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Can the American College of Surgeons Risk Calculator Predict 30-Day Complications After Knee and Hip Arthroplasty?

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ABSTRACT

Accurate risk stratification of patients undergoing total hip (THA) and knee (TKA) arthroplasty is essential in the highly scrutinized world of pay-for-performance, value-driven healthcare. We assessed the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) surgical risk calculator's ability to predict 30-day complications using 1066 publicly-reported Medicare patients undergoing primary THA or TKA. Risk estimates were significantly associated with complications in the categories of any complication ($P = .005$), cardiac complication ($P < .001$), pneumonia ($P < .001$) and discharge to skilled nursing facility ($P < .001$). However, predictability of complication occurrence was poor for all complications assessed. To facilitate the equitable provision and reimbursement of patient care, further research is needed to develop accurate risk stratification tools in TKA and THA surgery.

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Total hip (THA) and total knee arthroplasty (TKA) are highly effective procedures that measurably improve quality of life for patients suffering from symptomatic arthritic conditions [1]. Demand for THA and TKA is predicted to rise exponentially in the United States over the coming decades as a function of a growing and increasingly elderly population as well as expanding surgical indications that include the young and active patient [2]. These procedures carry non-negligible risks of complications [3,4] and have been targeted as priorities for quality improvement [5]. Several pre-surgical patient-specific factors have been associated with increased risk for a variety of adverse events [6–10] following THA and TKA surgery.

Post-arthroplasty complications can be costly and are economically burdensome to our already strained healthcare systems [11]. With the continued rollout of the Patient Protection and Affordable Care Act, the occurrence of certain adverse outcomes following THA and TKA will be publicly reported and will factor into quality related reimbursement schemes [12]. Risk stratification models are intended to facilitate valid comparison of risk-adjusted arthroplasty outcomes and intense research is currently focused on understanding and predicting risk of complication after arthroplasty [13,14].

The American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) is a validated, prospective, multicenter database that tracks surgical data from over 500 hospitals. The program currently offers an online, publicly available, surgical risk calculator [15]. An individual patient's demographic and pre-surgical comorbidity data are input, and a risk probability is returned for each of eleven complication categories. We aim to assess the ability of the ACS-NSQIP surgical risk calculator to predict 30-day complications after primary TKA and THA in a cohort of publicly reported Medicare patients.

Methods

ACS-NSQIP Surgical Risk Calculator

The ACS-NSQIP surgical risk calculator was derived from a dataset of over 1.4 million cases from 393 NSQIP-participating institutions [15]. The database includes information from participants in 43 states with hospitals ranging from rural community hospitals to large academic centers, generating a broad data set that has been widely used to identify national trends in various surgical fields [16]. Each site employs surgical clinical reviewers who are rigorously trained to collect data through chart review and, in certain cases, discussion with the treating surgeon and/or patient, allowing for robust, quality data with demonstrated

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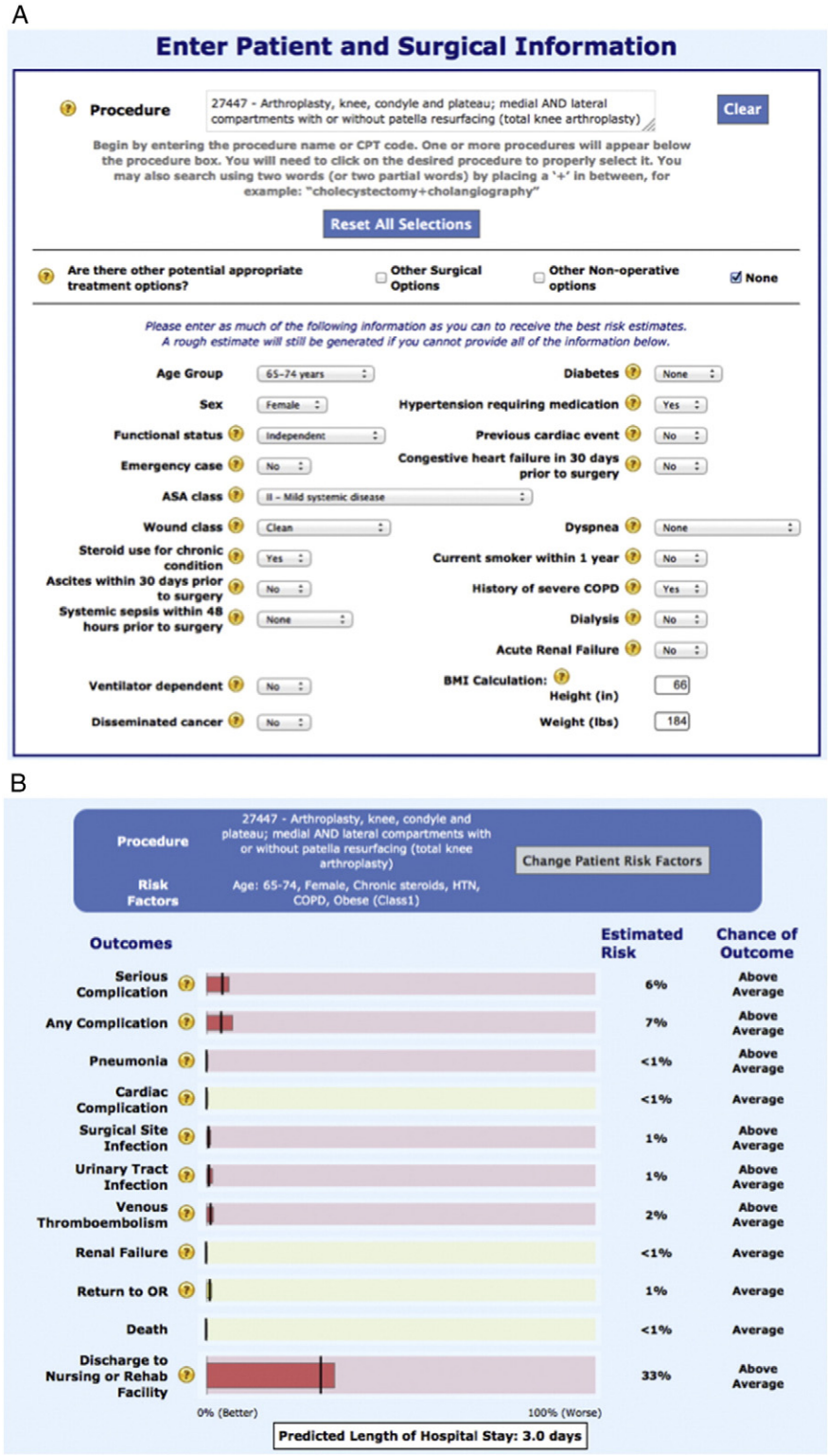

Fig. 1. Screenshots of the ACS-NSQIP surgical risk calculator (http://riskcalculator.facs.org). (A) Patient data entry. (B) Risk estimates and projected length of stay report.

inter-rater reliability [17,18]. The risk calculator cases were collected between 2009 and 2012, comprised 2805 different CPT codes, and spanned all surgical subspecialties. Twelve percent of cases included were coded as "orthopedics". Risk prediction models were created using both the CPT code as well as select clinical risk factors in random intercept, fixed slope hierarchical models [15].

A risk calculator online user interface (Fig. 1A) was developed and first made publically available in 2013. To use the calculator, the CPT code for the planned procedure as well as patient specific data and case variables are entered. The input variables with corresponding options include: age group (<65, 65–74, 75–84, and >85 years), sex, functional status (independent, partially dependent, totally dependent), emergency case status, American Society of Anesthesiologists (ASA) class, wound class, chronic steroid use, ascites within prior 30 days, systemic sepsis with prior 48 hours, ventilator dependence, disseminated cancer, diabetes (none, oral medication, insulin), hypertension

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