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Low Contamination Rates in Bag Urine Samples Can Be Achieved

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Authors' contributions

All authors equally contributed in reviewing and elaborating microbiological data and in writing the manuscript. All authors have read and approved the manuscript.

Research Article

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ABSTRACT

Aims: Although international guidelines consider bag urine sample (BUS) as an unreliable way to collect urine in non-cooperative children suspected to have urinary tract infection (UTI), BUS is a commonly used method both in hospital and at home. Contamination of urine samples is believed to be a major problem of this technique. To assess the contamination rate of BUS in our clinical practice we reviewed our microbiological data of the last three years in young children investigated for UTI.
Study Design: Retrospective study.
Place and Duration of Study: Department of Pediatrics, G.B. Morgagni-L. Pierantoni Hospital, Forlì, Italy (2010-2012).
Methodology: Microbiological records of BUS and clean catch urine (CCU), in infants younger than 36 months of age, were retrospectively reviewed. Trained nurses collected BUS according to a standardized procedure. We also reviewed the three-year microbiological records of CCU in children older than 36 months of age. Contamination of a urine sample was defined as the growth of multiple pathogens irrespective to CFU counts.
Results: A total of 583 microbiological records were reviewed, 71% were BUS, 7% and 22% were CCU in children younger and older than 36 months of age respectively. In children younger than 36 months of age, contamination rates were comparable (*P*=.90) when urine was collected with BUS (16%) or with CCU (14%). In patients older than 36 months of age, contamination rates were significantly reduced (2.4%; *P*<.001) in CCU compared with both BUS and CCU in younger children.

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Conclusion: A good adherence to a standardized nursing procedure for bag urine collection could limit the risk of contamination of urine samples.

Keywords: Urine collection; urinary tract infection; bag urine sample; clean catch urine; infants; children; contamination rates.

1. INTRODUCTION

Diagnosis of urinary tract infection (UTI) in children requires urine collection and cultivation by one of four methods: bag urine specimens (BUS), clean catch urine (CCU), catheter specimens (CS) and suprapubic aspiration (SPA). In not-toilet trained infants, CCU and SPA are commonly indicated as the most reliable ways to obtain urine samples, but they are perceived as invasive and painful by both parents and pediatricians. Evaluating different urine collection methods for the diagnosis of UTI, Karacan and co. [1] and Tosif and co. [2] found BUS to have unacceptably high contamination rates of 43.9% and of 46% respectively compared to CCU (26% and 14.3%), CS (12% and 14.3%) and SPA (9.1% and 1%). Previous reports showed contamination rates for BUS ranging from 30% to 70% [3]. Although International guidelines do not consider bag urine sample (BUS) as a reliable method of collecting urine in non-cooperative children suspected to have urinary tract infection (UTI), BUS is commonly used both in hospital and at home in most European countries [4]. In our institution, in not-toilet trained children, urine is usually collected by means of sterile bags according to a standardized nursing procedure. In order to assess the contamination rate of BUS in our clinical practice we reviewed microbiological data of the last three years in young children investigated for UTI.

2. MATERIAL AND METHODS

Three-year (2010-2012) microbiological records of BUS and CCU, in infants younger than 36 months of age, were retrospectively reviewed. Children were admitted to our inpatient or outpatient clinic with signs and/or symptoms suggesting UTI or because of a positive history of UTI. In our unit, the nursing procedure for BUS collection was standardized and centered upon accurate cleaning of the perineal/genital area, first with liquid soap and then with saline and gauze pads and replacement of the bag every 30-60 minutes or in case of fecal contamination. Trained nurses performed all the procedures. The same cleaning procedure was used for CCU and parents were instructed about proper CCU collection. Samples were either sent to the laboratory within few hours of collection or refrigerated at 4℃ and preserved, usually for less than 24 hours, with boric acid. We also reviewed the three-year microbiological records of CCU collected in children older than 36 months of age in a comparable clinical setting. Contamination of urine sample was defined as the growth of multiple pathogens irrespective to CFU counts. A positive urine culture was defined as a count of a minimum of 100 000 CFU/ml of a single pathogenic organism for both BUS and CCU. Descriptive and comparative (chi-squared test, analysis of variance) statistical analysis were used when appropriate. A $P \leq .05$ was accepted as significant.

3. RESULTS AND DISCUSSION

A total of 583 microbiological records were reviewed, 416 (71%) obtained by BUS, 42 (7%) and 125 (22%) by CCU in children up to and older than 36 months of age respectively. Two

hundred sixty-nine (46%) of them were male. Sex, age distribution and microbiological findings in the three subgroups are detailed in Table 1.

Table 1. Patients' data and microbiological findings in the three subgroups

	BUS (≤36 months)	CCU (≤36 months)	CCU (>36 months)
Patients number (%)	416 (71)	42 (7)	125 (22)
M/F	211/205	19/23	39/86
Mean age (SD) (months)	8.3 (8.3)	14.7 (14)	94 (41)
Median age (months)	5.7	7.9	87
Culture result (%)			
negative	301 (72)	30 (72)	113 (91)
positive	50 (12)	6 (14)	9 (7)
contaminated	65 (16)	6 (14)	3 (2)

Culture results were comparable (*P*=.90) when urine was collected either by BUS or CCU in children younger than 36 months of age. Sample contamination occurred in 65/416 (16%) BUS vs. 6/30 (14%) CCU (*P*=.70). In the BUS group, male to female ratio was comparable (*P*=.77) in children who had a negative (155/146), positive (23/27) and contaminated (33/32) culture. Although in these patients the result was not age-dependent [negative culture (mean age (SD)) 8.1 (8.3) months; positive culture 7.5 (7.9) months; contaminated culture, 9.5 (8.8) months; *P*=.37], urine contamination seemed to occur less frequently in neonates than both in infants and children over 1 month of age (contamination rate: <1 month = 11.2%; 1-12 months = 16%; 12-36 months = 22.5%; *P*=.056) Likelihood of contamination was significantly reduced [3/113 (2.4%); *P*<.001] in CCU of patients older than 36 months of age compared to both BUS and CCU of younger children. Isolates in positive cultures were *E. coli* (n=34), *Enterococci* (5), *Klebsiellae* (5) *Proteus* (3) and *Pseudomonas* (3) in BUS, *E. coli* (4) and *Enterococci* (2) in CCU of children younger than 36 months of age and *E. coli* (9) in all CCU samples from older children, respectively.

In reviewing our recent experience with BUS, we found a remarkably low (16%) contamination rate in non-toilet trained children. Our data seem to contradict the common view that BUS collection has an unacceptable risk of bacterial contamination [1-3]. We are prompted to believe that a strict adherence to a standardized procedure for BUS collection by trained nurses was critical in achieving the observed low contamination rate [5,6]. Nonetheless, accurate cleaning of the perineal/genital area has been shown to prevent urine contamination also in toilet-trained children of both sexes collecting a midstream sample [5].

It was interesting to observe that contamination rates for BUS and CCU in children younger than 36 months of age provided comparable results, whereas CCU in older children performed significantly better. As a matter of fact, sterile handling of the container, as part of the CCU sampling procedure in uncooperative children, can be a difficult task for both parents and nurses and might explain the observed lack of difference in contamination rates between BUS and CCU among children younger than 36 months. Some evidence exists that BUS collection may offer reliable results if correctly performed. A study by Schroeder and co. [7] found that the risk of ambiguous cultures was very low (7.4%) in BUS. Although the performance of CCU was even better (2.7% contaminated cultures) the Authors realistically concluded that the magnitude of difference was small and that 21 catheterized specimens were needed to avoid each ambiguous bag result. In their systematic review, Whiting and co. [8] did not exclude the possibility of using BUS in infants, but they also suggested that

current evidence on diagnostic performance of urine sampling with this technique was sparse and that further research was needed on this topic. In a condition of high pretest probability of UTI (i.e.: positive nitrite test), a positive culture obtained by BUS could be accepted as a reliable result [9]. In a direct comparison between BUS and CS, Etoubleau and co. [4] found that bag specimens led to unreliable results in 40% of cases versus 5.7% of CS. They suggested that CS should be used to confirm a BUS-obtained positive result, but that systematic catheterization for every child suspected to have UTI could not be recommended.

Our study has some limitations. First, the retrospective design did not allow any formal comparison between BUS and CS and/or SPA, which are currently considered the gold standard to obtain sterile urine samples for culture. CS and SPA have several drawbacks that narrow their diffusion in daily practice: they are painful procedures, poorly accepted by parents in many cultural settings, limited by technical difficulties requiring uncommon skills and expertise, frequently unsuccessful and even involuntary source of infection of the urinary tract. We did not use SPA and we obtained CS only in specific situations such as diagnostic imaging or when less invasive methods were impractical. Second, our study did not investigate the reliability of BUS in diagnosing UTI, but only its contamination rate in comparison with CCU in children younger than 36 months of age. We are well aware that a correct diagnosis of UTI may be challenging and that, sometimes, a positive urine culture is not sufficient to diagnose a UTI. A prospective study, combining clinical, biochemical and microbiological data, obtained with different methods of urine collection, would be required. Finally, our definition of “contaminated sample”, although commonly used in clinical practice, could be not univocally accepted [1,3].

4. CONCLUSION

Although affected by the limits of a retrospective analysis, our data suggest that good adherence to a standardized nursing procedure for bag urine collection could limit the risk of sample contamination, even in the routine practice of a pediatric ward. Further investigation on the best nursing practice in this field is needed.

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CONSENT

Not applicable.

ETHICAL APPROVAL

All the procedures were consistent with our Institutional Quality System.

COMPETING INTERESTS

Authors declare that no competing interests exist.

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