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Original article

The effect of surgical duration of transurethral resection of bladder tumors on postoperative complications: An analysis of ACS NSQIP data

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Abstract

Introduction: Transurethral resection of bladder tumor (TURBT) is a common procedure used in the diagnosis and treatment of bladder cancer. Despite how often it is performed, not much is known about the risk factors for complications. Traditional surgery has an increase in morbidity and mortality with increasing operative duration. We assess the effect of operative duration on TURBT complications.

Methods: The years 2006 to 2012 of the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) were queried for patients undergoing TURBT. We separated patients into 4 groups based on operative time: 0 to 30 minutes, 30.1 to 60 minutes, 60.1 to 90 minutes, and greater than 90 minutes. Standard statistical analysis including multivariate regression was performed to determine predictors of complications.

Results: A total of 10,599 TURBTs were included in our analysis. The overall complication rate for TURBT was 5.8% and there was an increase in the rate of complications seen as operative duration increased, which remained after controlling for age, comorbidities, tumor size, and American Society of Anesthesiology classification. Increased operative duration was associated with a greater risk of postoperative urinary tract infection, sepsis or septic shock, pulmonary embolism/deep venous thrombosis, reintubation or failure to wean, myocardial infarction, and death. Larger tumors were related to an increased odds of requiring blood transfusions.

Conclusions: Using a contemporary multicenter cohort of TURBTs from the ACS NSQIP database, we demonstrate that increased operative duration is associated with serious postoperative complications. This association was found to persist even after adjusting for patient age, comorbidities, tumor size, and functional status.

Keywords: Bladder cancer; TURBT; Complications; Outcomes

1. Introduction

There will be roughly 75,000 new cases of bladder cancer diagnosed in the United States in 2014 and an estimated 570,000 Americans are living with bladder cancer today [1]. Transurethral resection of bladder tumor (TURBT) is the standard by which bladder cancer is diagnosed, staged, and for most patients, treated. As non–muscle-invasive tumors recur greater than 50% of the time and several indications exist for re-resection [2], TURBT is a commonly performed procedure for urologists. Though new modalities for therapy are under development [3], including laser ablation [4], monopolar or bipolar resection remains the gold standard.

TURBT remains a technically challenging procedure despite the high volume performed in the United States. It has the highest rate of readmission among common outpatient urologic surgeries [5], yet there are few robust studies examining postsurgical complications. This is in stark contrast to the relative wealth of studies in other endourology procedures such as transurethral resection of prostate. With the exception of an isolated Veterans Affairs (VA) study by Hollenbeck et al. [6] in 2006, there is little data that details postoperative adverse events in TURBT specifically.

TURBT complications can be subdivided into 2 general categories: medical complications from anesthesia and those

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related to the surgical resection. The former is particularly important to practitioners as bladder cancer often occurs in the context of serious comorbidities, including coronary and peripheral arterial disease and chronic obstructive pulmonary disease. The inherent surgical risks associated with the resection include infection, bleeding, perforation, and urethral damage.

Here we analyze TURBT complications from the perspective of operative duration, as this variable is modifiable and thus relevant to practitioners. Increased surgical time is historically associated with a greater risk of morbidity and mortality and has been studied in other endoscopic urologic procedures [6,7]. We apply the same reasoning to better define the effect of longer operative time on the risk of postoperative complications after TURBT using a large multi-institutional surgical safety database. Such data is a crucial first step to determining if becoming a more time-efficient resectionist can improve patient outcomes.

2. Methods

2.1. Database description

In this study, years 2006 to 2012 of the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) were queried for patients undergoing TURBT. The NSQIP database, an initiative by the American College of Surgeons, records 30-day safety outcomes and over 130 variables on patients undergoing major inpatient or major outpatient surgeries. Only cases from patients aged 16 and older are included in the data set. Trained nurse abstractors are responsible for inputting institutional data, and the inter-rater reliability studies by the American College of Surgeons have found a 2.5% disagreement rate [8]. Further information on NSQIP is available through the American College of Surgeons.

2.2. Patient selection and study design

Current Procedure Terminology (CPT) codes (52234, 52235, and 52240) were used to identify TURBTs in NSQIP from 2006 to 2012. Cases were excluded if the patient underwent a second major procedure during the same admission, which would confound any assessment of complications. Retained patients were then stratified by total operative duration: 0 to 30 minutes, 30.1 to 60 minutes, 60.1 to 90 minutes, and greater than 90 minutes. Operative duration is strictly defined in NSQIP as total time of the operation; anesthesia time and total operating room time were not used to avoid measuring delays in patient transfer to the operating table, patient preparation, and induction of anesthesia.

2.3. Outcomes and statistical analysis

The primary outcome was the total incidence of medical complications across the operative duration categories. Secondary outcomes were the incidences of the individual medical complications. Multivariate regression modeling adjusted for patient age, tumor size, comorbidities, and American Society of Anesthesiology (ASA) classification when analyzing operative duration in relation to medical complication rates. A comorbidity count of more than 35 concurrent medical conditions tracked by NSQIP was used in the regression models. IBM SPSS v22.0 software was used for all statistical analyses which included chi-square test for reporting proportions and analysis of variance for comparing continuous variables.

3. Results

From 2006 to 2012, 10,559 patients underwent TURBT and were included in our study. Basic demographics and patient characteristics including comorbidity count, ASA classification, and tumor size can be found in Table 1. Overall complication rate and mean operative duration for all groups can be found in Table 2. Of note, most procedures or 58% ($n = 6{,}092$), were finished within 30 minutes (average time 17.9 min), although 4% ($n = 424$) lasted longer than 90 minutes (mean 132.1 min). Average operative time was 34.3 minutes (standard error 31.4 min) for all patients. Breakdown of tumor size in our cohort based on CPT code was: small tumors 42.3% (4,484), medium tumors 34.2% (3,629), and large tumors 23.1% (2,449). The rates of any complication in each group were 4.0%, 5.7%, and 7.9%, respectively ($P < 0.001$).

The cumulative incidence of medical complications demonstrated a direct and significant increase with operative duration (Table 2). Multivariate regression analysis confirmed the linear increase in complications across increasing operative duration after adjusting for patient age, comorbidities, tumor size and ASA classification. Procedures lasting greater than 90 minutes had a 2.5 times higher odds (95% CI: 1.8–3.5, $P < 0.001$), whereas those lasting between 30 to 60 and 60 to 90 minutes both had a 1.6 higher odds (95% CI: 1.3–2.0, $P < 0.001$; 95% CI: 1.2–2.1, $P = 0.003$, respectively) of being associated with a medical complication, compared with those procedures completed within 30 minutes. Sex was not used in multivariate analysis as there were no significant associations between sex and any of our end points on univariate analysis besides post-TURBT stroke.

The incidence of medical complications and mortality can be found in Table 3. The following complications were significantly more common with increased operative duration on univariate analysis: renal insufficiency, urinary tract infection (UTI), sepsis or septic shock, pulmonary embolism/deep venous thrombosis, reintubation or failure to wean, myocardial infarction, and death. Table 4 displays the results of multivariate regressions for the effect of operative duration on the frequency of the above medical complications after adjusting for patient age, comorbidities,