Implementation of an Inpatient Urine Culture Algorithm Decreased Catheter-Associated Urinary Tract Infections

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ABSTRACT

Background: Urine cultures (UC) are often obtained when symptoms of urinary tract infection (UTI) are absent. Indiscriminate UC can lead to misidentification of catheter-associated UTI (CAUTI). Pyuria (>10 WBC/hpf) has an excellent negative predictive value for UTI in immunologically normal patients.

Methods: In April 2015 the ability to order an inpatient UC was removed at our 650-bed academic medical center. UC was available only via a UTI Evaluation Panel requiring documentation of symptoms and special criteria supporting UC in the absence of pyuria (neutropenia, kidney/pancreas transplant, pregnant, impending urologic surgery, age <3 years, other). A UC was always performed if special criteria were met. Asymptomatic patients not meeting special criteria were not cultured. Symptomatic patients not meeting special criteria had UC reflexively performed based on an algorithm: >100 squamous cell = no UC; <100 squamous cells and ≤10 WBC/hpf = no UC; <100 squamous cells and >10 WBC/hpf = UC. NHSN CAUTI definitions were used which changed in 2015 (excluded candida and cultures with <100,000 CFU/ml). 2014 CAUTI rates were recalculated using 2015 definitions (A-CAUTI). Institutional catheter utilization (CD/PD) and CAUTI rates using catheter days (CD) and patient days (PD) before (1/14-3/15) and after (4/15-3/16) were compared using Poisson regression. UC and contaminated UC (UC with ≥3 isolates; C-UC) were compared one year before (4/14-3/15) and after (4/15-3/16).

Results: Catheter utilization decreased significantly (0.27 CD/PD vs. 0.20 CD/PD, *P*<0.0001) as did rates of UC, C-UC, CAUTI and A-CAUTI (Table). CAUTI rates measured per patient day showed a greater decrease than those measured by catheter day.

Measurement	Before	After	*P*	Model Estimated Risk (95% CI)
CAUTI/1000 CD	3.29	1.8	0.0004	0.55 (0.39, 0.76)
A-CAUTI/1000 CD	2.58	1.8	0.039	0.70 (0.49, 0.98)
CAUTI/1000 PD	0.85	0.36	<0.0001	0.42 (0.30, 0.59)
A-CAUTI/1000 PD	0.67	0.36	0.0005	0.54 (0.38, 0.76)
UC/1000 PD	35.9	19.3	<0.0001	0.54 (0.48, 0.60)
C-UC/1000 PD	3.3	1.8	<0.0001	0.56 (0.46, 0.68)

Conclusion: Implementation of a urine culture algorithm using symptoms and pyuria resulted in a significant decrease in UC, contaminated UC, and CAUTI.

INTRODUCTION

- Catheter-associated urinary tract infections (CAUTI) are common in hospitalized patients and surveillance definitions utilized by NHSN are non-specific and may result in false positive findings
  - For example a patient with a urinary catheter, fever, and positive urine culture is considered to have a CAUTI even if the fever has another explanation and no local UTI symptoms are present
- Asymptomatic bacteriuria (ASB) is common in catheterized patients and urine cultures (UC) are frequently ordered despite lack of UTI specific symptoms[1]
  - This results in potential over diagnosis of both CAUTI and treatment of ASB[2]
- Urine microscopy is useful for ruling out UTI with a high negative predictive value[3,4]
- We implemented a UTI culture algorithm as part of a multi-faceted CAUTI prevention initiative

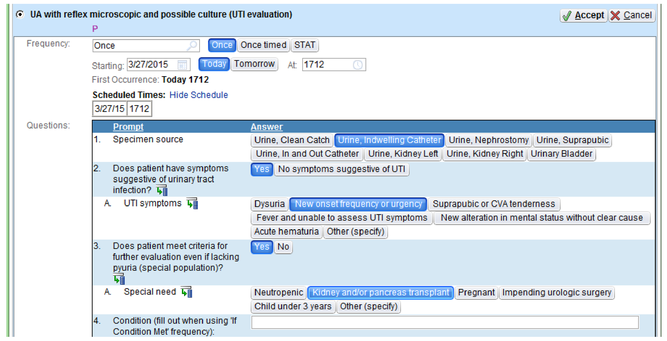
METHODS

Setting: 650-bed academic medical center

Interventions:

- Multi-faceted CA-UTI control program initiated 1/2015.
- Inpatient order for UC revised and replaced by a UTI evaluation panel 4/2015 requiring documentation of symptoms and patient characteristics as well as indications for a culture without symptoms or pyuria. See **Figure 1** for specific criteria.

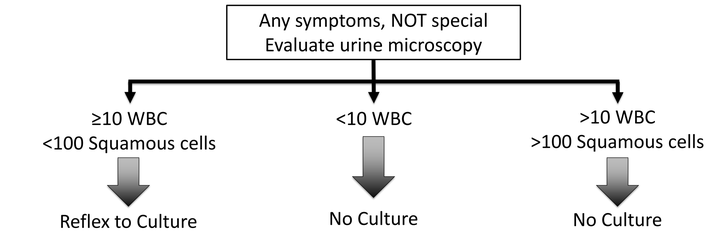
Figure 1: UTI Evaluation Panel Questions



Urine cultures were performed only if certain criteria were met

- No symptoms, no special criteria = No Culture
- Special criteria with or without symptoms = Culture

Figure 2: Urine Culture Algorithm



- Institutional CAUTI rates were defined per NHSN and 2014 CAUTIs were recalculated using the 2015 definition which excluded Candida and urine cultures with low colony counts (A-CAUTI)
- Rates were calculated per 1000 catheter days (CD) and 1000 patient days (PD) and compared before and after the change as was device utilization, UC ,and UC contamination (UC with ≥3 isolates; C-UC)
- All comparisons were made using Poisson regression comparing 1/14-3/15 with 4/15-3/16 with the exception of UC and C-UC (4/14-3/15 vs. 4/15-3/16)

RESULTS

- Catheter utilization declined significantly from 0.27 CD/PD to 0.20 CD/PD (*P*<0.0001)
- After implementation of the UTI panel UC decreased 54% (95%CI 0.38-0.60, P<0.001) with similar declines in the number of contaminated urine cultures (Table 1)
- Rates of CAUTI and A-CAUTI declined significantly after implementation of the UTI panel with greater declines detected when measured by PD

Table 1: Changes in CAUTI and UC Rates

Measurement	Before	After	P	Model Estimated Risk (95% CI)
CAUTI/1000 CD	3.29	1.8	0.0004	0.55 (0.39, 0.76)
A-CAUTI/1000 CD	2.58	1.8	0.039	0.70 (0.49, 0.98)
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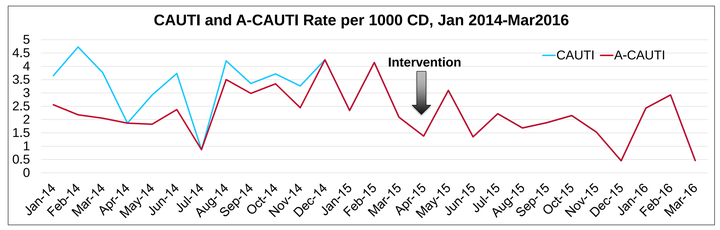

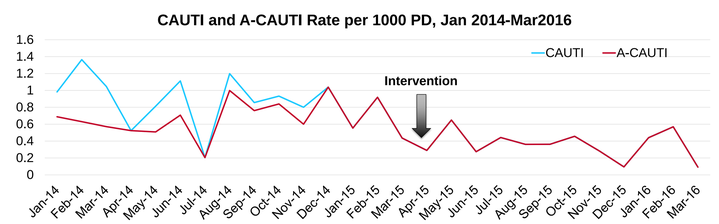

CONCLUSION

- Implementation of the UTI Panel was associated with a 54% decrease in urine cultures and a 45% decrease in CAUTI reported to NHSN
  - Implementation of the revised NHSN definition likely accounted for some decrease as demonstrated by a decreased change using A-CAUTI rates
- When we adjusted for both the new definition (A-CAUTI) and the change in CD (using PD) a 54% decrease in CAUTI was still noted
  - CAUTI per PD may be a better measure of interventions which impact both infections and catheter days
- The impact of these changes on antibiotic usage and treatment of asymptomatic bacteriuria have yet to be measured

Bibliography

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