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Near-perfect compliance with SCIP Inf-9 had no effect on catheter utilization or urinary tract infections at an academic medical center

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ABSTRACT

Background: The Joint Commission's SCIP Inf-9 mandated early removal of indwelling urinary catheters (IUCs), but the impact of compliance on catheter-associated urinary tract infection (CAUTI) and postoperative urinary retention (POUR) are unknown.

Methods: Retrospective pre- and post-intervention study at a single tertiary academic medical center of all patients undergoing general surgery procedures with an IUC placed at the time of surgery who were admitted for at least two days before and after a Best Practice Advisory was put in place to improve compliance with SCIP Inf-9.

Results: A total of 1036 patients were included (468 pre-intervention; 568 post-intervention). POUR occurred in 13% of patients and CAUTI in 0.8%. There was no change in POUR, CAUTI, or catheter utilization after the Best Practice Advisory was initiated. Both POUR and CAUTI predicted longer lengths of stay.

Conclusions: Near-perfect SCIP Inf-9 compliance had no effect on the CAUTI rate at our institution.

Summary: Implementation of a Best Practice Advisory that ensured near-perfect compliance with a SCIP process measure designed for early indwelling urinary catheter removal had no measurable effect on catheter associated urinary tract infections, catheter utilization, or urinary retention. Early catheter removal was associated with double the odds of urinary retention.

1. Introduction

Indwelling urinary catheters (IUCs) are ubiquitous in the postoperative setting and have a temporal association with urinary tract infections (UTIs).[1] The cost burden of catheter-associated UTIs (CAUTIs) has been estimated from $290 to $400 million annually.[2,3] IUC exposure of over two days is associated with increased CAUTI risk, with catheter duration considered a modifiable risk factor for CAUTI.[1,3]

To reduce nosocomial surgical complications, and CAUTIs specifically, the Centers for Medicare & Medicaid Services (CMS) and the Centers for Disease Control and Prevention introduced the Surgical Care Improvement Project (SCIP) in 2005. The goal of SCIP was to decrease the rates of surgical complications at least 25% by 2010.[4] In 2008, to discourage hospitals from billing for preventable infections, the CMS stopped reimbursing hospitals for the care of CAUTIs, a practice also referred to as nonpayment.[5] SCIP Inf-9 was introduced the following year to further reduce CAUTIs; this required that an IUC be removed by postoperative day two (with day of surgery being day zero) unless specific exemption criteria were met.[6]

At our institution, compliance with SCIP Inf-9 varied. In 2014, we initiated a Best Practice Advisory (BPA) in the electronic health record (EHR) that triggered an alert for patients with IUCs still in place 48 h after surgery. The BPA required providers to either remove the IUC, or document why the catheter was continued. As a result, SCIP Inf-9 compliance immediately increased to over 90%.

One potential consequence of early IUC removal is postoperative urinary retention (POUR), which was reported to occur in 22% of patients after colorectal surgery.[7] Compared to CAUTIs, the burden of POUR is less well studied and understood. Male gender, increasing age, surgery type, and medical comorbidities all have been found to predict POUR, and the occurrence of POUR is associated with longer lengths of stay, patient discomfort, UTIs, and noninfectious complications.[8]

The goal of this study was to examine the clinical impact of near-

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perfect SCIP Inf-9 compliance on patient outcomes after general surgery and to determine whether there was a resulting decrease in CAUTIs. We also sought to determine the incidence of POUR before and after the BPA was initiated, the risk factors for CAUTI and POUR in this patient population, and the impact of CAUTI and POUR on length of stay.

2. Materials and methods

2.1. Study design

We performed a retrospective pre- and post-intervention study of an IUC-related quality initiative at a single tertiary care institution. In May of 2014, our institution created a BPA within the EHR that required physicians to select a reason for IUC continuation prior to writing any additional orders if the catheter had been in for 48 h after surgery. The ordering physician could choose from a drop-down menu of reasons for IUC continuation, or alternatively, discontinue the IUC. We chose 7 months previous to this change (June–December 2013) as the "before" group, and 7 months after this change (June–December 2014) as the "after" group in order to study the effect of the BPA on compliance and outcomes. The University of California, San Francisco Committee on Human Research approved this study.

We identified adult patients aged 18 years or older who underwent general surgery procedures and who stayed in the hospital for at least two days following surgery. Patients who had an IUC placed at the time of surgery were included. We excluded patients with an IUC placed before the time of surgery, those who underwent concurrent urologic surgery, and patients who stayed longer than two weeks in the hospital postoperatively as these patients were likely to be outliers in terms of their hospital trajectory.

A quality improvement analyst performed a chart review for IUC-related data that included placement and removal time, placement time of subsequent IUC insertions, and occurrence of CAUTI. This data was spot checked by a quality improvement nurse. One investigator verified missing data and reviewed the EHR of all patients with positive CAUTIs to verify data integrity.

2.2. Definitions

The catheter utilization rate was defined as the total number of catheter days per total patient days. Our UTI and CAUTI definitions were obtained from the Centers for Disease Control's National Healthcare Safety Network.[9] We defined symptomatic UTI based on the definition as the presence of documented symptoms in the medical record (one of the following: fever $> 38\ ^{\circ}C$, suprapubic pain, frequency, urgency or dysuria at the time of culture) and a positive urine culture ($\leq$2 bacteria; one with at least 100,000 CFU). Urine cultures that grew yeast or mixed flora were not considered to be an infection. To be a CAUTI, the UTI must have occurred within 48 h after catheter placement with the catheter still in place, or within 48 h of catheter removal. The CAUTI rate was defined as the number of CAUTIs per 1000 catheter days. We documented POUR if a second IUC was inserted after the initial one was discontinued. Length of stay was measured from the date of the operation to discharge.

2.3. Predictor and outcome measures

Predictor variables included patient age, gender, body mass index, surgeon specialty (general, surgical oncology, colorectal, or endocrine), area of focus (upper gastrointestinal, hernia, colon, pelvis, hepatobiliary, pancreas, etc.), operative approach (open, laparoscopic, robotic, or perineal), emergent status, history of benign prostatic hypertrophy in a man, epidural placement, intraoperative fluid volume, duration of surgery, American Society of Anesthesiology (ASA) class, procedure length, and procedure type. At our institution, individual surgeon preference dictates the timing of IUC removal in patients with epidural catheters. Primary outcome measures included CAUTI rate, device utilization rate, POUR, and length of stay.

2.4. Statistical analysis

All data transformation and analysis was performed using Stata version 13 (College Station, TX). All reported p-values were 2-sided with a significance level of 0.05. Between-group differences in baseline characteristics were analyzed using a chi-squared test for dichotomous variables and a Wilcoxon rank sum test for skewed continuous outcomes and rates. Percentages were rounded to the nearest whole number unless that number was zero. Logistic regression adjusted for catheter time was used to identify risk factors for CAUTI and POUR. Covariates of interest were first tested in univariate then in multivariate logistic regression analyses and concordance statistic (c-statistic, or the area under the receiver operating curve) and Hosmer-Lemeshow goodness of fit with groups of 10 (in this test a p-value over 0.05 implies that the model is correctly specified) were checked. Because length of stay was a skewed outcome, we used a negative binomial regression used for analysis.

3. Results

3.1. Patient characteristics

A total of 1036 patients met inclusion criteria; 468 (45%) in the before-BPA group and 568 (55%) in the after-BPA group (Table 1). There were no between group differences in terms of age or gender. In the after-BPA group, there were more robotic cases (3% vs. 1%, $p = 0.05$) and a higher incidence of postoperative epidural usage (42% vs. 34%, $p = 0.006$). The latter is likely the result of enhanced recovery protocols implemented during that time period. The median IUC duration in both groups was 1.7 days.

3.2. Unadjusted outcomes

The urinary catheter utilization rate was unchanged after BPA implementation (0.38 vs. 0.4 total IUC days per total patient days, $p = 0.14$, Table 2). The CAUTI rate was also not significantly different (2.8 vs. 3.7 number of CAUTIs per total catheter days $\times$ 1000, $p = 0.7$). POUR occurred in 12% in the before-BPA group and in 13% of the after-BPA group ($p = 0.89$). The median length of stay was 5.2 days in the before-BPA group and 5.3 days in the after-BPA group. In the after-BPA group, 43% of patients met exemption criteria with the most common reason being for an epidural (Table 3).

3.3. Predictors of CAUTI and POUR

In multivariate logistic regression controlling for age and gender, IUC duration of >4 days was associated with 6 times the odds of CAUTI as compared to $\leq$2 days ($p = 0.04$, Table 4). For this model, the c-statistic was 0.74 and goodness of fit p-value 0.9. When risk factors for POUR were examined, IUC duration was inversely proportionate to risk, with 2–4 days being associated with half the odds of POUR ($p = 0.003$), and IUC duration of >4 days associated with one third the odds of POUR ($p < 0.001$, Table 5). Age also was a predictor of POUR, and female gender was protective from POUR, with an odds about half that of male patients. Finally, patients with an epidural catheter were 50% more likely to develop

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