Using the Urine Dipstick to Screen Out Unnecessary Urine Cultures: Implementation at One Facility

PATRICIA REILLY, LAURA MILLS, DANIEL BESSMER, CELIA JIMENEZ, PATRICK SIMPSON, MARK BURTON

This study examined the utility of performing urine cultures on biochemically negative urine specimens and details the implementation of a policy to cancel these cultures. Four reactions of the Multistix® SG (Bayer, Elkhart IN) urine dipstick (protein, occult blood, leukocyte esterase, and nitrite) were used as biochemical indicators. A three-month retrospective study examining the results of 843 urinalysis/urine culture pairs indicated that one-third of these cultures were probably unnecessary (negative dipstick/negative culture). Based on these results, a policy was implemented to screen those urine samples having both a urinalysis and urine culture ordered. Over a six-month period, 6,192 urine specimens were evaluated. Of these, 36% (2,260 cultures) were cancelled. Of the 3,932 samples cultured, 22.4% (883) were true positives (positive dipstick/positive culture) while 31.6% (1245) had a positive dipstick but grew organisms considered contaminants. The false positive rate was 40% (positive dipstick/negative culture), and the false negative rate was 6%. Implementation of this policy reduced the number of urines cultured by 36%.

ABBREVIATIONS: UA = urinalysis.

INDEX TERMS: biochemical screen; culture screen; urine culture; urine dipstick.

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Patricia Reilly PhD *is the supervisor of the Immunology and Microbiology Laboratories, Wilford Hall Medical Center, Lackland AFB TX.*

Laura Mills *is the noncommissioned officer in charge, Microbiology Laboratory, Wilford Hall Medical Center, Lackland AFB TX.*

Daniel Bessmer *is the Associate Chief, Core Laboratory, Wilford Hall Medical Center, Lackland AFB TX.*

Celia Jimenez *is the technical supervisor of the Hematology Laboratory, Wilford Hall Medical Center, Lackland AFB TX.*

Patrick Simpson *is a Medical Informations Systems Specialist, Wilford Hall Medical Center, Lackland AFB TX.*

Mark Burton MD *is the Medical Director of the Immunology and Microbiology Laboratories, Wilford Hall Medical Center, Lackland AFB TX.*

Address for correspondence: *Patricia Reilly PhD, PSC 54, Box 2361, APO AE 09601, 011-39-0434-66-5228 (fax). patricia.reilly@aviano.af.mil*

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Published reports have demonstrated that the urine dipstick can be used as a screen to eliminate unnecessary urine cultures.[1-4] These reports indicate that using leukocyte esterase activity and urinary nitrite production to indicate pyuria and bacteriuria, respectively, had both a high sensitivity (79.1% to 88.7%) and a high negative predictive value (90%). The sensitivity increased to 91% to 97% and the negative predictive value rose to 96% when four biochemical markers (leukocyte esterase, nitrite, protein, and occult blood) were used as screening parameters. These figures were similar in adult and pediatric populations, as well as in men and women. Our study was undertaken to confirm published reports and to determine if the biochemical results of the urine dipstick could be used to eliminate unnecessary urine cultures in our facility.

MATERIALS AND METHODS

Feasibility study

To determine if the published findings were applicable to our facility, a three-month retrospective review (November 1999 through January 2000) was performed on urine samples that had both a dipstick (UA) and a culture ordered. A positive urine dipstick (Multistix® SG, Bayer, Elkhart IN) was defined as one having a positive protein **or** blood **or** nitrite **or** leukocyte esterase. A positive culture was defined as a culture growing a clinically significant pathogen. Eight hundred and forty-three (843) urinalysis/urine culture pairs were compared. Our findings showed that 419 samples (49.7%) had a negative dipstick/negative culture, 96 (11.4%) had a positive UA/positive culture with a clinically significant pathogen, 185 (21.9%) had a positive UA/positive culture with organisms considered contaminants, 138 (16.4%) had a positive UA/negative culture, and five (0.6%) had a negative UA/positive culture with a clinically significant pathogen. Of the latter, three cultures showed >100,000 cfu/mL *Escherichia coli*, one showed >100,000 cfu/mL *Proteus mirabilis*, and one showed 50,000 to 100,000 cfu/mL *Enterococcus spp*. These findings indicated that a significant number of urine cultures performed in our laboratory could be defined as unnecessary.

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Implementation

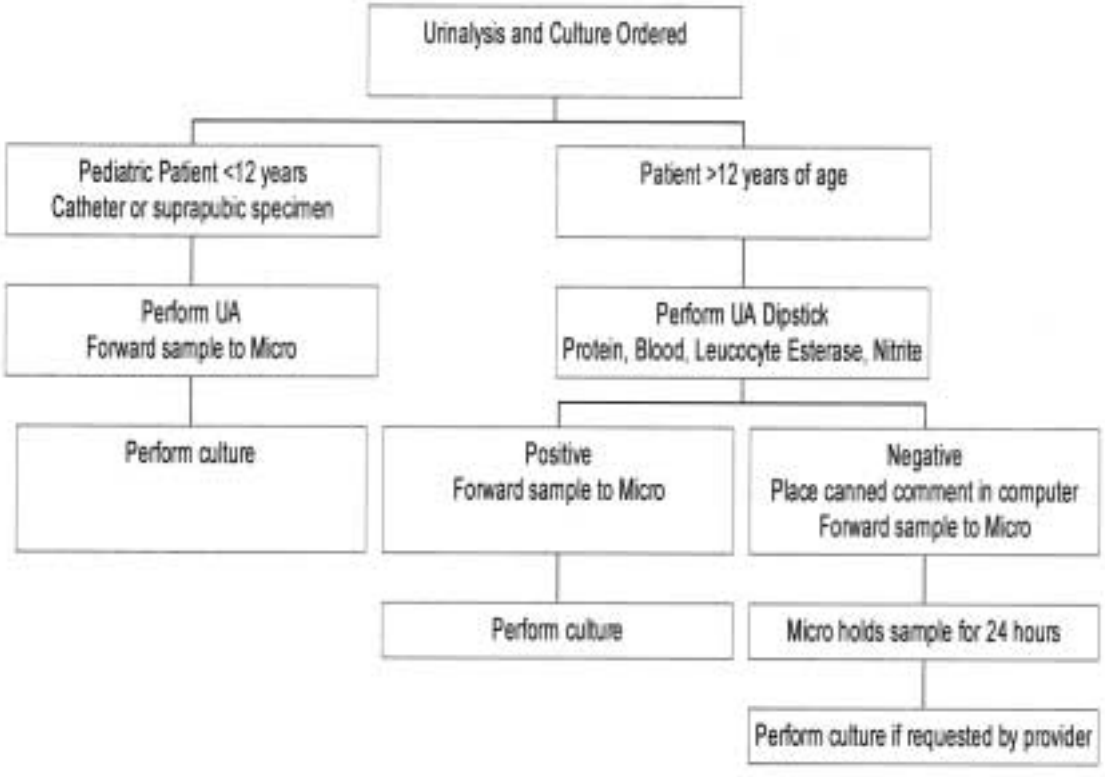
Following this retrospective study, and after consultation with the pathologist, an implementation plan was prepared.

- Urine samples having both a urinalysis and a urine culture are processed first in the urinalysis section, and then sent to microbiology. The supervisors of both sections met, and prepared an algorithm for implementation.
- Selected physicians from pediatrics, obstetrics, the emergency room, urology, and internal medicine were e-mailed the proposed flow chart and asked for input. As a result, the flow chart was modified, such that a culture would be performed regardless of dipstick results if the patient was less than or equal to 12 years of age and if the urine specimen was a catheterized or suprapubic sample. In addition, all cancelled urine culture samples would be held in Microbiology for 24-hours post cancellation and reordered immediately upon physician request.
- Using the revised flow chart, in-services were given to clinical laboratory technicians and scientists in urinalysis and microbiology to solicit ideas for smooth implementation (Figure 1). This was a key step, since success of the plan was dependent on the urinalysis technician/scientist recognizing a negative culture and canceling it, and then forwarding positive dipstick samples for culture. A poster defining the criteria for cancellation was mounted on the wall in the urinalysis laboratory.
- Laboratory information systems modified the computer test file to provide a prompt when negative urine results were entered into the computer. This served as a reminder to the urinalysis technician/scientist to either forward the sample to microbiology or to cancel the urine culture. When a culture was cancelled, a comment was generated that advised the provider for the reason with the number to call to reorder the sample.
- Prior to implementation, an article in the laboratory newsletter was circulated to the clinical and nursing staff. Approximately one week prior to implementation, an e-mail message was sent daily for one week to every provider in the facility advising them of the policy change.
- Policy adherence was monitored daily for a six-month period to ensure that cultures were not being cancelled inappropriately, and that provider requests to perform cultures were being honored.

RESULTS

In the six-month period following implementing the policy (September 2000–February 2001), 6,192 urinalysis/urine culture pairs

Figure 1. Algorithim for implementation. The flow chart for determining whether or not to culture paired urinalysis/urine culture specimens.



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were processed. Sixty-four percent (3,932) had cultures performed. These were samples that showed either a positive dipstick or a negative dipstick and were reordered on physician request, or not cancelled. Thirty-six percent (2,260) had a negative dipstick and were cancelled. The rate of cancellation appeared to be consistent at approximately one-third when tracked on a month-by-month basis (Figure 2). Of the 3,932 samples cultured, 22.4% (883) were true positives (positive dipstick/positive culture) while 31.8% (1248) had a positive dipstick but grew organisms considered contaminants. False positive results (positive dipstick/negative culture) were observed in 1558 (39.6%). One hundred fifty-eight samples were reordered. Six of these (4%) grew clinically significant pathogens (*Proteus mirabilis*, *Escherichia coli*, *Citrobacter koserii*, *Klebsiella pneumoniae*, greater than 100,000 colonies of coagulase negative *Staphlococcus spp.*). Two hundred forty three samples had a negative dipstick and should have been cancelled. Of these, 232 showed a negative culture and 11 grew clinically significant pathogens (yeast, *Escherichia coli*, Gram-positive cocci/*Streptococcus viridans*, *Pseudomonas aeruginosa*, *Enterococcus sp.*).

Figure 2. Paired urinalysis /urine culture samples. September 2000 - February 2001

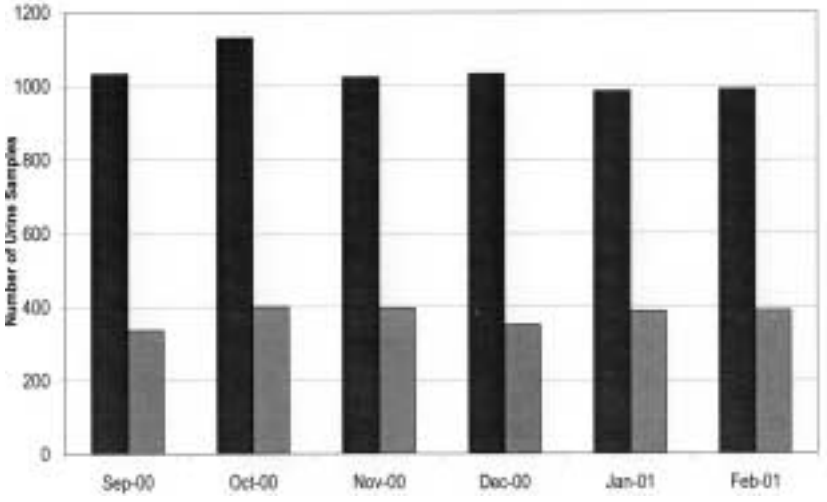
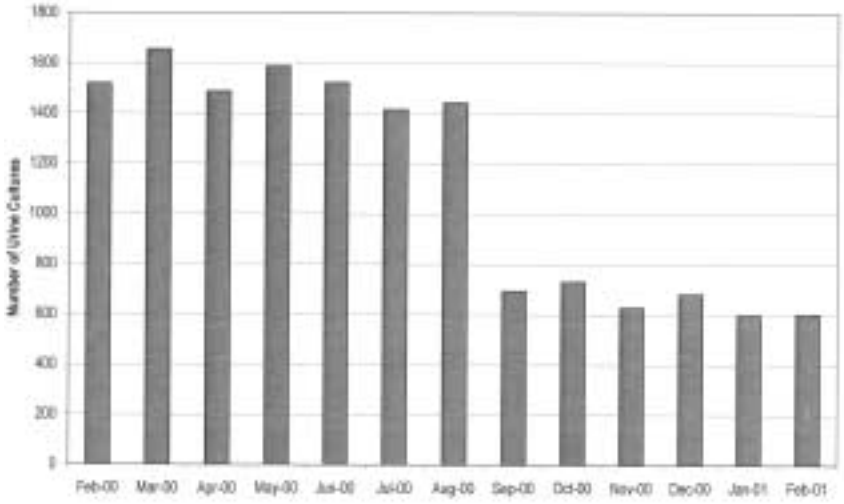


Figure 3. Urine cultures performed on paired urinalysis/urine culture samples. February 2000 - February 2001



DISCUSSION

This study was motivated by an observant technician noticing a trend. This, spurred on by a severe laboratory personnel shortage, led to a three-month retrospective study to determine the feasibility of using the urine dipstick to screen out unnecessary urine culture requests. Armed with data indicating that up to one-third of the urine cultures performed in microbiology were unnecessary, and a green light from the pathologist to proceed, supervisory personnel and several bench technicians from two laboratories, Microbiology and core laboratory (which includes urinalysis) met to develop an implementation plan, which is detailed above. In the first six months following implementation, a 36% drop in the number of urines cultured from urinalysis (UA)/urine culture samples was observed (Figure 3). This corresponded to a decrease of 6,012 cultures annually and an estimated supply savings of $3,487. This workload decrease was significant in that it provided the supervisor the flexibility to redistribute manpower from the urine bench (where cultures are worked up) to more labor intense areas of microbiology.

Key to the success of the new policy was strong and unwavering pathologist support. By soliciting physician input, at the department chief level, early in the process, we were able to initiate modifications for culture cancellation prior to presentation of the scheme to the clinical staff as a whole. As a result, at no point in the process did we encounter significant opposi-

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tion from the clinical staff. Ironically, implementation of the new policy within the laboratory proved to be the most difficult part of the process. Despite multiple section in-services, labeling of special baskets to hold cancelled urines, addition of computer prompts to remind technicians to save or cancel urines for culture, samples were cancelled that should have been cultured and vice versa. Although this number was small when compared to the total number of samples processed (less than 5%), it generated several phone calls from clinicians. To address this problem, we relied heavily on computer-generated ad hocs. A printout of cancelled cultures was generated at the beginning of each shift and examined to ensure that all pediatric, catheterized, or suprapubic samples had been cultured regardless of UA results. Daily, the UA results of all UA/urine culture pairs for the previous 24-hours were reviewed and cross-checked against the cancelled culture list. These ad hocs were modified at several points, e.g., when it was determined that samples from our remote clinics were not being captured on the ad hoc. Provider comments on the UA test request to perform a culture regardless of UA results were missed on several occasions. This has been resolved by designing an ad hoc which prints out all UA samples having a comment. This is reviewed on a daily basis by the supervisor.

In our laboratory, implementation of this policy has resulted in a significant decrease in the number of urine samples cultured with little or no impact on patient care. The level of supervisory review has increased. However, in our experience, in these days of scarce personnel, the ability to streamline a process generating significant workload has given us greater flexibility to place personnel in more labor intensive areas of the Microbiology laboratory. Our study showed that using the dipstick to screen urines was not foolproof. Of the samples showing a negative dipstick that were cultured, 11 (0.3%) grew a clinically significant pathogen. This rate was considered not considered clinically significant by our pathologist.

The success of the new policy keyed on three things: strong pathologist support, early involvement of the clinical staff and incorporation of their suggestions into the new policy, and continuing educational efforts supported by supervisory review of results. This last item may not be an issue in smaller facilities but was with us since ours is a large teaching laboratory with frequent personnel rotations into, and out of, urinalysis.

Regardless of the results of the urine dipstick, a provider should always be given the option of reordering a culture based on the patient's clinical findings. However, the biochemical parameters on the urine dipstick can be used as a screen to determine whether or not a urine culture should be performed. Implementation of this policy has resulted in the elimination of up to one-third of the urine cultures performed in our laboratory.

This paper was presented in poster format at the annual meeting of the Society of Armed Forces Medical Laboratory Scientists, Houston, TX, April 8–11, 2001

The opinions or assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Department of the Air Force or the Department of Defense.

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