

PROFESSIONAL PAPER

EFFECT OF URINE SAMPLE COLLECTION METHOD ON
CONTAMINATION RATE OF URINE CULTURE

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ABSTRACT

Introduction: Urine sample for biochemical analysis must fulfill certain criterions. The sample collection must be done by following established standards so that the results of analysis are reliable. In children of various age, especially during serious disease, adequate consideration must be devoted to this procedure.

Aims: To evaluate contamination rate of the urine sample according to the methods of obtaining samples and collecting specimens in seriously sick children of various age during their intensive treatment.

Methods: Urine culture findings in children treated in Intensive Care Unit (ICU) of Children's Hospital in Tuzla in period from January 2007 to the end of December 2007 were included in retrospective analysis according to the method of collecting (bag collection, urethral catheterization, clean catch). In all of the three groups the percentage of positive findings and percentage of contaminated specimens as well as sex related distribution was analyzed. The urine sample was obtained from urethral catheter only in patients with indication for urethral catheterization. Kruskal-Wallis test and regression model were used in statistical analysis.

Results: A total of 662 children were treated in ICU during the observed period. The urine sample for routine biochemical tests was obtained from all patients. In 107 patients (16.2 %) urine culture examination was indicated. In 48 (44.9%) patients urine sample was obtained by bag collection, in 41 (38.3%) by clean catch, and 18 (16.8%) by urethral catheterization. In 7 patients or 6.5% urine was contaminated. The majority of contaminated specimens were collected by bag (12.5%). In 20 (18.7%) patients urine culture was positive with significant number of etiologic agents and 80 (74.8%) specimens were negative. Difference in results in three monitored groups was statistically significant which was confirmed by Kruskal-Wallis test and stepwise regression model.

Conclusion: Obtaining urine sample by bag collection brings the highest risk for contamination.

Keywords: urine sample collection, specimens quality, child

INTRODUCTION

It is necessary to collect and save urine sample for analyses in a conditions as good as possible. Inadequate collection of urine sample or misinterpretation of such a sample may result with wrong diagnosis when considering urinary tract infection. The most difficult problem for collecting and the highest risk

for contamination of urine sample are in non toilet trained children, children who do not co-operate and especially with seriously ill children. Permanent and strict cleaning of genital area before collecting sample is necessary as well as sterile containers. Temporary evaluation of adequate collecting is necessary in hospital environment also to confirm the quality of expected and final results. The percentage of contaminated samples is higher in toilet trained children without

previous cleaning of genital area. Adequate cleaning can reduce risk of repeated collecting and inadequate antibiotics application.¹⁻⁷ In UCC Tuzla the procedure for methods of urine sample collection in pediatrics was adopted on September 17, 2009. Aim of this study is the evaluation of procedure about methods of collecting urine in children under intensive clinical treatment of various illnesses, age and sex.

PATIENTS AND METHODS

Study includes all children hospitalized in ICU-Children's hospital Tuzla during one year period from January 1st, 2007 to December 31st, 2007. Reason for their hospitalization is shown in Table 1.

Table 1. Indications for hospitalization in ICU from January 1st, 2007 to December 31st, 2007

Indications	N	%
Recurrent UTI	125	18.9
Renal diseases	10	1.5
Bacteriemia	142	21.4
Febrile seizures	166	25.1
Neurological disorders	96	14.5
Respiratory infections	39	5.9
Gastrointestinal disorders	49	7.4
Tumors	5	0.8
Miscellaneous	30	4.5
Total	662	100.0

As shown in Table 1, a total of 662 children underwent evaluation including urine sample sent for urinalysis, specifically the presence of nitrates, leucocytes or leucocytes esterase. Any sample indicating a trace or more of leucocytes, nitrates, presence of few or more bacteria were considered positive for urine culture.

The criterion for clinically significant bacteria was either a pure or predominate culture of 100000 bacteria in 1 ml urine. A contaminated urine specimen is defined in mixed culture of two or more isolated bacteria or no significant number of bacteria.³ In 107 children urine culture was indicated. They were divided in three groups accordingly to the method of collecting urine sample: a mid stream urine specimen, sterile adhesive bag and urethral catheter. We instilled urethral catheter in patients with serious diseases such as renal insufficiency, tumors, polytraumas, consciousness disorders etc.

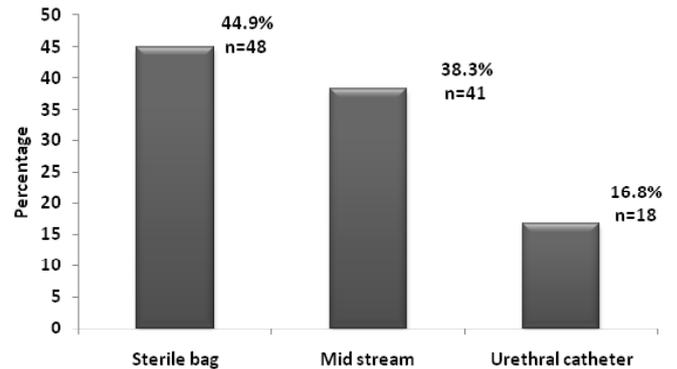


Figure 1. Rate of particular methods of collecting urine

Urine culture findings were analyzed accordingly to the method of collecting urine and gender. Individual correlation between positive urine culture findings and method of collecting was researched by Kruskal-Wallis test for poorly changeable independent variants and regressive analysis for permanently changeable independent variants. Variants with significant correlation (p 0.10) were afterwards included in regressive model. Variants are significant if correlate on level 0.05.

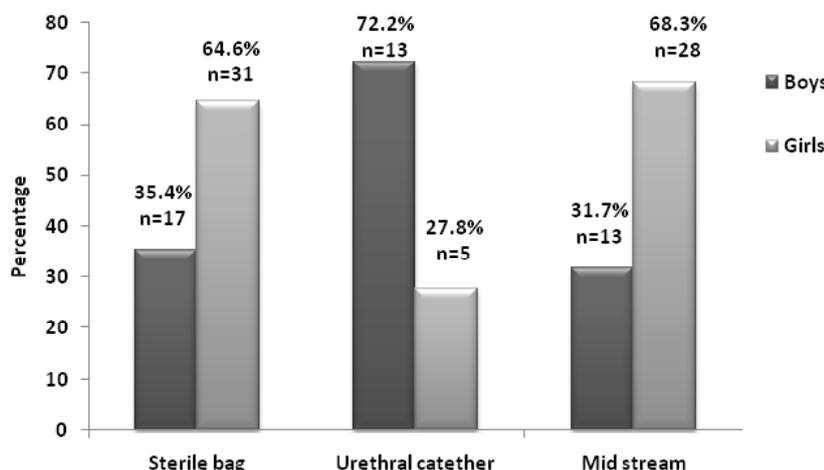
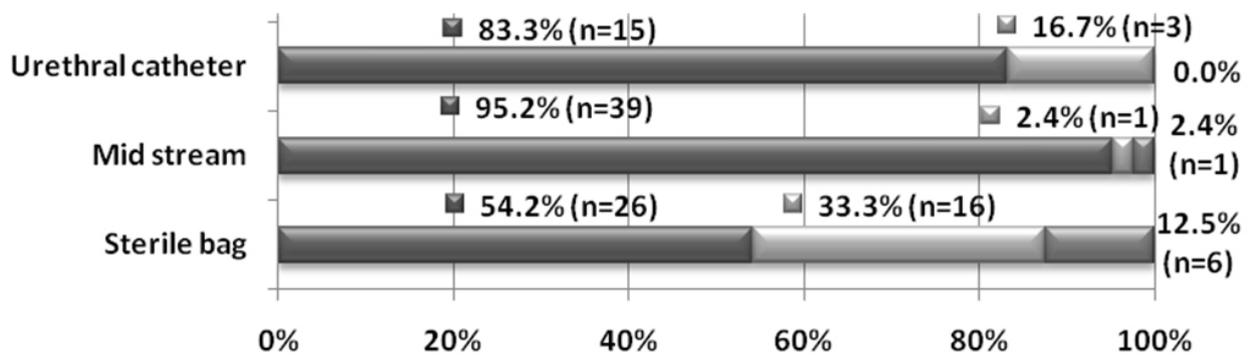


Figure 2. Distribution of methods for collecting samples accordingly to the gender



	Sterile bag	Mid stream	Urethral catheter
■ Sterile	54.2	95.2	83.3
■ Positive	33.3	2.4	16.7
■ Contaminated	12.5	2.4	0

Figure 3. Results of urine culture findings accordingly to the method of collecting

RESULTS

In the period from January till the end of December 2007, 662 children were treated in ICU at Children’s hospital in Tuzla. All of them had urine sample taken for routine biochemical analysis. From total number of 662 hospitalized children, 107 had pathological urine and urine culture was indicated for them. Specimens were further analyzed depending on the method of urine collection. In 48 children (44.9%) urine was collected by adhesive sterile bag, in 41 (38.3%) clean catch method was used and in 18 (16.8%) urine was collected by urethral catheterization.

Method of urinary collection also depends on gender. Sterile bag and clean catch are used more in girls, catheterization in boys. In 31 (64.6%) girls and 17

(35.4%) boys urine was collected by a sterile bag. In 28 (68.3%) girls and 13 (31.7%) boys urine was collected by mid stream collection. In 5 (27.8%) girls and 13 (72.2%) boys urine was collected by urethral catheterization.

Results of urine culture depending on method of collection and gender of patients are shown in table 2. Results of urine culture collected by sterile bag in 26 patients (12 boys and 14 girls) were sterile. In 16 patients (2 boys and 14 girls) result of urine culture was positive while 6 patients (3 boys and 3 girls) had contaminated urine culture. Urine was collected by mid stream collection method in 41 patients. From this group 39 patients (13 boys and 26 girls) had sterile urine culture. In only one patient (a girl) result was positive, and another girl had contaminated urine

Table 2. Findings of urine cultures according to the method of collecting and gender

Urine culture finding	Method of collecting			Total n (%)
	Sterile bag N (%)	Mid stream N (%)	Urethral catheter N (%)	
Sterile	26 (54.2)	39 (95.2)	15 (83.3)	80 (74.8)
- boys	12 (46.2)	13 (33.3)	11(73.3)	36 (45.0)
- girls	14 (53.8)	26 (66.7)	4(26.7)	44 (55.0)
Positive	16 (33.3)	1 (2.4)	3 (16.7)	20 (18.7)
- boys	2 (12.5)	/	2 (66.7)	4 (20.0)
- girls	14 (87.5)	1 (100.0)	1 (33.3)	16 (80.0)
Contaminated	6 (12.5)	1 (2.4)	/	7 (6.5)
- boys	3 (50.0)	/	/	3 (42.9)
- girls	3 (50.0)	1(100.0)	/	4 (57.1)

specimen. Results of urine culture collected by urethral catheterization (18 samples) were in 15 patients sterile-negative (11 boys and 4 girls). In 3 patients (2 boys and one girl) result of urine culture was positive. It was not contaminated urine culture results in this group.

In Table 2 results are classified by method of collection of urine and gender of patients. From all 107 patients, sterile urine was in 80 patients (74.8%), 20 patients (18.7%) had positive urine culture with significant number of pathogens, and 7 patients (6.5%) had contaminated urine culture.

Six out of seven contaminated urine cultures were collected by a sterile bag. Only one contaminated urine culture was collected by mid stream collection. When urine culture was collected by urethral catheterization no contamination was detected.

DISCUSSION

Urinary tract infections are the most common hospital acquired infections. Urinary tract infections are caused by a variety of pathogens including *Escherichia coli*, *Klebsiella species*, *Enterococcus species*, *Pseudomonas aeruginosa*, *Proteus mirabilis*, and other gram-multi-resistant bacteria.^{8,10,11} This is the reason why hospital personal and others who take care of urine collection should be given periodic in service training stressing the need for correct technique for urinary specimen collection. It is important to determine the benefits and harm of different urine collection method, used to obtain a valid urine sample specimen for analysis. The commonly used methods are urine collection bagged specimen and clean catch specimen (non invasive techniques) as well as urethral catheterization and supra-pubic aspiration (invasive techniques). In non toilet trained children, a urine specimen is most commonly collected by a sterile plastic collection bag. Although this method is non invasive, it has the highest rate of contamination. In toilet trained children urine sample is obtained by clean catch. Contamination can be reduced by cleaning uro-genital area before collecting specimen. Urethral catheterization is a very reliable method of collection of urine without contamination. The best way to obtain non contaminated urine specimen is supra-pubic aspiration. Urethral catheterization and supra-pubic aspiration are the gold standard for obtaining urine specimens for culture.^{1,10,11} In one year period we treated 662 patients in ICU Children's hospital in Tuzla. All of them had urine sample taken for routine biochemical analysis, while in 107 of them (16.2%) urine culture was indicated. In 48 patients (17 boys and 31 girls) urine specimen was collected by urine bag, in 41 patients (13 boys and 28 girls) by mid stream collection and 18 patients (13 boys and

5 girls) were catheterized. Analyzing the accuracy of methods for collecting urine sample and received results it is possible to evaluate certainty of particular methods what the other authors point out in their researches too.¹¹⁻¹³

Reliability of urine and urine culture findings significantly depends on preparation of patient, method and accuracy of collecting specimen and correct transport. Training for medical technicians and parents for proper collecting of urine sample is essential.⁹⁻¹⁵

Six out of seven contaminated urine cultures were collected by a sterile bag. Only one contaminated urine culture was collected by mid stream collection. No contamination was detected in urine cultures collected by urethral catheterization. It means that we used proper methods for collecting and that there is no reason for any distrust and doubt in using urethral catheterization especially in seriously sick children.¹³⁻¹⁷

CONCLUSION

Accuracy of urine and urine culture findings in children significantly depends on preparing the patient, method of collecting specimen, control during collecting, correct transport to biochemical and microbiological analyses. Among seriously sick children which are under intensive treatment, it has been increased the risk of ignoring the procedure of collecting the urine sample because of numerous diagnostic and therapeutic procedures which are implementing in the same time.

Education of medical staff, parents as well as analysis of all measures taken to obtain correct conditions for collecting samples is great importance in order to reach qualitative results of collecting. Related to total number of collected urine samples for microbiological analyses in our study only seven specimens were contaminated (6.5%). The highest risk for contamination while taking urine sample is while collecting urine by urine bag.

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