



# Elimination of Routine Urinalysis before Elective Orthopaedic Surgery Reduces Antibiotic Utilization without Impacting Catheter-associated Urinary Tract Infection or Surgical Site Infection Rates

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**Purpose:** Routine preoperative urinalysis has been the standard of care for the orthopedic population for decades, regardless of symptoms. Studies have demonstrated antibiotic overuse and low concordance between bacteria cultured from the surgical wound and the urine. Testing and treatment of asymptomatic urinary tract colonization before total joint arthroplasty (TJA) is unnecessary and increases patient risk. We investigated reducing antibiotic use by (1) modifying testing algorithms to target patients at risk, (2) modifying reflex to culture criteria, and (3) providing treatment guidelines.

**Materials and Methods:** A pre-post study was conducted to determine identify the impact of eliminating universal urinalysis prior to TJA on surgical site infection (SSI) and catheter-associated urinary tract infection (CAUTI) rates and number of antibiotic prescriptions. Patients who underwent primary hip or knee TJA or spinal fusions from February 2016 to March 2018 were included. Patient data was collected for pre- and post-practice change period (February 2016-October 2016 and August 2017-March 2018). Patient demographics, urinalysis results, cultures, and prescriptions were analyzed retrospectively from every tenth chart in the pre-period and prospectively on all patients in the post-period.

**Results:** A total of 4,663 patients were studied. There was a 96% decrease in urinalyses performed ( $P<0.0001$ ), and a 93% reduction rate in antibiotic utilization ( $P<0.001$ ). No significant difference in SSI and CAUTI rates was observed ( $P>0.05$ ).

**Conclusion:** The elimination of routine urinalysis before orthopedic surgery resulted in a reduction in antibiotic utilization with no significant change in the SSI or CAUTI rates. Cost savings resulted from reduced antibiotic usage.

**Key Words:** Arthroplasty, Antimicrobial stewardship, Urinalysis, Surgical wound infection, Urinary tract infections

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## INTRODUCTION

Total joint arthroplasty (TJA) continues to be a successful surgery for improving pain and function, with projections of 4.052 million TJA procedures in the United States expected in 2030 alone<sup>1)</sup>. Despite excellent results in outcomes for the majority of patients<sup>2)</sup>, complications still occur. Prosthetic joint infection (PJI) is a dreaded complication, which affects approximately 1% of all cases<sup>3)</sup>. As a result, routine preoperative management to mitigate risk factors such as diabetes and obese body mass index (BMI) is performed to improve outcomes of surgery<sup>4)</sup>.

Prescreening urinalysis testing is one strategy for preoperative management. The genitourinary tract represents a potential source of bacteria seeding into a joint, perhaps first evidenced with a 1974 retrospective study showing a relationship between PJI and perioperative urinary tract infection (UTI)<sup>5)</sup>. Although data associating preoperative screening with decreased rates of negative outcomes such as surgical site infections (SSIs) or catheter-associated UTIs (CAUTIs) is limited, other studies have reported increased rates of PJI in patients with UTI postoperatively<sup>6,7)</sup>. This finding has led some surgeons and institutions to perform universal urinary screening before elective TJA. Evidence for efficacy of this practice for patients without any symptoms remains controversial. Despite recent evidence recommending against<sup>8)</sup>, urinary screening prior to elective TJA and treatment of asymptomatic patients is still practiced. Such universal testing results in increased antibiotic prescription for asymptomatic bacteriuria, producing increased antibiotic resistance, adverse drug effects, and cost<sup>9)</sup>.

The purpose of this study was to evaluate the rates of SSIs, CAUTIs, and antibiotic prescriptions before and after elimination of universal prescreening urinalysis testing for elective TJA patients at a single-specialty orthopaedic hospital. The hypothesis of the study is that elimination of testing will not result in increased rates of SSIs or CAUTIs but will reduce antibiotic prescriptions.

## MATERIALS AND METHODS

### 1. Quality Improvement Initiative

Preoperative antibiotics for urinary tract infection in the elective orthopedic surgery population was identified as a potential area of antibiotic overutilization in our hospital by the hospital's "Antibiotic Stewardship Committee".

A quality improvement initiative was developed with the aim of reducing unnecessary antibiotic use in this population. The program consisted of modifying testing algorithms, modifying reflex-to-culture criteria, and providing treatment guidelines to practitioners.

### 2. Study Design

A pre-post study was subsequently conducted to determine the impact of the protocol change on SSI and CAUTI rates and number of antibiotic prescriptions. The study was approved by the Institutional Review Board (IRB) of New England Baptist Hospital (No. 1090003), and the written informed consent was obtained from all patients. Data were collected from the hospital's patient database for a pre-practice change period (February 2016 through October 2016), an intervention period (November 2016 through July 2017), and a post-practice change period (August 2017 through March 2018) for all patients undergoing a primary hip, revision hip, primary knee, revision knee, or spinal fusion procedure. The intervention period while the new practices were being executed was excluded from final data analysis.

Patient demographics, procedure-related variables, urinalysis results, urine culture results, and antibiotic prescriptions were collected from the hospital's orthopedic registry and patients' electronic medical record retrospectively from every tenth chart in the pre-practice change period and measured prospectively on all patients in the post-practice change period. For the post-practice change period, data on symptoms was collected prospectively from "Prescreening Urine Analysis Guides" filled out by the hospital's Preadmission Screening Unit. SSI and CAUTI rates were extracted prospectively from infection control databases using Center for Disease Control and Prevention/National Healthcare Safety Network definitions.

### 3. Pre-period Protocol

Prior to November 2016, all patients undergoing the above mentioned procedures underwent routine urinalysis during the preadmission screening visit with a reflex to culture for the following variables: bacteria, leukocyte esterase or nitrate on the dipstick, or white blood cell count greater than 5/high powered field. A positive urine culture was treated at the discretion of the prescreening nurse practitioner.

#### 4. Post-period Protocol

A “Prescreening Urine Treatment Guideline” was developed based on the current Infectious Diseases Society of America guidelines<sup>9</sup>. In addition to these guidelines, the criteria for a positive urinalysis with reflex to culture were modified to only reflex to culture for leukocyte esterase and/or white blood counts greater than five. Nurse practitioners were encouraged to follow a urine treatment guideline when deciding on treatment for patients with positive urine culture results or symptoms or urinary tract infection.

#### 5. Statistical Analysis

All patient data was entered into a research electronic data capture database. Univariate analysis was performed for comparison of groups for differences in age, gender, diabetes, procedure mix, foley catheter utilization, and other variables that may affect the outcomes. All statistical tests were performed in SAS (ver. 9.3; SAS Institute, Cary, NC, USA). The univariate analysis utilized *t*-tests, chi-square tests, and Fisher exact tests as appropriate. A  $P \leq 0.05$  was considered statistically significant.

### RESULTS

A total of 4,663 patients were analyzed during the study period, with 502 patients in the pre-period (every 10th patient from the 5,020-patient cohort) and 4,161 patients

in the post-period (Fig. 1). In the pre- and post-period, patients did not differ significantly with regard to demographic data including age, sex, BMI, American Society of Anesthesiologists classification, or surgery type ( $P > 0.05$  for all; Table 1). Urinalysis was performed in 99% of cases before the intervention, compared to only 3% of cases after ( $P < 0.001$ ; Table 1). Both performed urine cultures and positive urine cultures showed a significant decrease after the intervention ( $P < 0.001$  for all; Table 1).

There were no significant differences in the rate of CAUTI per 1,000 device days nor SSI rate per 100 procedures before and after intervention ( $P > 0.05$ ; Table 1). Antibiotic prescription due to urine testing was significantly higher in the pre-period compared to post-period ( $P < 0.001$ ; Table 1, Fig. 2).

### DISCUSSION

Infection after TJA is a difficult complication to treat, and prevention is paramount to a successful operation. Urinalysis is a routinely performed preoperative test and bacteria in the genitourinary tract are a potential target for preventing postoperative infections, but universal identification and treatment may not be recommended. Studies have shown that patients with a symptomatic UTI before surgery are at an increased risk for PJI<sup>7,10,11</sup>, and such infections should be treated before surgery<sup>12</sup>. However, assumptions of testing and treating asymptomatic patients to prevent PJI may not be warranted as this reflects a distinct clinical scenario.

Evidence for asymptomatic bacteriuria (ASB) and neg-

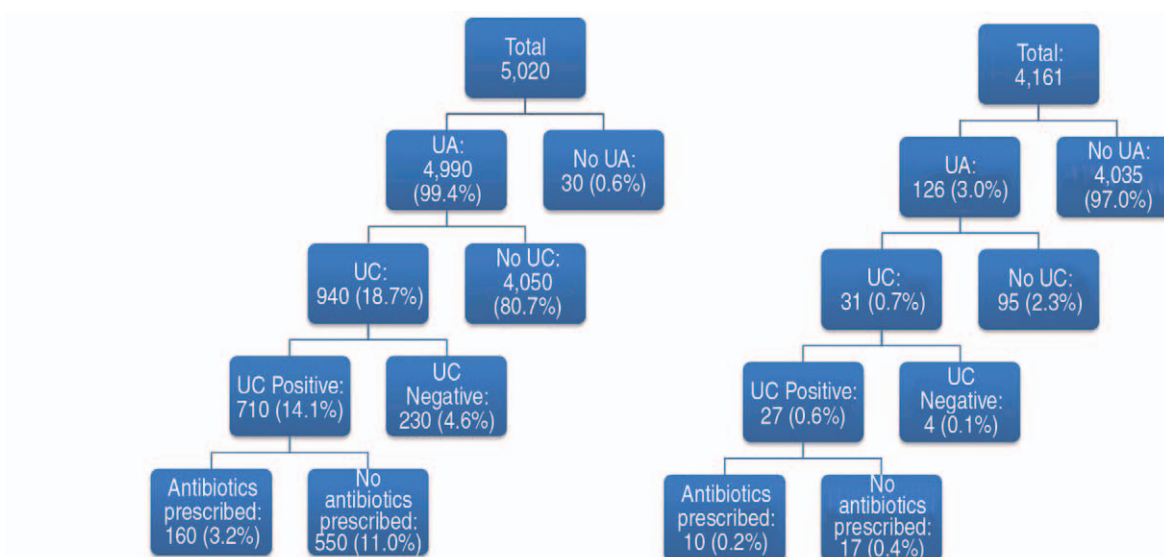


Fig. 1. Impact of prescreening urinalysis practice change in an elective orthopaedic population. UA: urinalysis, UC: urine culture.

**Table 1.** Demographics and Impact of Prescreening Urinalysis Practice Change

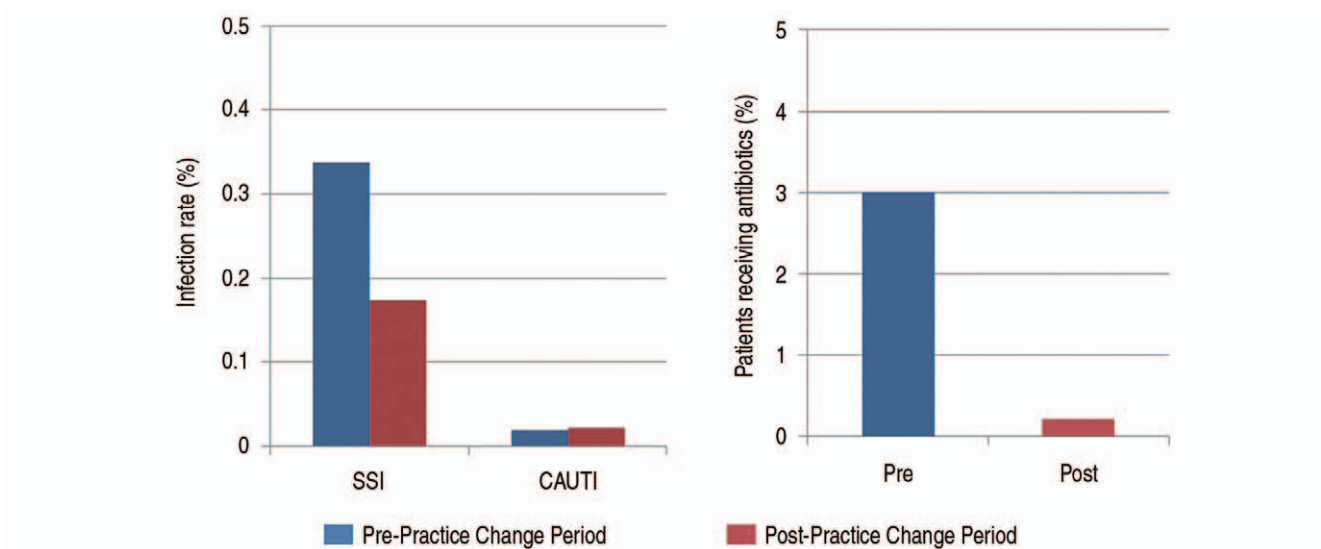
	Pre-period (n=502)	Post-period (n=4,161)	P-value
Age (yr)	64.1±10.5	65.7±9.5	0.100
Female	264 (52.6)	2,276 (54.7)	0.370
BMI (kg/m <sup>2</sup> )	30.9±6.4	30.7±6.3	0.570
ASA			0.016
1	16 (3.2)	221 (5.3)	
2	383 (76.3)	2,932 (70.5)	
3	101 (20.1)	1,001 (24.1)	
4	2 (0.4)	7 (0.2)	
Knee arthroplasty	234 (46.6)	1,973 (47.4)	0.878
Hip arthroplasty	222 (44.2)	1,862 (44.7)	
Fusion	46 (9.2)	356 (8.6)	
Urinalysis performed	499 (99.4)	126 (3.0)	<0.001
UC performed	94 (18.7)	31 (0.7)	<0.001
Positive UC	71 (14.1)	27 (0.6)	<0.001
UA resulted in antibiotic prescription	16 (3.2)	10 (0.2)	<0.001
Average catheter utilization rate*	0.2	0.14	<0.001
No. of CAUTI in each study period	1	1	
CAUTI rate/1,000 device-days	0.300	0.504	0.747
SSI rate/100 procedures	0.35	0.24	0.303

Values are presented as mean±standard deviation, number (%), rate, or number only.

Pre-period data reflects 1/10th of the total population in this period.

BMI: body mass index, ASA: American Society of Anesthesiologists, UC: urine culture, UA: urinalysis, CAUTI: catheter-associated urinary tract infection, SSI: surgical site infection.

\* Catheter-days/patient-days.



**Fig. 2.** Impact of prescreening urinalysis practice change on surgical site infection (SSI) rates, catheter-associated urinary tract infection (CAUTI) rates, and antibiotic prescriptions.

ative outcomes remains controversial. Up to 3-19% of patients undergoing elective TJA may have preoperative ASB<sup>8</sup>. Two studies demonstrated a higher risk of PJI in patients with ASB<sup>13,14</sup>. However, a study of over 20,000

patients found no association with positive urine culture prior to TJA and an increased risk of infection or PJI<sup>15</sup>. A 2019 meta-analysis showed that preoperative antibiotic therapy for ASB did not lower the risk of PJI<sup>8</sup>. Additionally,

these authors showed that the cultured PJI bacteria were often different from isolates found in the urine of asymptomatic patients—suggesting further evidence against antibiotic treatment in these scenarios<sup>8</sup>). In agreement with other studies<sup>16-18</sup>), our findings show that discontinuing the practice of universal urinalysis testing for patients prior to TJA decreases antibiotic usage without increasing infection rates.

At this time, the American Academy of Orthopedic Surgeons recommends preoperative urine testing prior to elective TJA, but they state that the evidence is weak regarding bacteriuria and negative outcomes<sup>12</sup>). Testing for and treating asymptomatic urinary colonization before orthopedic joint replacement surgery is likely unnecessary and may put the patient at additional risk<sup>10,19,20</sup>). In addition, treating ASB can be associated with adverse outcomes such as increased antibiotic resistance, adverse drug side effects, and unnecessary supply and personnel costs<sup>9</sup>).

There are several limitations in the current study, including its retrospective nature and relatively small sample size. However, we were able to find significant differences within our sample population. Due to the retrospective nature, universally testing in the pre-period did not allow the granular data to differentiate between asymptomatic and symptomatic UTIs; however, this did not result in significantly different infection rates in the pre- and post-period. This study, in the context of its limitations, adds to the literature of evidence to support abandoning universal preoperative urinalysis screening and the treatment of ASB. Future guidelines should consider this information when developing screening and treatment practices prior to TJA.

## CONCLUSION

Elimination of routine urinalysis before orthopedic surgery resulted in no change in SSI or CAUTI rates, but a 93% reduction in antibiotic utilization.

## CONFLICT OF INTEREST

The authors declare that there is no potential conflict of interest relevant to this article.

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