantly higher proportion in the POI group (P < 0.001). Co-morbidities were significantly different between the 2 groups, in which the POI group had a significantly higher proportion of patients with hypertension, diabetes, liver disease, and miscellaneous diseases. The 2 groups were comparable in terms of the proportion of patients with a previous history of abdominal surgery. Spine, hip, and limb surgeries were performed in 3 (23.08%), 8 (61.54%), and 2 (15.38%) patients in the POI group and in 116 (19.40%), 66 (11.04%), and 416 (69.57%) patients in the non-POI group, respectively. There were significant differences in the type of orthopedic surgery (P < 0.001), while the operation times were comparable between the 2 groups. The POI group had a significantly higher estimated blood loss compared with the non-POI group (P = 0.001). However, the proportion of patients managed with PCA or postoperative opioids did not differ between the 2 groups. After adjusting for age, body mass index, hypertension, diabetes, miscellaneous diseases, type of opera-
Discussion

This is the first study to show that severe constipation is significantly associated with POI following orthopedic surgery. Our results support those of an earlier study, which reported that the use of an effective bowel protocol decreased constipation and POI in patients undergoing orthopedic surgery. In that study, a new bowel program consisting of both a stool softener and routine use of a bisacodyl suppository on postoperative day 1 significantly decreased the rate of POI from 26.67 to 0.0 per 1,000 cases ($P = 0.123$) in patients with hip arthroplasty. The rate of constipation also decreased significantly from 120.0 to 37.04 per 1,000 cases ($P = 0.001$).

The mechanism underlying this association remains unknown but may be based largely on the similar proposed mechanisms for both severe constipation and POI. Many studies have also attempted to identify the causes of slow transit constipation, such as autonomic nervous dysfunction, enteric nervous dysfunction, and neuroendocrine dysfunction.

The highly adjusted OR for severe constipation might result from very low probability events for POI. POI occurs most commonly in patients who have undergone abdominal surgery. However, manipulation of the bowel affects postoperative inflammatory responses in the intestinal muscularis, thereby pro-
longing the POI. Our study population appeared to be appropriate for decreasing the potential for confounding occurrences (eg, bowel manipulation or inflammatory mediation effects).

To date, various procedures and agents—including laparoscopic surgery, thoracic epidurals, nonsteroidal anti-inflammatory drugs, and opiates—have shown clinical benefit in some. In our study, the adjusted odds ratio for POI development in patients with severe constipation was 35.23. This suggests that pharmacologic interventions for severe constipation might be added to the list of interventions efficacious for POI. We believe that our study will stimulate further research in this area. Gastroenterologists could make important contributions to the effort to decrease POI in orthopedic surgery patients with severe constipation.

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