EFFECT OF EDUCATION AND PERFORMANCE FEEDBACK ON RATES OF CATHETER-ASSOCIATED URINARY TRACT INFECTION IN INTENSIVE CARE UNITS IN ARGENTINA

Victor Daniel Rosenthal, MD, MSc, CIC; Sandra Guzman, RN, ICP; Nasia Safdar, MD

ABSTRACT

OBJECTIVE: To evaluate the effect of education and performance feedback regarding compliance with catheter care and handwashing on rates of catheter-associated urinary tract infection (UTI) in intensive care units (ICUs).

SETTING: Two level III adult ICUs in a private healthcare facility in Argentina.

PATIENTS: All adult patients admitted to the study units who had a urinary catheter in place for at least 24 hours.

METHODS: A prospective, open trial in which rates of catheter-associated UTI determined during a baseline period of active surveillance without education and performance feedback were compared with rates of catheter-associated UTI after implementing education and performance feedback.

RESULTS: There were 1,779 catheter-days during the baseline period and 5,568 catheter-days during the intervention period. Compliance regarding prevention of compression of the tubing by a leg improved (from 83% to 96%; relative risk [RR], 1.15; 95% confidence interval [CI_{95}], 1.03 to 1.28; $P = .01$) and so did compliance with handwashing (from 23.1% to 65.2%; RR, 2.82; CI_{95}, 2.49 to 3.20; $P < .0001$). Catheter-associated UTI rates decreased significantly from 21.3 to 12.39 per 1,000 catheter-days (RR, 0.58; CI_{95}, 0.39 to 0.86; $P = .006$).

CONCLUSION: Implementing education and performance feedback regarding catheter care measures and handwashing compliance was associated with a significant reduction in catheter-associated UTI rates. Similar programs may help reduce catheter-associated UTI rates in other Latin American hospitals (*Infect Control Hosp Epidemiol* 2004;25:47-50).

Catheter-associated urinary tract infections (UTIs) have accounted for as much as 40% of all nosocomial infections in the United States, affecting an estimated 800,000 patients per year.[1] Among the 25% of hospitalized patients who have a urinary catheter, the incidence of nosocomial UTI is approximately 5% per day, with virtually all patients developing bacteriuria by 30 days of catheterization.[2] One recent study found that most catheter-associated bacteriuria was asymptomatic,[3] but silent catheter-associated UTIs may represent a large pool of antibiotic-resistant pathogens[4] and drive a great deal of generally unnecessary antibiotic therapy. These infections have been shown to increase length of stay, hospital cost, and mortality.[5,6] In Argentina, we have found that catheter-associated UTI increases hospital stay by 13 days and the attributable cost is $1,970 (U.S.).[7]

Many countries in Latin America including Argentina lack mandatory infection control programs. This lack of governmental oversight has resulted in the development of local infection control programs loosely based on guidelines published in the United States. Among the numerous strategies that have been studied to reduce the risk of catheter-associated UTI, only the closed drainage system has been of value.[8] Novel technology, such as the use of silver hydrogel catheters, has shown promise in reducing the risk of catheter-associated UTI,[9] but such technology is difficult to implement with limited resources.

We report the results of a prospective, open trial assessing the effectiveness of education and performance feedback in reducing catheter-associated UTI rates in two level III cardiac and medical–surgical intensive care units (ICUs) in an Argentinean hospital.

METHODS

Setting

The study was conducted at Colegiales Medical Center, a private 180-bed hospital with one medical–surgical ICU (10 beds) and one coronary ICU (10 beds) in Buenos Aires, Argentina. The center has an infection control team composed of a physician with formal education and training in internal medicine, infectious diseases, and hospital epidemiology, an infection control nurse, and support personnel.

The two ICUs care for patients who have undergone open heart, neurosurgical, and orthopedic surgery as well as patients with severe medical illness. The institutional review board approved the study protocol.

Sterile closed urinary drainage systems were used for all catheterizations during both the baseline and intervention periods. In all cases, urinary catheters were

Dr. Rosenthal and Ms. Guzman are from the Department of Infectious Diseases and Hospital Epidemiology, Colegiales Medical Center, Buenos Aires, Argentina. Dr. Safdar is from the Section of Infectious Diseases, Department of Medicine, University of Wisconsin Medical School, Madison, Wisconsin.

Address reprint requests to Victor Daniel Rosenthal, MD, MSc, CIC, Arengreen 1366, Buenos Aires, Argentina 1405.

TABLE 1
CHARACTERISTICS OF THE PATIENTS AT STUDY ENTRY

	Baseline Period (n = 291)	Intervention Period (n = 1,010)	*P*
Male	118 (40.5%)	489 (48.4%)	.08
Mean age, y (SD)	74.71 (± 14.65)	74.68 (± 12.71)	.78
Average severity of illness score (SD)	3.07 (± 0.96)	2.96 (±1.00)	.12
Diabetes	38 (13.1%)	136 (13.4%)	.86
Cancer	19 (6.5%)	45 (4.5%)	.15
HIV	1 (0.3%)	2 (0.2%)	.64

SD = standard deviation; HIV = human immunodeficiency virus.

inserted using sterile gloves. Tubing was taped to a leg to prevent movement and urethral traction.

Data Collection

All patients with indwelling urinary catheters for more than 24 hours in the ICUs were enrolled. An infection control nurse extracted patient data prospectively from charts. The principal investigator (VDR) trained the data collectors at the center before initiation of the trial. Age, gender, average severity of illness score,[10] duration of catheterization, antibiotic use, use of other invasive devices, and other sites of infection while catheterized were recorded for each study patient. Data collection sheets were checked for potential errors and missing items by the study coordinator to confirm each diagnosis of catheter-associated UTI.

Surveillance

Active surveillance for catheter-associated UTI was begun during the baseline period and continued throughout the study using the methodology of the National Nosocomial Infections Surveillance (NNIS) System of the Centers for Disease Control and Prevention (CDC).[10]

Definitions

CDC definitions for catheter-associated UTI[11] were adopted. Patients had to have at least one of the following signs or symptoms with no other recognized cause: fever (body temperature greater than 38°C), urgency, frequency, dysuria, or suprapubic tenderness. Patients also had to have a positive urine culture with 10^5 or more microorganisms/cm^3 and no more than two species of microorganisms.

Culture Techniques

The decision to culture urine was made independently by the patient's attending physician. Specimens not immediately processed were refrigerated at 4°C. All cultures were inoculated within 8 hours of the urine sample being obtained. Standard laboratory methods were used to identify microorganisms.[12]

Intervention

The intervention consisted of education and performance feedback.

Education

Education was implemented during the intervention period regarding hand hygiene in the healthcare setting and urinary catheter care published by the CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC).[13,14] All contents of the CDC guidelines were recommended, but major emphasis was given to compliance with handwashing using antiseptic soap before catheter insertion and positioning the catheter so as to avoid compression of the catheter by a leg, avoiding obstruction to urinary flow.

Performance Feedback

Performance feedback was started during the intervention period. Data regarding compliance with infection control practices were provided to the ICU staff. Monthly performance feedback was provided at infection control meetings and posted in the ICUs in the form of bar charts documenting rates of compliance with handwashing and avoiding compression of the urinary catheter by a leg. Compliance rates and catheter-associated UTI rates were forwarded to the ICU administrators.

Compliance

Compliance with handwashing and placement of urinary catheters without compression of the tubing by a leg were assessed and data entered into a standard form by a research nurse who observed healthcare worker behavior in the study units randomly twice a week. Compliance with handwashing was defined as washing hands with an antiseptic soap for at least 10 seconds without subsequently touching the faucet before each contact with a patient.

Statistical Methods

Epi-Info software (version 6.0; CDC, Atlanta, GA) was used for data analysis. Differences between treatment groups were analyzed using chi-square analysis for dichotomous variables and the Student's *t* test for continuous variables. When appropriate, Fisher's exact test was used. Relative risk (RR) ratios, 95% confidence intervals (CI_{95}), and *P* values were determined for all primary outcomes. Sample size was calculated for a power of 80% and an alpha error of 0.05.

RESULTS

During the study period (September 2000 to September 2002), 1,301 adult patients in the study ICUs required urinary catheters and all patients were enrolled in the study. Patients from the preintervention period (September to December 2000) were similar to patients from the intervention period (January 2001 to September 2002) regarding gender, age, average severity of illness score, and the presence of diabetes mellitus, cancer, and human immunodeficiency virus (Table 1). When the base-

TABLE 2
COMPLIANCE WITH INFECTION CONTROL PRACTICES

	Preintervention		Intervention			
	No. Compliant/ No. of Observations	%	No. Compliant/ No. of Observations	%	RR (CI_{95})	*P*
Urinary catheter care*	385/462	83	1,923/2,004	96	1.15 (1.03–1.28)	.01
Handwashing	268/1,160	23.1	2,763/4,241	65.2	2.82 (2.49– 3.20)	< .0001

RR = relative risk; CI_{95} = 95% confidence interval.
*Keeping the urinary catheter above the leg to avoid compression of tubing.

line and intervention periods were compared, compliance with the infection control practices emphasized in the study was statistically different.

A total of 7,347 catheter-days were accumulated during the course of the trial, with 1,779 during the baseline period and 5,568 during the intervention period.

Compliance with avoiding compression of the catheter by a leg improved from 83% to 96% (RR, 1.15; CI_{95}, 1.03 to 1.28; P = .01). Compliance with handwashing improved from 23.1% to 65.2% (RR, 2.82; CI_{95}, 2.49 to 3.20; P < .0001) (Table 2). The catheter-associated UTI rate declined significantly from 21.3 to 12.39 per 1,000 catheter-days (RR, 0.58; CI_{95}, 0.39 to 0.86; P = .006) (Table 3).

TABLE 3
RATES OF CATHETER-ASSOCIATED URINARY TRACT INFECTION DURING THE STUDY

	Preintervention	Intervention	RR (CI_{95})	*P*
Catheter-days	1,779	5,568	-	-
Catheter-associated UTI	38	69	-	-
Catheter-associated UTI rate*	21.3	12.39	0.58 (0.39–0.86)	.006

RR = relative risk; CI_{95} = 95% confidence interval; UTI = urinary tract infection.
*Number of catheter-associated UTIs per 1,000 catheter-days.

DISCUSSION

Most healthcare institutions in Latin America lack basic infection control programs and most caregivers are unaware of simple, inexpensive methods for preventing catheter-associated UTI.

The role of education and performance feedback in the prevention of catheter-associated UTI has not been extensively evaluated. In a prospective study, Goetz et al. showed a significant reduction in catheter-associated UTI rates from 32 per 1,000 catheter-days to 17 per 1,000 catheter-days with the use of periodic feedback to nursing staff regarding rates of catheter-associated UTI.[15] The results of the current study are in keeping with those of Goetz et al.

Previous studies at this hospital found that education and performance feedback could increase compliance with handwashing[16] and vascular catheter care.[17] Implementation of such policies has greatly reduced our rates of catheter-associated bloodstream infection.[17] In a prospective study by Britt et al., focused education emphasizing infection control measures for prevention of nosocomial infection was highly successful, with a decline in the overall incidence of endemic nosocomial infections from 9.2% to 4.8% (P < .001).[18]

In this study, we have shown that education and training of healthcare personnel can result in significant improvements in compliance with basic infection control measures with a similarly significant reduction in rates of catheter-associated UTI. Implementation of a program in which performance feedback was given to healthcare workers resulted in further improvements in compliance with infection control measures and a further reduction in the rates of catheter-associated UTI. A limitation of each of these studies is that they were open trials without contemporaneous controls. However, because no other interventions were in place during this time frame, it seems likely that education and performance feedback had a major impact on the rates of catheter-associated UTI. Although there were no statistically significant differences between the study populations in the baseline and intervention periods, there was a trend toward a greater proportion of male patients during the intervention (P = .08). Women are at considerably greater risk for catheter-associated UTI, and the shift in the study population toward a greater number of men may also have played a role in reducing infections during the intervention period, but the relative reduction in catheter-associated UTI was much greater than the relative increase in male patients during the intervention period.

Implementation of education and performance feedback was associated with increased compliance and a reduction in catheter-associated UTI rates.

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