ORIGINAL ARTICLE

SURGICAL CARE OF THE AGING POPULATION

Expectations and Outcomes in Geriatric Patients With Do-Not-Resuscitate Orders Undergoing Emergency Surgical Management of Bowel Obstruction

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Objective: To describe the outcomes and the expected postoperative course for patients with do-not-resuscitate (DNR) orders (DNR patients) who undergo emergency surgical management of bowel obstruction.

Design: We retrospectively identified all patients who underwent emergency surgical management of intestinal obstruction and who were classified previously as DNR using the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) Participant Use Data File for 2005 through 2009. We constructed a forward stepwise multivariate logistic regression model to determine predictors of postoperative mortality. We used propensity score analysis to determine the effect of DNR status on postoperative outcomes.

Setting: Institutions participating in the NSQIP.

Patients: All patients entered in the NSQIP database.

Main Outcome Measures: Thirty-day postoperative mortality and complication rates.

Results: We identified 242 patients who met the study criteria. Mean age was 80.9 years. Thirty-day mortality was 29.8%, with 47.1% of patients experiencing a postoperative complication. The presence of a postoperative complication was an independent predictor of postoperative mortality. Comparison of matched cohorts revealed a significantly higher postoperative mortality in DNR patients even after adjusting for comorbidities and overall complication rate.

Conclusions: Outcomes are poor after emergency surgical intervention for bowel obstruction in elderly DNR patients, with high postoperative complication and mortality rates. The presence of a DNR order is an independent risk factor for postoperative mortality. Patients, their families, and their physicians must be counseled on surgical expectations preoperatively and made aware of the significantly higher risks involved when a DNR order exists in the setting of emergency surgical management of bowel obstruction.

JAMA Surg. 2013;148(1):23-28

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DO-NOT-RESUSCITATE (DNR) orders are intended to allow patients to communicate their wishes for terminal care and forego cardiopulmonary resuscitation in the event of cardiopulmonary arrest. A paucity of literature exists regarding the implications of a DNR order on outcomes among geriatric patients presenting with bowel obstruction. Previous studies have demonstrated that the presence of a DNR order is a surrogate marker of terminal illness and impending death.[1-3] However, the effect of DNR orders on surgical patients, particularly elderly patients in need of emergency surgical intervention, remains unclear. Our primary objective was to identify the outcomes and expected postoperative course for patients with DNR orders (DNR patients) who received emergency surgical management of bowel obstruction.

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In addition, concerns exist about the impact of a DNR order outside traditional end-of-life situations, particularly regarding any effect on the intensity and aggressiveness of medical treatment and surgical intervention. Conflicting data exist whether the presence of a DNR order is an independent risk factor for postoperative outcomes or whether these orders simply act

as confounding proxies for overall comorbidity.[4,5] As such, a secondary objective of this study was to further characterize the effect of DNR status on postoperative outcomes after emergency surgical management of bowel obstruction.

METHODS

The American College of Surgeons National Surgical Quality Improvement Program (NSQIP) Participant Use Data File for 2005 through 2009 was used for this retrospective analysis, which included all patients who underwent an emergency surgical procedure for intestinal obstruction (defined as postoperative codes 560.0, 560.1, 560.2, 560.3, 560.30, 560.39, 560.8, 560.81, 560.89, and 560.9 from the *International Classification of Diseases, Ninth Revision*) and who had a DNR order before the index procedure. The NSQIP defines DNR classification as

> the patient has had a do-not-resuscitate (DNR) order written in the physician's order sheet of the patient's chart and it has been signed or cosigned by an attending physician in the 30 days prior to surgery. If the DNR order as defined above was rescinded immediately prior to surgery in order to operate on the patient, [then the patient was considered to belong to the DNR group] (http://www.acsnaqip.org).

The following preoperative and intraoperative variables were included for analysis: patient age, sex, transfer to the hospital from a long-term care facility, race/ethnicity, body mass index, American Society of Anesthesiology physical status classification of 4 or greater, diabetes mellitus, tobacco use within the past year, more than 2 drinks of alcohol per day within 2 weeks before the operation, dyspnea at rest or on exertion, preoperative functional status, preoperative mechanical ventilation, chronic obstructive pulmonary disease, pneumonia at the time of the procedure, ascites, esophageal varices, congestive heart failure, hypertension requiring medical therapy, peripheral vascular disease (ie, a history of revascularization or amputation for peripheral vascular disease, rest pain, and/or gangrene), neurologic disorder (ie, impaired sensorium, prior coma, hemiplegia, history of transient ischemic attacks, stroke with or without neurologic deficit, tumor involving the central nervous system, paraplegia, and/or quadriplegia), coronary artery disease (ie, myocardial infarction ≤6 months before the operation, prior percutaneous coronary intervention, a prior cardiac operation, and/or angina ≤1 month before the operation), renal disease (ie, acute renal failure present ≤24 hours before the procedure and/or the need for dialysis ≤2 weeks before the operation), disseminated cancer, open or infected wound preoperatively, use of corticosteroids within 30 days of an operation for a chronic medical condition, more than 10% loss of body weight in the 6 months before the operation, bleeding disorder (ie, long-term anticoagulation therapy other than aspirin that is not discontinued preoperatively), the need for preoperative transfusion of more than 4 U of packed red blood cells within 72 hours before the surgical procedure, chemotherapy for malignant disease within 30 days before the procedure, radiotherapy for malignant disease within 90 days before the procedure, and preoperative sepsis. Intraoperative variables included operative time, procedure type, laparoscopic approach, incisional wound classification, and the need for an intraoperative transfusion of packed red blood cells. Possible classifications for procedure type included lysis of adhesions (*Current Procedural Terminology* [*CPT*] codes 44005, 44050, 44055, and 44180), small-bowel resection or bypass (*CPT* codes 44120, 44125, 44130, 44200, and 44202), colectomy with anastomosis (*CPT* codes 44140, 44141, 44145, 44160, 44204, 44205, and 44227), colectomy without anastomosis (*CPT* codes 44143, 44144, 44150, and 44156), ostomy construction or revision (*CPT* codes 44188, 44310, 44314, 44320, and 44345), or other procedure (*CPT* codes 44020, 44021, 44110, 44602, 44604, 44615, 44700, 44800, and 44955).

The primary outcome measures for our analysis were 30-day postoperative morbidity and mortality. Secondary outcome measures included the incidence of specific complications and postoperative length of hospitalization (for patients surviving postoperatively through 30 days). Specific complications included superficial, deep incisional, or organ or space surgical site infection; wound disruption; pneumonia; unplanned intubation; pulmonary embolism; ventilatory requirement longer than 48 hours postoperatively; urinary tract infection; progressive renal insufficiency; acute renal failure requiring hemodialysis; stroke; coma lasting longer than 24 hours; cardiac arrest; myocardial infarction; bleeding requiring transfusion of 4 U or more of packed red blood cells within 72 hours postoperatively; peripheral nerve injury; failure of a graft, prosthesis, and/or flap; deep venous thrombosis; sepsis; and septic shock.

Measures of central tendency or proportions were assessed for DNR patients undergoing emergency surgical management of bowel obstruction for all preoperative, intraoperative, and postoperative outcome variables. We performed univariate comparison of primary outcome measures in patients with and without postoperative complications using the Pearson χ^2 test. To determine predictors of postoperative mortality in these patients, a forward stepwise multivariate logistic regression model was constructed with postoperative mortality as the dependent variable and all of the previously mentioned preoperative and intraoperative characteristics as independent variables. The model also included the presence or absence of a postoperative complication as a predictor variable to determine the potential association between postoperative morbidity and mortality in this patient population. We performed univariate comparison of postoperative length of stay, overall and stratified by the presence or the absence of a postoperative complication, using the Wilcoxon rank sum test.

We used propensity score analysis to determine the effect of DNR status on postoperative outcomes after emergency surgical management of bowel obstruction. First, patients who were not classified as being in the DNR group and who underwent one of the same emergency surgical procedures as the DNR group (based on principal *CPT* code) for a diagnosis of intestinal obstruction were identified from the NSQIP database. Patients classified as non-DNR who underwent other types of emergency procedures for bowel obstruction were not considered for inclusion in the propensity score analysis because of the likelihood that a patient's DNR status might affect the type of operation performed for an obstruction. Using the patients from the original analysis and this new non-DNR group, we created a nonparsimonious logistic regression analysis model to identify predictors of a patient's classification as DNR. Preoperative patient characteristics and intraoperative procedural characteristics were included as predictor variables in this model to adjust for patient condition and the complexity of the index procedure. The presence or the absence of a postoperative complication was also included as a variable in the regression model. A propensity score for DNR status ranging from 0 to 1 was then calculated for each patient using the logit coefficients for the predictors of DNR classification. The propensity scores were used to create 2 evenly matched groups based on DNR status using a caliper-matching algorithm with a caliper distance of 0.005 and with controls being used only once in the matching. We then compared the preoperative and intraoperative characteristics using Wilcoxon signed rank tests for continuous variables and McNemar χ^2 tests for categorical variables. Comparison

of postoperative mortality was performed using a conditional logistic regression model with preoperative DNR status and any other preoperative/intraoperative variables that differed between the propensity-matched cohort on univariate analysis as potential predictor variables. All statistical analyses were performed using commercially available software (STATA, version 11.0; StataCorp).

RESULTS

We identified 242 patients in the 2005 through 2009 NSQIP Participant Use Data File with DNR classification who nonetheless underwent an emergency operation for bowel obstruction. **Table 1** shows the preoperative and intraoperative characteristics of these patients and their operations. In general, these patients were elderly (mean [SD] age, 80.9 [10.7] years), and a high proportion received an American Society of Anesthesiologists physical status classification of 4 or greater. Fifty-eight patients (24.0%) were residents of a long-term care facility, and 52 (21.5%) were classified as having partially or totally dependent functional status preoperatively. Patients were hospitalized for a median of 2 days before the emergency operation, and 116 (47.9%) were classified as having systemic inflammatory response syndrome, sepsis, or septic shock preoperatively. Intraoperatively, 66 patients (27.3%) required only lysis of adhesions, 72 (29.8%) required small-bowel resection or bypass, and 74 (30.6%) required colon resection with or without anastomosis. The mean operative time was slightly longer than 90 minutes for these operations.

Seventy-two patients (29.8%) died within 30 days of their index operation, whereas 114 (47.1%) had at least 1 postoperative complication. Although the mortality rate in patients without a postoperative complication was high, those who developed a complication postoperatively were much more likely to die within 30 days of their index operation than patients who did not have a complication (**Figure 1**).

The median (interquartile range) postoperative length of stay for patients who survived postoperatively was 9 (7-14) days. Patients with a nonlethal complication required a significantly longer postoperative hospitalization (median [interquartile range], 11 [8-18] days) than did patients with no postoperative complication (8 [5-11] days; $P < .001$). **Table 2** shows the specific complications experienced by DNR patients undergoing emergency surgical management of bowel obstruction and the mortality rates associated with each of those complications. Infectious complications were the most common, including pneumonia, septic shock, sepsis, urinary tract infection, and superficial incisional surgical site infection. Of the complications occurring in at least 5% of patients, several were associated with mortality greater than 50%, including pneumonia, septic shock, and unplanned reintubation.

In the NSQIP Participant Use Data File for 2005 through 2009, 7153 non-DNR patients underwent one of the same emergency procedure types as the DNR patients in our analysis and were used as the basis for our propensity score analysis. Matching DNR and non-DNR patients on the basis of their propensity for being classified as DNR (adjusting for all the previously described preoperative and intraoperative patient- and procedure-related variables and the overall complication rate)

Table 1. Preoperative and Intraoperative Variables of DNR Patients Undergoing Emergency Surgical Management of Bowel Obstruction

Preoperative or Intraoperative Variable	Data[a] (n = 242)
Age, mean (SD), y	80.9 (10.7)
Female sex	159 (65.7)
Transferred from long-term care facility	58 (24.0)
White race	210 (86.8)
BMI, mean (SD)	22.9 (6.0)
ASA physical status classification ≥4	100 (41.3)
Diabetes mellitus	34 (14.0)
Ongoing tobacco use	31 (12.8)
Heavy alcohol use	4 (1.7)
Dyspnea	48 (19.8)
Dependent functional status	52 (21.5)
Preoperative ventilatory assistance	11 (4.5)
Chronic obstructive pulmonary disease	42 (17.4)
Preoperative pneumonia	14 (5.8)
Ascites	25 (10.3)
Esophageal varices	2 (0.8)
Congestive heart failure	18 (7.4)
Hypertension	172 (71.1)
Peripheral vascular disease	16 (6.6)
Neurologic disorder	84 (34.7)
Coronary artery disease	41 (16.9)
Renal disease	9 (3.7)
Disseminated cancer	19 (7.9)
Infected wound	16 (6.6)
Long-term corticosteroid use	22 (9.1)
Weight loss	16 (6.6)
Bleeding disorder	56 (23.1)
Preoperative transfusion	1 (0.4)
Chemotherapy in past 30 d	14 (5.8)
Radiotherapy in past 90 d	3 (1.2)
Preoperative sepsis	
None	126 (52.1)
Systemic inflammatory response syndrome	81 (33.5)
Sepsis	23 (9.5)
Septic shock	12 (5.0)
Preoperative length of hospital stay, median (IQR), d	2 (1-4)
Duration of operation, mean (SD), min	92.5 (57.5)
Type of procedure	
Lysis of adhesions	66 (27.3)
Small-bowel resection or bypass	72 (29.8)
Colectomy with anastomosis	48 (19.8)
Colectomy without anastomosis	26 (10.7)
Ostomy (including revision)	21 (8.7)
Other	9 (3.7)
Laparoscopic approach	12 (5.0)
Incisional wound classification	
Clean	36 (14.9)
Clean/contaminated	131 (54.1)
Contaminated	46 (19.0)
Dirty/infected	29 (12.0)
Intraoperative transfusion	30 (12.4)

Abbreviations: ASA, American Society of Anesthesiologists; BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); DNR, do not resuscitate; IQR, interquartile range.

[a] Unless otherwise indicated, data are expressed as number (percentage) of patients.

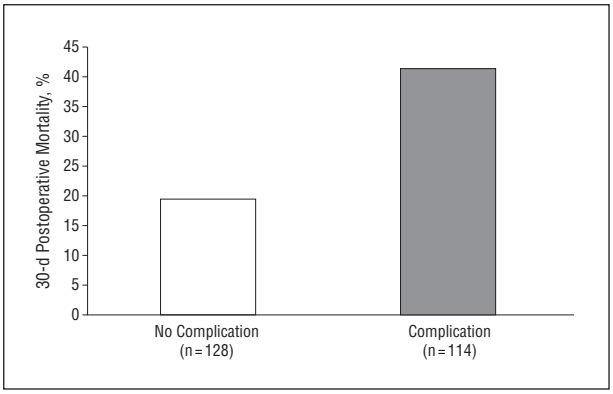

Figure 1. Comparison of the 30-day postoperative mortality in patients with do-not-resuscitate orders by the presence or absence of postoperative complications. We adjusted for preoperative and intraoperative characteristics and the presence or absence of postoperative complications using stepwise multivariate logistic regression to calculate the odds ratio of 3.19 (95% CI, 1.70-5.99; $P = .001$).

Table 2. Incidence of Specific Complications and Associated Failure-to-Rescue Rates for DNR Patients Undergoing Emergency Surgical Management of Bowel Obstruction

	No. (%) of Patients	
Outcome Variable	DNR Patients (n = 242)	Complication-Specific Mortality Rate
Ventilation >48 h	46 (19.0)	28/46 (60.9)
Pneumonia	32 (13.2)	17 (53.1)
Septic shock	23 (9.5)	16 (69.6)
Sepsis	22 (9.1)	7 (31.8)
Urinary tract infection	17 (7.0)	1 (5.9)
Superficial incisional surgical site infection	14 (5.8)	3 (21.4)
Unplanned intubation	13 (5.4)	11 (84.6)
Deep venous thrombosis	7 (2.9)	0
Organ/space surgical site infection	6 (2.5)	2 (33.3)
Wound disruption	6 (2.5)	4 (66.7)
Bleeding within 72 h of operation	5 (2.1)	2 (40.0)
Progressive renal insufficiency	4 (1.7)	3 (75.0)
Acute renal failure requiring hemodialysis	4 (1.7)	3 (75.0)
Deep incisional surgical site infection	4 (1.7)	2 (50.0)
Pulmonary embolism	3 (1.2)	1 (33.3)
Myocardial infarction	3 (1.2)	2 (66.7)
Coma >24 h	2 (0.8)	2 (100.0)
Cardiac arrest	0	NA
Graft/prosthesis failure	0	NA

Abbreviations: DNR, do not resuscitate; NA, not applicable.

Table 3. Preoperative and Intraoperative Characteristics for Patient Cohort Matched on Propensity for Being Classified as DNR Before Emergency Surgical Management of Bowel Obstruction[a]

Variable	Non-DNR Patients (n = 224)	DNR Patients (n = 224)	*P* Value
Age, mean (SD), y	80.9 (8.0)	81.0 (10.2)	.27
Female sex	143 (63.8)	149 (66.5)	.57
Transferred from long-term care facility	47 (21.0)	50 (22.3)	.66
White race	207 (92.4)	199 (88.8)	.18
BMI, mean (SD)	23.6 (6.9)	22.9 (5.9)	.24
ASA physical status classification ≥4	93 (41.5)	90 (40.2)	.76
Diabetes mellitus	23 (10.3)	32 (14.3)	.20
Ongoing tobacco use	34 (15.2)	28 (12.5)	.41
Heavy alcohol use	5 (2.2)	3 (1.3)	.41
Dyspnea	58 (25.9)	46 (20.5)	.17
Nonindependent functional status	41 (18.3)	49 (21.9)	.33
Preoperative ventilatory assistance	12 (5.4)	9 (4.0)	.51
Chronic obstructive pulmonary disease	54 (24.1)	38 (17.0)	.06
Preoperative pneumonia	16 (7.1)	13 (5.8)	.58
Ascites	26 (11.6)	23 (10.3)	.65
Esophageal varices	1 (0.4)	1 (0.4)	>.99
Congestive heart failure	16 (7.1)	15 (6.7)	.86
Hypertension	162 (72.3)	158 (70.5)	.68
Peripheral vascular disease	17 (7.6)	14 (6.3)	.59
Neurologic disorder	85 (38.0)	74 (33.0)	.26
Coronary artery disease	43 (19.2)	38 (17.0)	.54
Renal disease	7 (3.1)	7 (3.1)	>.99
Disseminated cancer	17 (7.6)	17 (7.6)	>.99
Infected wound	18 (8.0)	14 (6.3)	.48
Long-term corticosteroid use	11 (4.9)	18 (8.0)	.18
Weight loss	15 (6.7)	14 (6.3)	.85
Bleeding disorder	57 (25.4)	49 (21.9)	.37
Preoperative transfusion	0	0	>.99
Chemotherapy in past 30 d	15 (6.7)	12 (5.4)	.55
Radiotherapy in past 90 d	1 (0.4)	1 (0.4)	>.99
Preoperative SIRS/sepsis/septic shock	102 (45.5)	101 (45.1)	.92
Preoperative length of hospital stay, median (IQR), d	1 (0-3)	2 (1-4)	.02
Duration of operation, mean (SD), min	97 (68)	94 (59)	.62
Bowel resection, ostomy, or procedure other than lysis of adhesions	154 (68.8)	162 (72.3)	.39
Laparoscopic approach	13 (5.8)	10 (4.5)	.49
Contaminated or dirty/infected incisional wound	68 (30.4)	68 (30.4)	>.99
Intraoperative transfusion	21 (9.4)	27 (12.1)	.35
Postoperative complication	112 (50.0)	104 (46.4)	.42

Abbreviations: ASA, American Society of Anesthesiologists; BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); DNR, do not resuscitate; SIRS, systemic inflammatory response syndrome.

[a] Unless otherwise indicated, data are expressed as number (percentage) of patients.

resulted in the creation of 224 matched patient pairs who appeared to be very well balanced with respect to patient- and procedure-related variables (**Table 3**). Comparison of the matched cohorts between the DNR and non-DNR groups revealed a significantly higher postoperative mortality in patients who were classified as DNR before their procedure even after adjusting for complication rate (**Figure 2**).

COMMENT

Surgical decision making for geriatric patients with bowel obstruction is complex and is complicated further by the presence of a DNR order. Although surgeons will often attempt a trial of nonoperative management in patients with obstructive symptoms, patients who show evidence of clinical deterioration or who fail to improve will be offered surgical management. The fact that the DNR patients in our analysis had a longer median preoperative length of hospitalization than the non-DNR patients suggests that surgeons may have a higher threshold for offering surgical management to DNR patients. Whether this higher threshold is justified, however, depends on the intent underlying individual patients' decisions to designate themselves as DNR. Among patients for whom DNR applies only to immediate life-sustaining measures, such as endotracheal intubation and/or cardiopulmonary resuscitation, the withholding of necessary albeit aggressive interventions, such as emergency surgery, is not justified.

Our comparison of a cohort of elderly non-DNR and DNR patients who were well matched for preoperative and intraoperative characteristics demonstrates high postoperative mortality rates regardless of preoperative DNR status. This finding is not necessarily surprising because our study sample includes only elderly patients who receive emergency surgical intervention and is supported by other reports in the literature regarding outcomes after surgical intervention for bowel obstruction in elderly and DNR patients. For example, Mann and colleagues[6] reported a 30-day mortality rate of 23% and a complication rate of 74% for patients undergoing emergency palliative abdominal surgery. Numerous previous studies have also demonstrated that, in patients undergoing surgical intervention for bowel obstruction, advanced age is one of the most significant factors associated with increased postoperative complications and mortality.[7-11]

In addition, our comparison of a propensity-matched cohort of non-DNR and DNR patients suggests that the presence of a preoperative DNR order may increase a patient's risk of early postoperative mortality. Because the non-DNR and DNR patients in this cohort were well matched for most preoperative and intraoperative variables, we cannot readily attribute the disparate mortality rates of these groups to a higher number or higher severity of comorbid illnesses in the DNR group. Similarly, because the non-DNR and DNR patients in the cohort were also well matched for the presence or the absence of postoperative complications, we cannot attribute the disparate mortality rates of the groups to a greater risk of developing complications. However, the effect of DNR status on postoperative mortality, while significant, appears to be relatively small given the high mortality rates seen in the DNR and non-DNR patients. Nevertheless, our findings emphasize the need to educate patients and their families regarding the significantly increased risks involved in surgical management of small-bowel obstructions when a DNR order is present. Furthermore, our results suggest that, in this population, physicians, patients, and their decision makers must take particular care to assess patient wishes preoperatively.

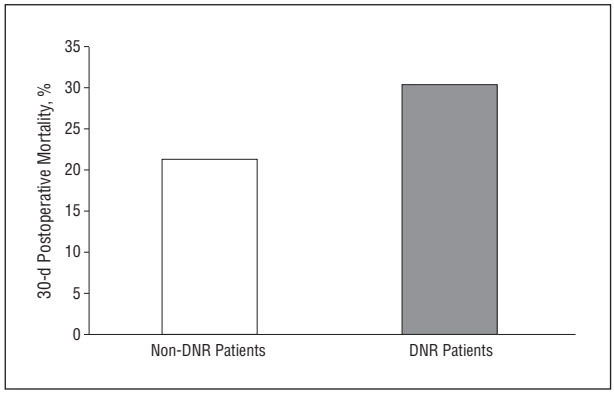

Figure 2. Comparison of 30-day postoperative mortality based on do-not-resuscitate (DNR) status. We used a conditional logistic regression model, adjusting for variables found in the univariate analysis (Table 3) to differ significantly between the propensity-matched cohort to calculate the odds ratio of 1.54 (95% CI, 1.01-2.35; $P = .04$).

We do not know how the presence of a DNR order affects patient outcomes in the setting of surgically treated bowel obstruction. Recent studies have reported differing conclusions regarding postoperative outcomes in DNR patients, and we need to define the effect of a DNR order further on escalation of care and treatment choices in the emergency perioperative period.[4,5,12] In a study of 4128 DNR patients, Kazaure et al[4] found DNR status to be an independent risk factor for poor surgical outcomes, whereas Saager et al[5] found DNR status to have no effect on 30-day mortality. In our propensity-matched cohort comparing DNR with non-DNR outcomes, we determined that DNR status is an independent risk factor for overall mortality even after adjusting for overall postoperative complication rate. Given the fact that these 2 groups were otherwise similar in their preoperative and intraoperative profiles, we hypothesize that patients with preoperative DNR orders may be less inclined to pursue rescue from serious postoperative complications. Further prospective survey-based analysis will be needed to confirm this interpretation.

This study has limitations inherent to all retrospective studies and should be interpreted with consideration of these. Most important, we were only able to analyze and to adjust for variables measured and recorded in the NSQIP database. As such, potentially relevant factors, such as the timing of a DNR order or distinguishing whether the patient or a surrogate requested the order, could not be studied. Similarly, although the NSQIP Participant Use Data File has been validated, it is nonetheless an administrative database, potentially introducing coding errors into our analysis. This study is also limited by a potential for significant selection bias because we were unable to account for situations in which the presence of a DNR order may have led to surgeon refusal to take a patient with bowel obstruction to the operating room. Finally, we were only able to match non-DNR and DNR patients for those preoperative and intraoperative variables that are available through the NSQIP database. Other preoperative variables not tracked by the NSQIP database may affect mortality signifi-

cantly and occur with greater frequency among DNR patients compared with non-DNR patients.

The prevalence of DNR orders has increased in recent decades,[13] and the effects of this increase on elderly patients presenting with bowel obstructions have not been well studied in the literature. The NSQIP database is uniquely positioned to explore geriatric variables in surgical patients, and we anticipate future growth in related studies. In our study, we found that the presence of a DNR order is associated with poor outcomes in patients undergoing emergency surgical management of bowel obstruction. Our results suggest that the presence of a DNR order represents an independent risk factor for postoperative mortality even after risk adjustment for complication rates. In light of these findings, decision makers—patients, their families, and their physicians—must be counseled on surgical expectations preoperatively and be made aware of the significantly increased perioperative risks involved when a DNR order exists. Given the emergent nature of the patient population studied, adequate time must be taken during the initial consultation and preoperative consent process to discuss these risks and to fully understand the patient's wishes. What remains elusive is the exact reason for the observed mortality association: Is DNR status simply a confounding marker of advanced age and illness, or does it influence perioperative decision making regarding escalation and intensity of care? Additional research is needed to determine more clearly the underlying causes and to characterize further the effect of a preoperative DNR order on surgical outcomes.

Accepted for Publication: June 25, 2012.
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Author Contributions: *Study concept and design:* Speicher and Scarborough. *Acquisition of data:* Scarborough. *Analysis and interpretation of data:* Speicher, Lagoo-Deenadayalan, Galanos, Pappas, and Scarborough. *Drafting of manuscript:* Speicher and Scarborough. *Critical revision of the manuscript for important intellectual content:* Speicher, Lagoo-Deenadayalan, Galanos, Pappas, and Scarborough. *Statistical analysis:* Scarborough. *Administrative, technical, and material support:* Speicher, Lagoo-Deenadayalan, Galanos, Pappas, and Scarborough. *Study supervision:* Lagoo-Deenadayalan and Scarborough.
Conflict of Interest Disclosures: None reported.

REFERENCES

1. Loertscher L, Reed DA, Bannon MP, Mueller PS. Cardiopulmonary resuscitation and do-not-resuscitate orders: a guide for clinicians. *Am J Med*. 2010;123(1):4-9.
2. Weiss GL, Hite CA. The do-not-resuscitate decision: the context, process, and consequences of DNR orders. *Death Stud*. 2000;24(4):307-323.
3. Morrell ED, Brown BP, Qi R, Drabiak K, Helft PR. The do-not-resuscitate order: associations with advance directives, physician specialty and documentation of discussion 15 years after the Patient Self-determination Act. *J Med Ethics*. 2008;34(9):642-647.
4. Kazaure H, Roman S, Sosa JA. High mortality in surgical patients with do-not-resuscitate orders: analysis of 8256 patients. *Arch Surg*. 2011;146(8):922-928.
5. Saager L, Kurz A, Deogaonkar A, et al. Pre-existing do-not-resuscitate orders are not associated with increased postoperative morbidity at 30 days in surgical patients. *Crit Care Med*. 2011;39(5):1036-1041.
6. Mann CD, Norwood MGA, Miller AS, Hemingway D; Leicester Colorectal Specialist Interest Group. Nonresectional palliative abdominal surgery for patients with advanced colorectal cancer. *Colorectal Dis*. 2010;12(10):1039-1043.
7. Fevang BT, Fevang J, Stangeland L, Soreide O, Svanes K, Viste A. Complications and death after surgical treatment of small bowel obstruction: a 35-year institutional experience. *Ann Surg*. 2000;231(4):529-537.
8. Smith GA, Perry JF Jr, Yonehiro EG. Mechanical intestinal obstructions: a study of 1,252 cases. *Surg Gynecol Obstet*. 1955;100(6):651-660.
9. Ti TK, Yong NK. The pattern of intestinal obstruction in Malaysia. *Br J Surg*. 1976;63(12):963-965.
10. Lo AM, Evans WE, Carey LC. Review of small bowel obstruction at Milwaukee County General Hospital. *Am J Surg*. 1966;111(6):884-887.
11. Deutsch AA, Eviatar E, Gutman H, Reiss R. Small bowel obstruction: a review of 264 cases and suggestions for management. *Postgrad Med J*. 1989;65(765):463-467.
12. Wenger NS, Greengold NL, Oye RK, et al; SUPPORT Investigators. Patients with DNR orders in the operating room: surgery, resuscitation, and outcomes: Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments. *J Clin Ethics*. 1997;8(3):250-257.
13. Cherniack EP. Increasing use of DNR orders in the elderly worldwide: whose choice is it? *J Med Ethics*. 2002;28(5):303-307.