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High Mortality in Surgical Patients With Do-Not-Resuscitate Orders

Analysis of 8256 Patients

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Objective: To evaluate outcomes of patients who undergo surgery with a do-not-resuscitate (DNR) order.

Design: Retrospective cohort study.

Setting: More than 120 hospitals participating in the American College of Surgeons National Surgical Quality Improvement Program from 2005 to 2008.

Patients: There were 4128 adult DNR patients and 4128 age-matched and procedure-matched non-DNR patients.

Main Outcome Measures: Outcomes were occurrence of 1 or more postoperative complications, reoperation, death within 30 days of surgery, total time in the operating room, and length of stay. The χ^2 test was used for categorical variables and *t* and Wilcoxon tests were used for continuous variables. Multivariate logistic regression was done to determine independent risk factors associated with mortality in DNR patients.

Results: Most DNR patients were white (81.5%), female (58.2%), and elderly (mean age, 79 years). Compared with non-DNR patients, DNR patients experienced longer length of stay (36% increase; $P<.001$) and higher complication (26.4% vs 31%; $P<.001$) and mortality (8.4% vs 23.1%; $P<.001$) rates. Nearly 63% of DNR patients underwent nonemergent procedures; they sustained a 16.6% mortality rate. After risk adjustment, DNR status remained an independent predictor of mortality (odds ratio, 2.2; 95% confidence interval, 1.8-2.8). American Society of Anesthesiologists class 3 to 5, age older than 65 years, and preoperative sepsis were among independent risk factors associated with mortality in DNR patients.

Conclusions: Surgical patients with DNR orders have significant comorbidities; many sustain postoperative complications, and nearly 1 in 4 die within 30 days of surgery. Do-not-resuscitate status appears to be an independent risk factor for poor surgical outcome.

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DO-NOT-RESUSCITATE (DNR) orders preclude the use of cardiopulmonary resuscitation (CPR) in a clinically unresponsive, pulseless patient.[1] These orders are generally associated with advanced disease[2,3] and may be surrogate markers of impending death.[1,4,5] Approximately 70% of patients in the United States die with a DNR order, which is often written within the 3 days immediately preceding death.[4,6]

See Invited Critique at end of article

Patients with a DNR order consent to a variety of surgical procedures ranging from palliative surgery to aggressive attempts at extension of life.[7,8] The goals of surgical interventions in such patients include gaining "additional time,"[9] improving quality of life, decreasing pain, or treating isolated problems, such as a fracture.[10]

Most studies of DNR surgical patients have focused on the ethical implications of a DNR order in the perianesthesia period.[10-13] Results of the Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatment were published more than a decade ago and included a subanalysis of 57 participant patients with DNR orders who underwent surgery. Wenger et al[7] concluded that DNR orders do not appear to hinder access to surgery and that many patients with poor short-term prognoses choose and receive surgery.

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The use of DNR orders has been increasing over the past decades[14]; up to 15% of patients with a DNR order have surgery.[15,16] There is a paucity of literature on the characteristics and surgical outcomes of DNR patients. The aims of this study were to characterize patients who have DNR orders and undergo surgery with regard to their demographic and clinical characteristics and to identify predictors of their short-term outcomes following surgery.

METHODS

DATA SOURCE

This was a retrospective analysis of adult patients with a preexisting DNR status who underwent surgery at more than 120 US hospitals participating in the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) included in the Participant Use Data File from 2005 to 2008. The ACS-NSQIP collects data on 135 variables, including preoperative risk factors, intraoperative variables, and 30-day postoperative morbidity and mortality for patients undergoing major surgical procedures in both the inpatient and outpatient settings. Baseline demographic and clinical characteristics, anesthesia type, operative details, and postoperative data included in the ACS-NSQIP Participant Use Data File are prospectively collected by trained nurses through medical record review and patient follow-up.

PATIENTS

In ACS-NSQIP, a patient is deemed DNR

> if the patient has had a DNR order written in the physician's order sheet of the patient's chart, and it has been signed or co-signed by an attending physician in the 30 days prior to surgery; (or) if the DNR order as defined above has been rescinded immediately prior to surgery in order to operate on the patient.[17]

A DNR variable is among 135 variables included in the ACS-NSQIP database. In this study, adult (≥18 years) DNR patients who underwent surgery in the NSQIP (2005-2008) data file were identified using this variable. The DNR patients were matched by age (±3-year age window) and procedure (using *Current Procedural Terminology* codes) to non-DNR patients. The match ratio was 1:1. Procedure matching was done using the *Current Procedural Terminology* variable, which specifies the code of the primary operative procedure.[17]

BASELINE CHARACTERISTICS

Patient demographic characteristics included age, sex, race, transfer status, and functional status prior to their acute illness and surgery. Clinical characteristics included preoperative laboratory values; inpatient vs outpatient procedure; emergent vs nonemergent surgery; American Society of Anesthesiologists classification; prior operation within 30 days of surgery, intraoperative blood transfusion requirement, and occurrences such as CPR; unplanned intubation or myocardial infarction; operative wound classification as defined by the primary surgeon; and highest level of resident surgeon present in the case (by postgraduate year). Preoperative laboratory values were modeled as categorical variables using established laboratory cutoff values.[18]

General comorbidities included hypertension requiring medication; diabetes mellitus (taking oral hypoglycemic medications or insulin); smoking status during the year prior to surgery; long-term steroid use; and current alcohol use (defined as consumption of >2 drinks per day in the 2 weeks prior to surgery). Pulmonary, cardiovascular, hepatobiliary, renal, neurologic, nutritional, immunity-related, and other comorbidities were based on definitions provided in the ACS-NSQIP user guide.[17]

Table 1. Groupings of *CPT* Codes for Common Procedures Done in DNR Patients, ACS-NSQIP (2005-2008)[a]

Procedure	*CPT* Code
Colectomy	44140, 44141, 44143 ,44144 ,44145, 44146, 44147, 44150, 44152, 44155, 44156, 44157, 44158, 44160, 44204, 44205, 44206, 44207, 44208, 44210, 44212, and 44213
Lower extremity amputation	27590, 27592, 27594, 27596, 27598, 27880, 27881, 27882, 27884, 27886, 27888, and 27889
Cholecystectomy	47562, 47563, 47564, 47600, 47605, 47610, 47612, and 47620
Small-bowel procedures	44050, 44010, 44020, 44021, 44050, 44055, 44110, 44120, 44121, 44125, 44130, 44602, 44603, 44604, 44605, 44615, 44620, 44625, 44626, 44640, 44661, 44700, 44799, 44800, 44180, 44187, 44188, 44200, and 44202
Exploratory laparotomy	49000
Femur fracture repair	27235, 27236, 27244, 27245, 27248, 27506, 27507, 27509, 27511, and 27513
Appendectomy	44950, 44955, 44960, and 44970

Abbreviations: ACS-NSQIP, American College of Surgeons National Surgical Quality Improvement Program; *CPT*, *Current Procedural Terminology*; DNR, do-not-resuscitate.
[a] Procedures done in more than 2% of study sample.

OUTCOMES

Clinical outcomes of interest were occurrence of 1 or more postoperative complications, reoperation, and death within 30 days of surgery. Economic outcomes of interest were total time spent in the operating room and hospital length of stay. Complications, recorded as dichotomous outcomes in the data set, were grouped into major and minor categories as defined by Dimick et al.[19] Major complications included reintubation, failure to wean/ventilator use for more than 48 hours, pneumonia, pulmonary embolism, myocardial infarction, cardiac arrest requiring CPR, stroke, coma lasting more than 24 hours, acute renal failure, renal insufficiency, wound dehiscence, deep wound infections, organ/space infections, severe sepsis, septic shock, and bleeding requiring 5 U or more of blood. Minor complications were superficial wound infection, urinary tract infection, deep venous thrombosis/thrombophlebitis, and peripheral nerve injury. Complications also were grouped by type or body system: respiratory, cardiac, urologic, neurologic, wound related, septic, and other (bleeding, deep vein thrombosis/thrombophlebitis). Mortality rates of DNR and non-DNR patients also were analyzed by the type of surgical procedure performed (identified by *Current Procedural Terminology* codes) (**Table 1**).

STATISTICAL ANALYSIS

Bivariate analyses comparing preoperative variables and outcomes of interest of DNR and non-DNR patients were performed using 2-tailed χ^2 analysis for categorical variables and 2-sided *t* and Wilcoxon rank sum tests for continuous variables. Continuous variables were not transformed. All *P* values <.05 were considered significant. Because the study was based on matched data, conditional logistic regression was used to determine risk factors associated with mortality for the overall sample.[20] Separate multivariate stepwise logistic regression mod-

Table 2. Demographic and Clinical Characteristics of DNR and Non-DNR Patients, ACS-NSQIP (2005-2008)[a]

Characteristic	% DNR (n=4128)	% Non-DNR (n=4128)	*P* Value
Demographic			
Age, y			Matched
18-44	4.7	4.7	
45-64	17.0	17.0	
65-80	29.7	29.7	.001
>80	48.7	48.7	
Female	58.2	54.1	
Race			
White	81.5	76.0	
Black	6.8	10.0	
Hispanic	3.2	4.5	<.001
Other	1.3	1.8	
Unknown	7.2	7.8	
Transfer status			
Home	68.2	87.3	
Acute care facility	8.3	4.7	<.001
Chronic care facility	22.2	7.2	
Other	1.3	0.7	
Functional status prior to surgery			
Independent	42.2	71.7	
Partially dependent	35.3	18.8	<.001
Totally dependent	22.5	9.6	
Preoperative laboratory values			
Albumin, <3.5 g/dL	71.3	50.3	<.001
Creatinine, >1.2 mg/dL	33.4	30.0	.001
White blood cell count, /μL			
<4000	5.1	4.8	
4000-11 000	58.9	68.2	<.001
>11 000	36.0	27.0	
Operative			
Emergent surgery	34.6	24.1	<.001
ASA class			
1-2	11.1	22.7	
3	48.7	55.8	<.001
4	37.5	20.3	
5	2.7	1.2	
Intraoperative blood transfusion, U			
None	84.4	88.8	
1	5.5	3.8	<.001
>1	10	7.5	

Abbreviations: ACS-NSQIP, American College of Surgeons National Surgical Quality Improvement Program; ASA, American Society of Anesthesiologists; DNR, do-not-resuscitate.

SI conversion factors: To convert albumin to grams per liter, multiply by 10; creatinine to micromoles per liter, multiply by 88.4; white blood cell count to $\times 10^9$/L, multiply by 0.001.

[a] Percentages have been rounded and may not add up to 100.

els were generated to determine risk factors of 30-day postoperative mortality for DNR and non-DNR patients. Odds ratios with 95% confidence intervals were calculated. A *P* value <.20 on bivariate analyses was used to identify preoperative variables that should be entered into multivariate regression models. A *P* value <.05 was the significance criterion used to identify independent risk factors in multivariate regression models.

Data analyses and management were performed using SPSS for Windows (version 17.0; SPSS Inc, Chicago, Illinois). The ACS-NSQIP Participant Use Data File is a public database with deidentified data; therefore, this study was granted exemption by our institutional review board.

RESULTS

Between 2005 and 2008, there were 4167 DNR patients in the ACS-NSQIP Participant Use Data File database. A 99% match rate yielded 4128 DNR patients and 4128 age- and procedure-matched non-DNR patients included in this study.

PATIENT CHARACTERISTICS

The mean (SD) age of the study sample was 79.1 (1.6) years (**Table 2**). Most DNR patients were female, white, and elderly. Compared with non-DNR patients, DNR patients were more likely to be admitted from an acute/chronic/other facility, have functional impairment, and have abnormal preoperative laboratory values. Approximately 27.1% and 12.8% of DNR and non-DNR patients, respectively, lost their independent functional status in the time between onset of illness and surgery (*P*<.001).

The most common surgical specialties involved in the care of DNR patients were general surgery (68.1%), followed by vascular surgery (25.1%), and orthopedics (4.1%). The DNR patients were more likely to have a higher American Society of Anesthesiologists class, inpatient procedure, contaminated or dirty operative wounds, and surgery without assistance of a surgery resident. Approximately 63% of DNR patients underwent nonemergent surgery, but as a group, they were more likely to have an emergent procedure than non-DNR patients (*P*<.001); they also were more likely to receive a blood transfusion (Table 2). Intraoperative myocardial infarction, unplanned intubation, and cardiac arrest requiring CPR were rare (0.7%), and occurrence of such intraoperative events in the groups was comparable (0.8% DNR and 0.6% non-DNR; *P*=.43).

The mean number of comorbidities for the study sample was 3.6 (**Table 3**); DNR patients had a mean of 4.3 comorbidities, while non-DNR patients had a mean of 3.1 comorbidities (*P*<.001).

OUTCOMES

Unadjusted Outcomes

The overall complication rate was 28.6% (**Table 4**). The DNR patients had higher complication rates than non-DNR patients (31% vs 26.4%; *P*<.001). Among patients who experienced complications, there was no significant difference in the mean number of complications DNR patients sustained compared with non-DNR patients (1.9 vs 2 complications, respectively; *P*=.70). There also were no significant differences in rates of reoperation (10.5% DNR vs 9.3% non-DNR; *P*=.06).

The overall mortality rate was 15.3%. Compared with non-DNR patients, more than twice as many DNR patients died within 30 days of surgery (8.4% vs 23.1%; *P*<.001). The DNR patients were more likely to die regardless of the urgency of the surgical procedure (35.5% vs 17.8% and 16.6% vs 5.5%; *P*<.001 for emergent and nonemergent procedures, respectively). Cardiopulmonary resuscitation was rare but associated with a high mor-

Table 3. Comorbidities of 8256 DNR and Non-DNR Patients, ACS-NSQIP (2005-2008)

Characteristic	% DNR (n=4128)	% Non-DNR (n=4128)	*P* Value
General			
Diabetes mellitus	27.5	21.2	<.001
Hypertension	70.9	69.0	.06
Current smoking	16.5	13.6	<.001
Alcohol use	4.5	2.5	<.001
Long-term steroid use	8.8	5.0	<.001
Cardiovascular			
Congestive heart failure	9.4	4.5	<.001
Myocardial infarction	4.5	2.4	<.001
Percutaneous coronary intervention	10.0	10.3	.64
History of cardiac surgery	14.7	13.9	.30
Angina	2.6	1.6	.002
Peripheral vascular disease	14.1	12.8	.09
Rest pain	12.7	11.4	.06
Pulmonary			
Ventilator dependent	4.8	3.5	.002
Chronic obstructive pulmonary disease	17.0	9.5	<.001
Pneumonia	5.9	2.3	<.001
Dyspnea	24.9	18.1	<.001
Hepatobiliary			
Ascites	6.7	3.6	<.001
Esophageal varices	0.7	0.2	.001
Renal			
Renal failure	3.8	1.7	<.001
Dialysis	7.8	4.8	<.001
Neurologic			
Impaired sensorium	9.5	3.9	<.001
Coma	0.9	0.5	.02
Transient ischemic attack	9.2	7.2	.001
Stroke with neurologic deficits	14.3	6.3	<.001
Stroke without neurologic deficits	6.5	5.7	.11
Central nervous system tumor	0.6	0.1	<.001
Paralysis[a]	9.0	3.2	<.001
Nutritional/immune/other			
Disseminated cancer	8.1	3.6	<.001
Recent chemotherapy	3.3	1.4	<.001
Recent radiotherapy	1.5	0.8	.008
Substantial weight loss	8.9	5.1	<.001
Bleeding disorder	21.1	14.9	<.001
Preoperative transfusion	2.4	0.9	<.001
Open wound	23.0	15.5	<.001
Preoperative sepsis	34.4	20.9	<.001

Abbreviations: ACS-NSQIP, American College of Surgeons National Surgical Quality Improvement Program; DNR, do-not-resuscitate.
[a] Paralysis includes quadriplegia, hemiplegia, and paraplegia.

tality rate that was comparable for DNR (88%) and non-DNR (83.3%) patients ($P=.49$).

Colectomy (16.8%), lower extremity amputation (11%), and cholecystectomy (9.1%) were the most common procedures performed in the study sample (**Figure 1**). Compared with non-DNR patients, DNR patients were more likely to die after every procedure analyzed. Mortality rates were highest after exploratory laparotomy for DNR and non-DNR patients (50.5% vs 20.1%, respectively); however, only about 4% of the study sample underwent this procedure.

Table 4. Unadjusted 30-Day Clinical Outcomes of DNR and Non-DNR Patients, ACS-NSQIP (2005-2008)

Characteristic	% DNR (n=4128)	% Non-DNR (n=4128)	*P* Value
Overall complications	31.0	26.4	<.001
Major complications	26.2	20.3	<.001
Minor complications	10.3	10.8	.54
Mortality	23.1	8.4	<.001
Complications by system or type			
Cardiac			
Cardiac arrest requiring CPR	1.2	1.5	.34
Myocardial infarction	0.8	0.6	.25
Pulmonary			
Failure to wean/ventilator use >48 h	9.0	7.4	.03
Reintubation	3.6	4.4	.12
Pneumonia	6.7	5.3	.04
Urologic			
Renal insufficiency	1.3	0.9	.14
Acute renal failure	2.0	1.4	.03
Urinary tract infection	5.1	4.6	.498
Central nervous system			
Stroke	0.9	1.0	.495
Coma >24 h	1.0	0.4	.002
Wound			
Surgical site infections[a]	6.1	7.9	.002
Dehiscence	1.3	1.1	.37
Septic	12.3	9.7	<.001
Other			
Bleeding requiring ≥5 U of blood	1.7	1.0	.02
DVT/thrombophlebitis	2.3	2.2	.19

Abbreviations: ACS-NSQIP, American College of Surgeons National Surgical Quality Improvement Program; CPR, cardiopulmonary resuscitation; DNR, do-not-resuscitate; DVT, deep venous thrombosis.
[a] Surgical site infections include superficial, deep, and organ/space wound infections.

Operative and hospital stay measures are provided in **Figure 2**. Mean (SD) time spent in the operating room for the overall sample was 154.1 (1) minutes. There was no difference in the proportion of patients who were still in the hospital 30 days after their surgery (3.8% DNR vs 3.3% non-DNR; $P=.21$).

Adjusted Outcomes

After adjustment for multiple risk factors, a DNR order remained an independent risk factor associated with death (adjusted odds ratio, 2.2; 95% confidence interval, 1.8-2.8; $P<.001$) (**Figure 3**). American Society of Anesthesiologists class 3 to 5, disseminated cancer, preoperative sepsis, impaired sensorium, and low serum albumin level were associated with death in DNR and non-DNR patients (**Table 5**). Although American Society of Anesthesiologists class remained the strongest predictor of mortality in both groups, this risk factor was more strongly associated with mortality in DNR patients compared with non-DNR patients.

COMMENT

In summary, DNR surgical patients appear to be more likely to have multiple comorbid conditions and func-

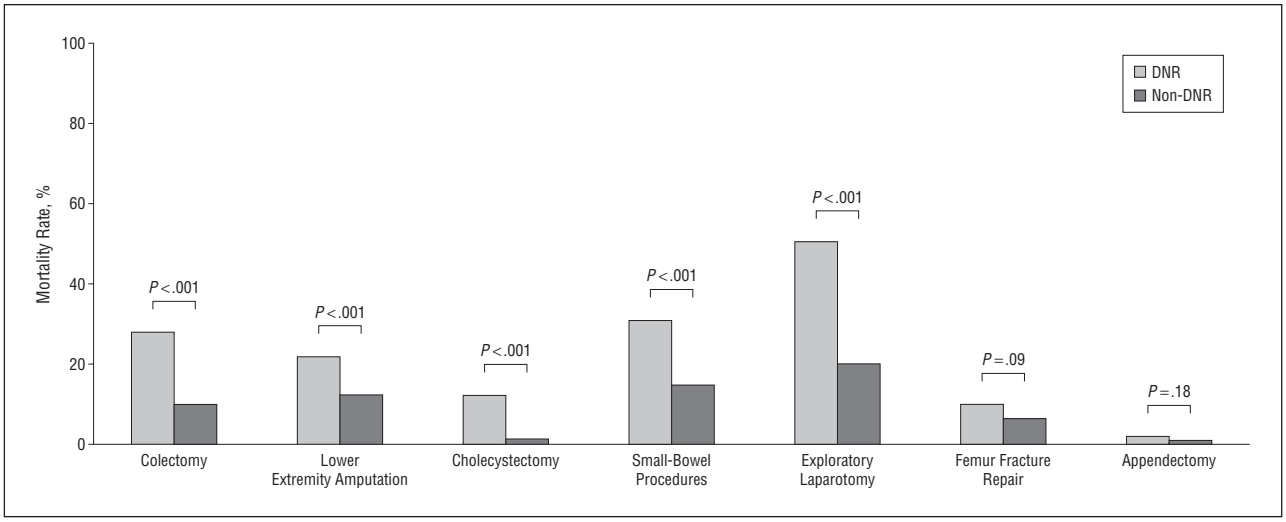

Figure 1. Unadjusted mortality rates of do-not-resuscitate (DNR) and non-DNR patients by procedure, American College of Surgeons National Surgical Quality Improvement Program (2005-2008). Procedures were done in 2% or more of study sample (decreasing frequency from left to right of x-axis).

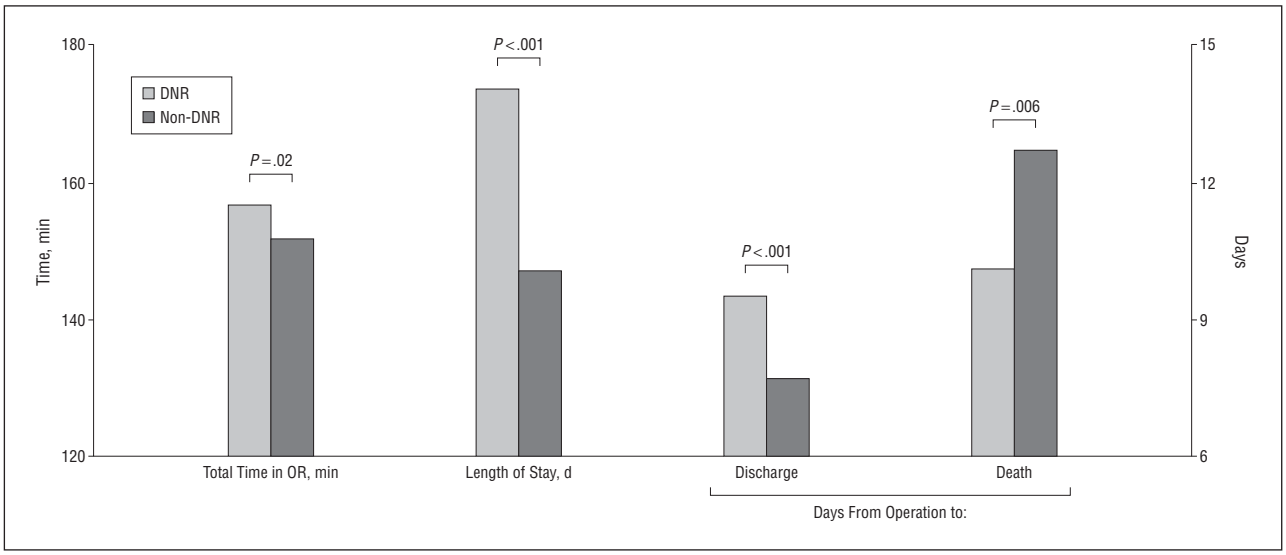

Figure 2. Unadjusted operative and hospital stay measures of do-not-resuscitate (DNR) and non-DNR patients, American College of Surgeons National Surgical Quality Improvement Program (2005-2008). OR indicates operating room.

tional impairment than age- and procedure-matched non-DNR surgical patients. This is consistent with the observation that a DNR order is often a proxy for poor prognosis.[1,3,21] The DNR patients who underwent surgery in the ACS-NSQIP data set had higher mortality compared with age- and procedure-matched non-DNR patients. A DNR order was independently associated with 30-day mortality after risk adjustment.

Our findings are supported by the few prior studies in the literature. Wenger et al[7] analyzed outcomes of 57 patients with DNR orders who underwent surgery, finding that 52% died within 30 days of surgery. The most common procedure in their cohort was tracheostomy (32%), which suggests there was critical illness with possible prolonged ventilator dependence. This might explain the high mortality rate observed in that study. Wenger et al did not evaluate whether a DNR order was independently associated with postoperative death. In another study involving more than 12 000 patients, Wenger et al[3] examined the outcomes of DNR patients 65 years and older (n=1468) admitted to a medical service. After risk adjustment, they found that DNR patients were 4 times more likely to die than non-DNR patients.

Similarly, Shepardson et al[22] found an increased risk of death for DNR stroke patients (n=2898) compared with non-DNR stroke patients. After adjusting for multiple risk factors using propensity scores, the odds ratio of mortality for DNR patients compared with non-DNR patients in their study ranged from 2.4 to 34, depending on when the DNR order was written during hospitalization.

The presence of "unmeasured sickness"[3] or "unmeasured prognostic factors"[22] in DNR patients could explain the observed increased risk of death among DNR patients. Beach and Morrison[23] examined the effect of DNR orders on the decisions of 241 physicians to provide life-prolonging treatments other than CPR for patients near the end of life. They found that the presence of a DNR

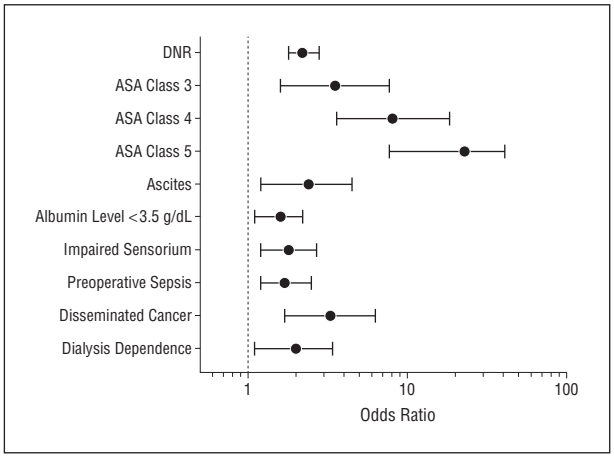

Figure 3. Multivariate analysis of independent predictors of mortality, American College of Surgeons National Surgical Quality Improvement Program (2005-2008). Multivariate logistic regression model adjusted for more than 30 risk factors. The x-axis is in logarithmic scale. ASA indicates American Society of Anesthesiologists; DNR, do-not-resuscitate. To convert albumin to grams per liter, multiply by 10.

Table 5. Independent Risk Factors Associated With Mortality in DNR and Non-DNR Patients, ACS-NSQIP (2005-2008)[a]

Risk Factor	OR (95% CI)	
	DNR	Non-DNR
ASA class		
3	3.8 (1.9-7.6)	3.4 (1.6-7.1)
4	6.8 (3.4-13.7)	7.2 (3.4-15.3)
5	18.5 (8.1-42.5)	11.6 (4.2-32.2)
Age, y		Not an independent risk factor
65-79	1.6 (1.2-2.1)	
≥80	2.0 (1.6-2.6)	
Disseminated cancer	2.1 (1.6-2.9)	3.1 (1.9-5.0)
Ventilator dependence	2.3 (1.6-3.4)	Not an independent risk factor
Preoperative sepsis	1.8 (1.5-2.2)	2.2 (1.6-3.0)
Ascites	1.8 (1.3-2.4)	Not an independent risk factor
Impaired sensorium	1.7 (1.3-2.2)	1.9 (1.3-3.0)
Albumin level <3.5 g/dL	1.8 (1.4-2.3)	2.2 (1.6-3.0)
Creatinine level >1.2 mg/dL	1.7 (1.4-2.0)	Not an independent risk factor
Dialysis dependence	Not an independent risk factor	2.4 (1.6-3.7)
Emergent surgery	Not an independent risk factor	1.9 (1.4-2.6)

Abbreviations: ACS-NSQIP, American College of Surgeons National Surgical Quality Improvement Program; ASA, American Society of Anesthesiologists; CI, confidence interval; DNR, do-not-resuscitate; OR, odds ratio.

SI conversion factors: To convert albumin to grams per liter, multiply by 10; creatinine to micromoles per liter, multiply by 88.4.

[a] Separate multivariate regression models (with death as the dependent variable) were created for DNR and non-DNR patients. Both models adjusted for more than 30 risk factors. Referents: ASA class 1 or 2; age younger than 65 years; albumin level more than 3.5 g/dL; creatinine level less than 1.2 mg/dL; and "not present" for all other risk factors.

order was negatively associated with physicians' intent to provide life-prolonging treatments unrelated to CPR. In a study of patients with acute heart failure, Chen et al[24] showed that DNR patients were less likely to receive any quality assurance measures for acute heart failure, including assessment of left ventricular function, anticoagulation, and nonpharmacologic interventions. In a study of DNR patients in a hospice setting, Hickman et al[25] found that up to 23% of DNR patients did not want antibiotic therapy, and up to 89% did not want interventions involving the use of feeding tubes or intravenous fluids. These studies indicate that patients and medical providers sometimes associate DNR orders with less aggressive medical care and often curtail treatments other than CPR.[1,21,24] All of these factors may have contributed to our finding of increased death soon after surgery among patients with a preoperative DNR order.

Most DNR patients in our study population underwent nonemergent procedures in spite of their baseline complexity of illness. The high postoperative mortality among these patients raises concerns about the appropriateness of some of these procedures. In addition, some DNR patients received CPR in the course of their surgical care. Cardiopulmonary resuscitation may have been performed in patients who rescinded their DNR order but were still coded as DNR in the NSQIP data set. Nonetheless, honoring a DNR order in the perioperative period remains a matter of debate.[9,12,13] Higher rates of functional impairment and multiple comorbidities among DNR surgical patients potentially affect recovery time and discharge disposition, all of which could explain the longer hospital length of stay observed among DNR patients.

Limitations of our study largely stem from the fact that the NSQIP Participant Use Data File is an administrative database; while there may be coding errors, NSQIP has been validated.[26] Markers of severity of illness such as cancer stage are not captured in the database. Our finding of increased risk of death among DNR patients who underwent nonemergent procedures may have been affected by the fact that some of these procedures were urgent rather than entirely elective. Information about patient preferences is not provided in ACS-NSQIP. Such data would potentially help to understand DNR patients' decisions to undergo nonemergent surgery and provide insight about whether some DNR patients prefer less aggressive overall care in the postoperative period. This study involves a subset of DNR patients who had a DNR order in the 30 days prior to surgery. The expected short-term survival of these patients is not provided in the database. The strengths of our study include its multiinstitutional nature, large sample size, and age and procedure matching, all of which attenuate bias related to patient and provider characteristics.

The DNR patients may have surgery to gain "additional time"[9]; nevertheless, our study demonstrates that almost a quarter of DNR patients die within 30 days of surgery. Informed consent and elicitation of the goals of surgery, especially as they relate to overall goals of care, are essential for guiding surgical decisions involving DNR patients and their families. Issues pertaining to DNR status are complex, and they should be anticipated long before the 30-day period leading to an operation. Additional research is needed to evaluate the decision making of DNR patients with respect to undergoing surgery, particularly in the nonemergent setting, and the impact of a preoperative DNR

order on postoperative surgical care and to determine the long-term outcomes of DNR patients by procedure.

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INVITED CRITIQUE

Surgery and Do-Not-Resuscitate Orders

The Real Risks Defined

Some of the most unpleasant yet memorable conversations we have as surgeons include those conducted in the wee hours of the night with patients facing terminal illness plus an acute surgical emergency. Often we experience the all-too-familiar ethical squeeze play—why am I the one to conduct this sad, wrenching conversation when the patient has already chosen to let death take its course?

Controversy over perioperative management of DNR orders has been widely recounted, culminating in the position of "required reconsideration" by esteemed groups including the American College of Surgeons and the