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Postoperative outcomes in patients with perforated bowel: early versus late intervention



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ABSTRACT

Background: Time to intervention is suggested to be a crucial factor for a number of surgical conditions. In this study, we aim to examine the postoperative outcomes associated with the timing of surgical intervention in patients with perforated bowel.

Materials and methods: Cross-sectional study using the Nationwide Inpatient Sample database, 2003-2010. The study population included adult (≥ 18 y) inpatients who had perforated intestine or colon and underwent bowel surgery.

Results: A total of 5412 (64.6%) patients who had an early surgical intervention on same day of admission and 2985 (35.4%) patients who had a delayed surgery were included. Patients with comorbidities or those in hospitals in the Northeast region of the United States were more likely to have a delayed intervention ($P < 0.01$). In low-risk patients who are aged < 65 y old and with no comorbidities, the timing of surgery did not associate with the risk of postoperative complications ($P = 0.77$) and mortality ($P = 0.08$), whereas in high-risk patients who are aged ≥ 65 y old or with comorbidities, an early surgical intervention was associated with a lower risk of complications (odds ratio: 0.77; 95% CI: 0.69-0.87; $P < 0.001$), and a lower mortality risk (odds ratio: 0.79; 95% CI: 0.68-0.92; $P = 0.002$). Patients with a delayed intervention were associated with a hospital stay > 15 d ($P < 0.001$) and a higher cost of health services ($P < 0.01$). **Conclusions:** Patients treated in the Northeast of the United States were more likely to experience a delayed surgery. Delay of surgical intervention is associated with unfavorable outcomes only in older patients or those with comorbidities.

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Introduction

Bowel perforation is the most common cause of secondary acute peritonitis.^{1,2} It is associated with considerable mortality and morbidity and requires early diagnosis and

emergent management.^{3,4} Small intestinal perforations usually result from inflammation and necrosis caused by conditions such as ulcer and mesenteric ischemia, whereas colon perforations commonly complicate diverticulitis and colitis.¹

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Table 1 – Descriptive statistics of the study population in relation to the day of surgery.

Population characteristics	Study population (%) (n = 8397)	Surgery day		P*
		A day or more after admission (%) (n = 2985)	Same day of admission (%) (n = 5412)	
Age (y)				
<45	13.5	13.1	13.8	
45-65	33.3	31.9	34.1	
≥65	53.1	55.0	52.1	0.039
Gender				
Male	44.4	41.5	46.0	
Female	55.6	58.5	54.0	<0.001
Race				
White	79.9	78.0	81.0	
Black	9.0	10.1	8.4	
Hispanic	6.8	7.5	6.4	
Asian/Pacific Islander	1.8	1.8	1.8	
Native American	0.2	0.2	0.3	
Other	2.3	2.4	2.2	0.05
Service payer				
Medicare	52.8	54.9	51.7	
Medicaid	6.9	7.2	6.8	
Private	31.6	30.5	32.3	
Self-pay	4.9	3.9	5.5	
No charge	0.6	0.9	0.5	
Other	3.0	2.6	3.3	<0.001
CCIS				
0	42.3	39.6	43.8	
1	30.7	31.0	30.5	
≥2	27.0	29.4	25.7	<0.001
Admission type				
Nonelective	91.7	92.1	91.6	
Elective	8.3	7.9	8.4	0.44
Postoperative complications				
Absent	45.4	41.3	47.6	
One or more	54.6	58.7	52.4	<0.001
In-hospital mortality				
Not reported	85.4	82.6	86.9	
Reported	14.6	17.4	13.1	<0.001
Length of stay				
≤15 d	75.7	67.5	80.2	
>15 d	24.3	32.5	19.8	<0.001
Hospital volume (surgeries/y)				
Low: 1-2	30.4	30.4	30.4	
Intermediate: 3-6	50.2	50.8	49.9	
High: ≥7	19.4	18.8	19.7	0.64
Hospital region				
Northeast	21.2	23.6	19.8	
Midwest	18.2	17.4	18.6	

(continued)

Table 1 – (continued)

Population characteristics	Study population (%) (n = 8397)	Surgery day		P*
		A day or more after admission (%) (n = 2985)	Same day of admission (%) (n = 5412)	
West				
West	40.8	40.0	41.3	
South				
South	19.9	19.0	20.3	0.003
Hospital location				
Rural	14.3	13.9	14.5	
Urban	85.7	86.1	85.5	0.49
Hospital teaching status				
Nonteaching	60.6	59.9	61.0	
Teaching	39.4	40.1	39.0	0.38
Cost of health service				
≤\$44,626.05	75.0	69.3	78.2	
>\$44,626.05	25.0	30.7	21.8	<0.001

CCIS = Charlson comorbidity index score.

* Chi-square test.

Surviving Sepsis Guidelines recommend source-control intervention within 12 h of diagnosing bowel perforation.⁵ However, there is a paucity of large randomized controlled trials that investigated the role of time to intervention in intestinal perforation; in addition, a review of literature reveals contradictory definitions and findings. Buck *et al.*,⁶ reported that with every hour delay of intervention, there is a 2.4% decrease in the probability of survival. Conversely, Hecker *et al.*,⁷ did not identify a significant difference in mortality risk in relation to delay in surgery.

The purpose of this study is to examine postoperative outcomes in relation to time of intervention as measured from the admission day. We also aim to examine the characteristics of patients with perforated bowel who underwent a delayed surgery.

Materials and methods

The study is a cross-sectional analysis using the Nationwide Inpatient Sample (NIS) database for the years 2003-2010. The NIS is part of the Healthcare Cost and Utilization Project, sponsored by the Agency for Healthcare Research and Quality. This is the largest all-payer inpatient care database that is publicly available in the United States. It contains data from approximately 8 million hospital stays from about 1000 hospitals sampled to approximate a 20% stratified sample of US community hospitals. The NIS is publicly available and de-identified database that is exempt from approval of the institutional review board.⁸ International Classification of Disease, 9th Revision was used in defining the diagnoses and procedures of interest.

The study population included adult (≥18 y) inpatients with intestinal or colon perforation (International Classification of Disease, 9th Revision: 569.83) and who underwent colostomy, enterostomy, or colon or intestinal resection as the primary procedure (Appendix A). Consequently, based on the day of

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