Research Square

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Preoperative Internal Medicine Evaluation Reduces 30-Day Postoperative Mortality Risk in Patients with Cancer

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Research

Keywords: preoperative care, cancer, surgical oncology, postoperative mortality

Posted Date: June 15th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-33938/v1

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Abstract

Background

The effect of preoperative internal medicine evaluations on cancer patients undergoing surgery is uncertain.

Methods

We conducted a retrospective cohort study of cancer patients who had been included in the National Surgery Quality Improvement Program from 2011–2014 to determine the effect of an Internal Medicine Perioperative Assessment Center (IMPAC) evaluation on the risk of 30-day mortality compared to that of patients who proceeded directly to surgery.

Results

Of the 11,577 participants, 3589 underwent an IMPAC evaluation. Among the propensity score-matched cohorts, the odds ratio (OR) of 30-day mortality was .39 (95% CI = .18-.84).

Conclusions

Our findings demonstrate that a preoperative internal medicine evaluation was associated with lower 30-day mortality.

Introduction

Surgeons commonly refer patients for evaluation by internists or specialists prior to surgery to optimize comorbidities and reduce the risk of postoperative complications.[1–3] This is particularly important in patients with cancer, as they may have higher rates of comorbidities than those without cancer.[4] However, to our knowledge, there are no published studies describing the effect of preoperative internal medicine evaluations on patients with cancer, and the medical literature for the general patient population has been mixed. Several studies have shown a reduction in in-hospital mortality, length of stay, and medically avoidable surgery cancellations in non-cancer patients who underwent a preoperative evaluation by an internist or anesthesiologist.[5,6] Other studies have shown that preoperative evaluations result in increased healthcare spending with no effect on care[7] and are associated with poorer clinical outcomes, including increased postoperative mortality.[8]

To clarify the effect of preoperative internal medicine evaluations on patients with cancer who are undergoing surgery, we compared the odds of 30-day postoperative mortality among patients who underwent a preoperative internal medicine evaluation with those of a matched cohort who did not.

Methods

Study Sample and Setting

We conducted a retrospective cohort study of data from January 2011 to December 2014 collected as part of The University of Texas MD Anderson Cancer Center's participation in the American College of Surgeons National Surgery Quality Improvement Program (NSQIP). NSQIP is the first nationally validated, risk-adjusted, outcomes-based program designed to measure and improve the quality of surgical care.[9] At each participating hospital, a surgical clinical reviewer retrospectively abstracts clinical data from the electronic medical record of randomly assigned patients, starting from 6 months prior to surgery until 30 days after surgery.[9] This study included patients ages 18 years or over who had a major inpatient or outpatient surgery at MD Anderson during the study period. The institutional review board at MD Anderson approved the study protocol.

Patients were referred for a preoperative internal medicine evaluation by the Internal Medicine Perioperative Assessment Center (IMPAC) at the discretion of the surgery team. Surgeons referred based on the presence of medical conditions that required additional management, such as cardiovascular, endocrine, or venous thromboembolic diseases. We considered patients as "IMPAC" patients if they had a preoperative internal medicine evaluation up to 60 days before surgery. IMPAC patients received at least one outpatient, preoperative internal medicine evaluation by an internal medicine physician or nurse practitioner. Controls proceeded directly to surgery without an IMPAC evaluation. Both IMPAC and control group patients underwent an anesthesia assessment and were eligible for referral to additional specialists for perioperative management.

Measures

Baseline demographics and clinical variables were abstracted by NSQIP-trained surgical clinical reviewers.[9] Clinical variables included functional status (independent, partially dependent, totally dependent), American Society of Anesthesiology (ASA) class, body mass index (BMI) class,

acute renal failure, ascites within 30 days, chronic obstructive pulmonary disease (COPD), congestive heart failure, diabetes, dialysis, disseminated cancer, dyspnea, hypertension, smoking within the last year, steroid use for a chronic condition, systemic sepsis within 48 hours of surgery (none, systemic inflammatory response syndrome (SIRS), sepsis or septic shock), ventilator-dependent and emergency case. We included patients who were classified as ASA class 5 or 6 or who were ventilator dependent, as these patients were ambulatory at the time of their IMPAC evaluation. We recoded surgical Current Procedural Terminology codes into 16 surgery types (Supplemental Table 1). The primary outcome of the study was 30-day mortality after surgery.

Statistical Analysis

We compared the characteristics of the IMPAC and control groups using Chi-square or Fisher's exact test. To reduce the effect of bias from non-random referral to IMPAC on the estimation of IMPAC evaluation on mortality, we performed exact matching on surgery type and propensity score matching with a caliper width equal to 0.2 on the other 19 NSQIP variables in a 1:1 ratio.[10] The propensity score was the conditional probability of an IMPAC evaluation, given all NSQIP risk variables in the multivariate logistic regression model. The balance on a variable between the IMPAC and control groups was assessed by absolute standardized differences before and after matching. An absolute standardized difference < 10% suggested an acceptable balance between the IMPAC and control groups.

We used logistic regression models using the double robust estimation to assess the difference in mortality between the two matched cohorts and between different patient groups, as defined by the NSQIP variables. We consolidated the levels of several variables (functional status, ASA class, systemic sepsis, diabetes status, dyspnea, and BMI classification) into two levels to obtain a more precise estimate of the odds ratio in model fitting. Variables with a significance level < .05 in the univariate models were considered the candidate variables of the multivariate logistic regression model and were used to estimate the effect of IMPAC evaluation on mortality. We used the forward selection method with IMPAC evaluation forced to remain in the models. A maximum of four variables were kept to avoid overfitting. A two-sided *P* value was considered significant. The R package “MatchIt” and SAS version 9.4 were used to perform the analyses.[11]

Results

Of the 77,000 patients who underwent surgery at MD Anderson during the study period, 11,577 were included in the NSQIP program. Table 1 compares selected demographics and medical comorbidities of IMPAC patients (n=3,589) and the control group (n=7,988). Before matching, IMPAC patients were older (*P*<.001) and more likely to be male (*P*<.001) than controls. They were also more likely to have the medical comorbidities shown in table 1 (*P*<.001 for all) except for disseminated cancer (*P*<.204). Urology and breast surgeries were the most common (Supplemental Table 1).There were 57 deaths among study participants within 30 days of surgery, 17/3572 (.47%) among IMPAC patients and 40/7948 (.50%) among controls.

Initially, IMPAC and control groups were imbalanced due to significant differences in the following variables: age group, sex, ASA class, BMI class, COPD, diabetes, dyspnea, hypertension, and smoking within the last year. The matching procedure identified 2,804 matched pairs and substantially reduced the imbalance on the variables used for matching (absolute standardized differences <10%, Supplemental Table 2). The univariate logistic regression results after matching are shown in Supplemental Table 3. In the multivariate logistic regression model (Table 2), the odds of death were 6.77 times higher in patients who had used steroids (95% CI=3.00, 15.30; P<.001), 11.70 times higher in patients with sepsis (95% CI=4.60, 29.70; P<.001), and 5.39 times higher in patients with dyspnea (95% CI=2.42, 12.00; P<.001). After adjusting for these other predictors, the odds of death within 30 days was lower (.39, 95% CI=.18, .84; P<.001) among IMPAC patients compared to controls.

Discussion

In this retrospective study, patients with cancer who underwent a preoperative internal medicine evaluation before elective surgery had lower odds of death in the 30 days after surgery than did matched control patients who did not. The IMPAC evaluation included multiple features that improved patient care. IMPAC clinicians performed evidence-based management of comorbidities, including anticoagulation, diabetes, and hypertension.[12] IMPAC clinicians placed orders directly rather than requiring surgeons to enact recommendations. Finally, while the IMPAC evaluation was generally a one-time visit, the staff identified high-risk patients for close follow-up by the inpatient general internal medicine consultation service during the postoperative period.

Our results are consistent with those of another study of 5,000 patients undergoing a preoperative internal medicine evaluation prior to elective surgery that showed a decrease in inpatient mortality (1.27–.36%, $P < .05$).[5] In contrast, a retrospective study of 250,000 patients undergoing major elective, non-cardiac surgery in Canada found that a preoperative internal medicine evaluation was associated with an increased risk of 30-day mortality (RR = 1.16, 95% CI = 1.07–1.25).[8] It is possible that this study was limited by the ability to adjust for the increased likelihood of being referred for a preoperative internal medicine evaluation among those with more chronic illnesses. To our knowledge, no published studies have specifically assessed the effect of preoperative internal medicine evaluations on clinical outcomes in patients with cancer. Future research focused on preoperative management is needed in order to identify strategies that may improve clinical outcomes.

As expected, we found that the presence of sepsis, chronic steroid use, or dyspnea prior to surgery was associated with an increased odds of death within 30 days after surgery. These results are consistent with prior research using NSQIP data that showed an increased risk of 30-day mortality among cancer and non-cancer patients with these conditions.[13]

Our study had limitations. As we evaluated patients who underwent elective surgery for cancer diagnoses, our results may not be generalizable to other populations. Patients who were referred for an IMPAC evaluation may have had a greater comorbidity burden than those who were not referred. However, because we implemented propensity score matching, those potential differences were likely minimized.

Conclusions

In summary, we found that preoperative internal medicine evaluation prior to elective surgery was associated with a lower risk of 30-day mortality among patients with cancer. While patients may benefit from seeing a general internist prior to surgery, further research is needed to determine which preoperative interventions affect outcomes and which patients are most likely to benefit.

List Of Abbreviations

ASA, American Society of Anesthesiology

BMI, body mass index

CI, confidence interval

COPD, chronic obstructive pulmonary disease

IMPAC, Internal Medicine Perioperative Assessment Center

NSQIP, National Surgical Quality Improvement Program

RR, relative risk

SIRS, systemic inflammatory response syndrome

OR, odds ratio

Declarations

Ethics approval and consent to participate

The institutional review board at MD Anderson Cancer Center approved the study protocol.

Consent for publication

Not applicable

Availability of data and materials

The data that support the findings of this study are available from the National Surgical Quality Improvement Program but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the National Surgical Quality Improvement Program.

Competing interests

The authors declare that they have no competing interests

Funding

Supported by the NIH/NCI through Cancer Center Support Grant P30CA016672 and used the Biostatistics Resource Group.

Authors' contributions

TS (analysis and interpretation of data, drafting the article, and final approval of the version to be published). AG (contribution to conception and design, acquisition of data, analysis and interpretation of data, and final approval of the version to be published). JF (acquisition of data, analysis and interpretation of data, and final approval of the version to be published). CL (acquisition of data, analysis and interpretation of data, revising the article critically for important intellectual content and final approval of the version to be published). HL (acquisition of data, analysis and interpretation of data, revising the article critically for important intellectual content and final approval of the version to be published). SP (analysis and interpretation of data and final approval of the version to be published). JH (analysis and interpretation of data, drafting the article, revising the article critically for important intellectual content, and final approval of the version to be published). SS (contribution to conception and design, acquisition of data, analysis and interpretation of data, and final approval of the version to be published. All authors are in an agreement to be accountable for all aspects of the work, thereby ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The authors read and approved the final manuscript.

Acknowledgements

The authors would like to thank Ann Sutton in MD Anderson’s Scientific Publications, Research Medical Library for her contributions in editing.

References

1. Wijeysundera DN, Austin PC, Beattie WS, Hux JE, Laupacis A. Variation in the practice of preoperative medical consultation for major elective noncardiac surgery: a population-based study. Anesthesiology. 2012;116(1):25–34.
2. Riggs KR, Segal JB. What is the rationale for preoperative medical evaluations? A closer look at surgical risk and common terminology. Br J Anaesth. 2016;117(6):681–4.
3. Pausjenssen L, Ward HA, Card SE. An internist's role in perioperative medicine: a survey of surgeons' opinions. BMC Fam Pract. 2008;9:4.
4. Geraci JM, Escalante CP, Freeman JL, Goodwin JS. Comorbid disease and cancer: the need for more relevant conceptual models in health services research. J Clin Oncol. 2005;23(30):7399–404.
5. Vazirani S, Lankarani-Fard A, Liang LJ, Stelzner M, Asch SM. Perioperative processes and outcomes after implementation of a hospitalist-run preoperative clinic. J Hosp Med. 2012;7(9):697–701.
6. Blitz JD, Kendale SM, Jain SK, Cuff GE, Kim JT, Rosenberg AD. Preoperative evaluation clinic visit is associated with decreased risk of in-hospital postoperative mortality. Anesthesiology. 2016;125(2):280–94.

7. Auerbach AD, Rasic MA, Sehgal N, Ide B, Stone B, Maselli J. Opportunity missed: medical consultation, resource use, and quality of care of patients undergoing major surgery. Arch Intern Med. 2007;167(21):2338–44.
8. Wijeysundera DN, Austin PC, Beattie WS, Hux JE, Laupacis A. Outcomes and processes of care related to preoperative medical consultation. Arch Intern Med. 2010;170(15):1365–74.
9. American College of Surgeons National Surgical Quality Improvement Program. https://www.facs.org/quality-programs/acs-nsqip/about. Accessed February 17, 2020.
10. Austin PC. A critical appraisal of propensity-score matching in the medical literature between 1996 and 2003. Stat Med. 2008;27(12):2037–49.
11. Ho D, Imai K, King G, Stuart E. MatchIt: nonparametric preprocessing for parametric causal inference. J Stat Softw. 2011;42:1–28.
12. Sahai SK. Perioperative assessment of the cancer patient. Best Pract Res Clin Anaesthesiol. 2013;27(4):465–80.
13. Cohen ME, Bilimoria KY, Ko CY, Hall BL. Development of an American College of Surgeons National Surgery Quality Improvement Program: Morbidity and Mortality Risk Calculator for Colorectal Surgery. J Am Coll Surg. 2009;208(6):1009–16.

Tables

TABLE 1. Selected Characteristics of Patients Receiving an Internal Medicine Perioperative Assessment Center (IMPAC) Evaluation vs Controls

Characteristic	IMPAC (n = 3589), n (%)	Controls (n = 7988), n (%)	*P* Value
Age group (years)			<.001
<65	1805 (50)	6118 (77)	
65-74	1188 (33)	1419 (18)	
75-84	493 (14)	393 (5)	
≥85	103 (3)	58 (1)	
Sex			<.001
Female	1844 (51)	4846 (61)	
Male	1745 (49)	3142 (39)	
ASA class			<.001
1-2	312 (9)	1991 (25)	
3-5	3258 (91)	5917 (75)	
BMI class (kg/m^2)			<.001
Underweight or normal (≤24.9)	898 (25)	2553 (32)	
Overweight (≥25)	2691 (75)	5435 (68)	
COPD	187 (5)	136 (2)	<.001
Congestive heart failure	24 (1)	7 (0)	<.001
Diabetes	831 (23)	558 (7)	<.001
Dialysis	13 (0)	9 (0)	.004
Disseminated cancer	428 (12)	1020 (13)	.204
Dyspnea	309 (9)	305 (4)	<.001
Hypertension	2307 (64)	2662 (33)	<.001
Smoking within the last year	506 (14)	834 (10)	<.001
Emergency Case	22 (1)	86 (1)	.016

Abbreviations: ASA, American Society of Anesthesiologists; COPD, chronic obstructive pulmonary disease; BMI, body mass index.

TABLE 2. Multivariate Logistic Regression Model of 30-Day Mortality by Order in Model

Order	Parameter	OR (95% CI)	*P* Value
Always in	IMPAC admission		
	No	Ref	
	Yes	0.39 (.18, .84)	.016
1	Sepsis		
	None	Ref	
	SIRS, sepsis, or septic shock	11.7 (4.60, 29.7)	<.001
2	Steroid use for chronic condition		
	No	Ref	
	Yes	6.77 (3.00, 15.3)	<.001
3	Dyspnea		
	No	Ref	
	Moderate exertion and at rest	5.39 (2.42, 12.0)	<.001

Abbreviations: OR, odds ratio; CI, confidence interval; IMPAC, Internal Medicine Perioperative Assessment Center, SIRS, systemic inflammatory response syndrome.

Supplementary Files

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