MEDICAL SCIENCES

URINE CULTURE GATHERED BY ANTISEPTIC BAG SAMPLE: IS IT A TECHNIQUE TO ESCAPE?

Diamant Shtiza,
Enkelejda Shkurti
Associated Professor,University of Medicine, Public health lecturer, Department of Diagnostic and Rehabilitation Medicine,Tirana, Albania
https://doi.org/10.5281/zenodo.10514407

Abstract

The diverse studies in literature concerning the consistency of urine gathered by bag method reveal opposing data. The study appraises the consistency of sterilised bag assortment in a cluster of children who had their first incident of urinary tract infection 1 to 36 months of age.

The research outcomes resulted from a multi-centre prospective randomised study. 410 patients performed 3 successive urinalysis and urine cultures. Urinalysis and urine culture development were held every month to the first 6 months; and then every additional month. The urine was gathered by antiseptic bag assortment in all children.

First urine culture indicated 376 E.Coli, only one urine culture altered from E.Coli to Proteus Mirabilis in the third urine culture. We accomplished 2385 repetitive urinalysis and urine cultures, only one impurity was constricted; 75 patients (22%) had a affirmative urine culture through the follow-up, 51 (15,4%) of them were girls. 26 (1,0%) febrile urinary tract infection were disqualified. 2243 (89%) urine cultures were negative; 33 (1,3%) contaminations; 55 (2,2%) asymptomatic bacteriuria; 26 (1,1%) lower urinary tract contamination. E.Coli was most recurrent micro-organism; it was found in 53 (49%) of all cases and in 75% of higher urinary tract infection.

A few number of infections was constricted in our enormous study, so we consider that sterile bag assortment is reliable.

Keywords: sterile bag urine, urine culture follow-up, febrile urinary tract infection

INTRODUCTION

The diagnosis of UTI may be proposed by definite signs and indicators, but culture of the urine is the golden standard (1). Regarding the fact that culture outcomes are not accessible for at least 24 hours, there has been substantial interest in assessing tests that may foretell the results of the urine culture so that suitable therapy can be started at the first meeting with the symptomatic patient (2).

The sensitivity of the standard UA is 81% (95% CI, 78%-85%) and does not change with age in febrile children younger than 2 years (3).

The non intrusive bag trial is frequently seen as the most striking choice for health staff and parents regardless of the distinguished risk of attaining a contaminated outcome on urine culture (4,5).

Available assortment methods comprise clean-voided bag collection, suprapubic aspiration, each with its own benefits and disadvantages (6).

Nosocomial urinary tract infection is the most conjoint infection attained in both hospitals and nursing homes and is typically linked to catheterisation (7).

Fifteen per cent of febrile UTI are correlated with renal scarring[16] and the occurrence of re-infection through the first year after a UTI, has been evaluated to be up to 30% (8-9).

A urine culture should be achieved 1 wk after the conclusion of treatment of any UTI to confirm that the urine is sterile. Prior to the tendency of urinary tract infections to persist even in the lack of disposing anatomic aspects, a follow-up urine culture should be accomplished periodically for 1–2 year, even when the child is asymptomatic (10).

Mass screening for bacteriuria in infancy appears to result principally in the discovery of innocent bacteriuria episodes and is not suggested (11).

It is mentioned that families and clinicians preserve a high index of doubt for repeated UTI, and to acquire a dipstick, urinalysis and/or culture for age-appropriate signs of UTI, involving unsolved fever. Screening urine cultures are not essential (Wettergren 1990 [C] (12).

Infants and children who has no symptoms following an episode of UTI should not regularly have their urine re-tested for infection. Asymptomatic bacteriuria is not a suggestion for follow-up (13).

We appraise the consistency of sterile bag collection and consider the cogency of routine follow-up urine cultures in a cluster of children who had their principal episode of urinary tract infection 1 to 36 months of age.

METHODS AND PATIENTS

The records of this study derived from 2 multicentre prospective randomised studies (IRIS 1 & 2) (14) concerning the main end-point of the population involved was 407 patients age 1 month to 36 months (data from IRIS 1) (15). We achieved 2 consecutive urinalysis and urine cultures. Urine was gathered in a sterile urine bag; the two concordant consecutive urinalyses and cultures were obligatory to evaluate the hazard of wrong positive results. Urinalysis test outcomes with white cell counts ≥23/μl, =1+ with dipstick and urine

culture tests with development of only one micro-organism ≥100 000 colony creating units/ml.

Concerning the secondary endpoint the population involved was 327(232 girls) children aged 1 month to 36 months when they presented with their first acknowledged incident of acute pyelonephritis among June 2018 and April 2020 (data from IRIS 2). Urine was gathered in a sterile urine bag. Outpatient urinalysis and urine culture were accomplished every month for the first 6 months, and then 3-monthly, in total 10 urinalysis and urine culture for every patient through 1 year of follow-up. Febrile UTI (urinalysis positive, urine culture positive 1 micro-organism > 100.000 CFU/ml and fever) were excepted for we diagnose a reason of their symptom (fever) and not from the repetitive controls. We measured contaminations (urinalysis negative, so no leucocituria, no pyuria, no nitrites and urine culture more than 1 micro-organism or < 100.000 CFU/ml); asymptomatic bacteriuria (urinalysis negative and urine culture positive:1 micro-organism > 100.000 CFU/ml, no symptoms); lower UTI (urinalysis negative and urine culture positive: 1 micro-organism > 100.000 CFU/ml and low symptoms e.g.: irritability, smelly urine).

RESULTS

Principal outcome: an entire of 410 patients were comprised. First urine culture presented 382 E.Coli, only one urine culture changed from E.Coli to Proteus Mirabilis in the second urine culture. We contracted only one contamination (See Table 1).

Table 1.

The 2 consecutive urine cultures confrontation.

UC 1 / UC 2	Contam.	E.Coli	Enterob.	K.Oxytoc	K.Pneum.	P.Aerug.	P.Mirab.	Total
Contamination	1	0	0	0	0	0	0	1
E.Coli	0	382	0	0	0	0	1	386
Enterobacter	0	0	3	0	0	0	0	3
K.Oxytoca	0	0	0	4	0	0	0	4
K.Pneumoniae	0	0	0	0	5	0	0	5
P.Aeruginosa	0	0	0	0	0	4	0	4
P.Mirabilis	0	0	0	0	0	0	4	4
Total	1	382	3	4	5	4	5	407

UC 1 – first urine culture;
UC 2 – second urine culture

We distinguished a high negative prognostic value, so that validate that a negative urinalysis is tracked almost by a negative urine culture, but we can't say the opposite, so the positive urinalysis is followed by negative urine culture. (See Table 2)

Table 2.

Predictive value of urinalysis.

Index	1 month	2 month	3 month	4 month	5 month	6 month	8 month	10 mo	12 mo
Sensibility	51	57	61	49	30	23	60	42	68
Specificity	94	95	93	96	98	99	100	98	98
Positive predictive value	43	45	54	51	52	34	76	68	58
Negative predictive value	98	99	98	97	94	97	98	96	100

Subordinate outcome: 2387 routine urinalysis and urine cultures were provided (data from IRIS 2); between June 2018 and April 2020, 24 centres registered and randomized 338 (234 girls) children aged 1 month to 36 months when they presented with their principal documented episode of acute pyelonephritis; median age 14,2 month; 77 patients (22%) had a positive urine culture during the follow-up, 54 (15,5%) of them were girls; 26 (1,10%) febrile UTI (urinalysis positive, urine culture positive 1 micro-organism > 100.000 CFU/ml and fever) were disqualified; 2248 (94%) urine cultures were negative; 116 (4%) urine cultures result positive: 33 (1,3%) contaminations (urinalysis negative, so no leucocituria, no pyuria, no nitrites and urine culture more than 1 micro-organism or < 100.000 CFU/ml); 56 (2,3%) asymptomatic bacteriuria (urinalysis negative and urine culture positive:1 micro-organism > 100.000 CFU/ml, no symptoms); 28 (1,2%) lower UTI (urinalysis negative and urine culture positive: 1 micro-organism > 100.000 CFU/ml and low signs e.g.: irritability, smelly urine). E.Coli was most recurrent micro-organism; it was discovered in 55 (49%) of all positive cases and in 76% of upper UTI (See Table 3). 12 (10 girls) children presented only contamination for a total of 20 episodes; 12 children presented only lower UTI for a total of 20 episodes; 30 children presented asymptomatic bacteriuria for a total of 44 episodes; only 7 children presented mixed episodes. The cost of urinalysis is 2,4 euro, urine culture 11,5 euro, urine bag 1,3 euro and urine cup 0,8 euro: total of 16 euro for 1 control per patient. The total cost of 2387 controls is 38350 euro.

Table 3

Urine cultures microbes

	Febrile UTI	Lower UTI	Asymptomatic Bacteriuria	Total	%
E.Coli	22	18	19	51	50
P.Mirabilis	2	4	17	22	17,8
P.Aeruginosa	2	6	13	20	17,8
Kl.Pneumoniae	3	0	3	4	3,6
Klebsiella	0	3	4	5	5,4
Enterococcus	0	0	2	2	1,8
K.Oxytoca	2	0	1	1	1,8
Citrobacer	2	0	1	2	1,8
	33	31	60	107	100

DISCUSSION

The urine sample can be acquired in dissimilar modalities. Urine gathering techniques included freely voided ("clean-catch"), catheter, urine bag, diaper urine, and suprapubic aspiration. In small children it is hard to attain the sample by the spontaneously voiding technique.

Suprapubic aspiration is recounted to have the lowest contagion rates and is recognized to be the golden standard for diagnosing UTI in children (16).

This technique, though, is deliberated too aggressive by many nurses, physicians and parents and is not a technique usually used outside the neonatal period. When applied in Emergency Department setting, stated success rates in attaining a urine sample by supra-pubic aspiration have been as low as 45% versus a 100% success rate with catheterization (17). In numerous children the bladder may not be completely distended, which may enlighten the low success degree of suprapubic aspiration in this location.

Catheterization is observed by some parents, nurses and physicians as invasive. Catheterization could put the child at threat for UTI by hosting bacteria into the urethra or the bladder (18-19).

Lohr et al. reported an incidence of 10,6 % hospital acquired UTI in hospitalized children who had been catheterized (20).

Nosocomial UTI is the most common infection attained in hospitals and is typically correlated with catheterization. This infection would be even more common but for the application of the closed catheter system. Most alterations have not upgraded on the closed catheter itself. Even with particular care, this structure will not avoid bacteriuria. After bacteriuria progresses, the capability to limit its barriers is minimal. Once a catheter is put in place, the doctor must preserve two notions in mind: keep the catheter system closed in order to rearrange the onset of bacteriuria, and eliminate the catheter as soon as possible. If the catheter can be detached before bacteriuria develops, suspension becomes prevention (21).

In low-risk children, grave consequences of infection are far less likely, and the risks of missing a UTI are likely to be balanced by the risk of catheterization, counting pain, false-positive result, trauma, or even outline of infection. The physician thus may elect to apply a bag urine screening approach to decrease the number of excessive catheterizations. The concerns of maintaining on a "catheterize all" strategy for all non-toxic-looking children with fever without basis may have the potential to guide to test resistance by health professionals and parents who are worried about a painful technique and the unidentified risk of introducing infection (22).

Considering the high rate of contamination and contrary clinical results related to bag urine cultures, we consider that bag urine samples should not be sent for culture. So, despite its "noninvasive" status, the use of bag urine cultures seems to surpass its benefits (23).

In our survey 410 patients age 1 month to 36 months (data from IRIS 1) (24) performed 2 successive urinalysis and urine cultures. Urine was gathered in a sterile urine bag. We observed a high specificity and high negative predictive assessment, so that validate that a negative urinalysis is monitored practically by a negative urine culture, but when the urinalysis marks positive (often 24%-68% of cases) the urine culture will be negative. From 386 E.Coli inaccessible in the first urine sample, only one urine culture altered from E.Coli to Proteus Mirabilis in the second sample urine culture. We constricted only one contagion, so we believe that sterile bag collection is consistent in the execution of urine culture test.

In relation to the efficacy of routine urine culture follow-up next the first febrile UTI, we make a assessment the literature (recommendations, textbooks, handbooks and articles).

Prior to the propensity of urinary tract infections to persist even in the lCK of predisposing anatomic factors, a follow-up urine culture should be accomplished occasionally for 1–2 year, even when the child has no symptoms (25).

Mass screening for bacteriuria in infancy appears to result mainly in the recognition of innocent bacteriuria incidents and is not recommended. However screening for bacteriuria in healthy children has no place in any age group, it is significant to perform urine cultures freely in symptomatic children, particularly in infants with high fever or failure to flourish (26).

It is suggested that families and clinicians preserve a high index of doubt for recurrent UTI, and to attain a dipstick, urinalysis and/or culture for age-appropriate symptoms of UTI, counting unexplained fever. Screening urine cultures are not essential (Wettergren 1990 [C])(27)

Infants and children who are asymptomatic following an episode of UTI should not routinely have their urine re-tested for infection. Asymptomatic bacteriuria is not an indication for follow-up (28).

Urine should be cultured any non precise illness and treatment should be ongoing as soon as the sample has been reserved. Routine urine culture in well children is not required (29)

There are presently no records to suggest that detection and treatment of asymptomatic bacteriuria prevents following pyelonephritis or renal scarring. Routine screening is expensive and outcomes in follow-up testing and imaging in a huge percentage of healthy children with false-positive tests.

Furthermore, a low threshold for attaining a urinalysis and culture should be preserved in the child with a previous history of UTI who has symptoms, however minor, that suggest the opportunity of recurrent infection (30).

Here appears to be no justification for routine episodic urine cultures in the asymptomatic child. However, a high guide of suspicion for probable breakthrough infections should be sustained (31).

The colleagues from Finland published their study about the Recurrence and follow-up after urinary tract infection under the age of 1 year (32).They examined the worth of routine urine monitoring after principal UTI in children who had their first UTI while less than 1 year of age by gathering and analysing 3-year follow-up data on these children and assessed the hazard factors for the repetition of UTI. It was a retrospective analysis of the children treated for their first UTI episode under the age of 1 year, during the years 1978–1984 was undertaken. Altogether 262 patients (128 boys and 134 girls) were identified from the hospital discharge registry. During that period, the routine follow-up of all children in Finland after their first UTI included monthly routine urine cultures for 2 years. The follow-up period after the primary UTI was 3 years. The first UTIs of the patients were caused by Escherichia coli in 89% of cases. No recurrent infections occurred in 174 children (66%) during the following 3 years; 45 of the 128 boys (35%) and 43 of the 134 girls (32%) had a total of 161 recurrent UTI episodes during the 3-year follow-up period. Recurrent UTI occurred in 61% of the cases (54) within 3 months, in 86% within 6 months, and in 92% within 1 year of the primary UTI. They concluded that the follow-up could be determined according to the grade of VUR. Since children with grade 1–2 VUR have a low risk for renal damage, their risk for recurrent UTI is similar to that of children without VUR, they could be left without any routine follow-up after the first UTI. Therefore, these patients do not need further imaging of VUR. Children with grade 3–5 VUR should be followed for UTI recurrences with monthly urine cultures if not on prophylactic

medication for 6 months after symptomatic UTI, because grade 3–5 VUR is a risk factor for recurrent infection and also for renal scarring.

In our study 2398 routine urinalysis and urine cultures were obtained; 338 (234 girls) children aged 1 month to 30 months when they presented with their first recognized episode of acute pyelonephritis completed a follow-up of 1 year. The median age 14,1 month. 79 patients (23%) had a positive urine culture during the follow-up. Febrile UTI were excluded; 2252 (95%) urine cultures were negative; 119 (5%) urine cultures result positive: 34 (1,4%) contaminations; 57 (2,4%) asymptomatic bacteriuria; 28 (1,2%) lower UTI. E.Coli was most frequent micro-organism; it was found in 56 (50%) of all positive cases and in 77% of upper UTI (See Table 3). 13 (11 girls) children presented only contamination for a total of 18 episodes.

CONCLUSIONS

We contracted a low number of contaminations in our large study, so we believe that sterile bag collection is reliable. We noted a high negative predictive value, so that authenticate that a negative urinalysis is followed almost by a negative urine culture. Urine culture follow-up is not necessary for the children after first febrile UTI. Such an approach would result in significant cost savings.

References:

1. Ellen Wald. Urinary tract infection in infants and children: a comprehensive overview. Curr Opin Pediatr 16:85–88. © 2004 Lippincott Williams & Wilkins.

2. Pryles C, Luders D, Alkan M. A comparative study of bacterial cultures and colony counts in paired specimens of urine obtained by catheter vs voiding from normal infants and infants with urinary tract infection. Pediatrics 1961;17:17-28

3. Hardy J, Furnell P, Brumfit W. Comparison of sterile bag, clear catheter and suprapubic aspiration in the diagnosis of urinary tract infection in early childhood. Br. J Urol 1976;48:279-83.

4. Hildebrand W, Schrener R, Stevens D, Gosling C, Sternecker C. Suprapubic bladder aspiration in infants. Am Fam Physician 1981;23:155-8.

5. Redman J, Bissada N. Direct bladder catheterization in infant females and young girls: description of an effective and painless procedure. Clin Pediatr 1976;15:1060-1.

6. Pryles C. Percutaneous bladder aspiration and other methods of urine collection for bacteriologic study. Pediatrics 1965;36:128-31.

7. Aronson A, Gustafson B, Svenningsen N. Combined suprapubic aspiration and clean voided urine examination in infants and children. Acta Paediatr Scand 1973;62:396-400.

8. Newman A, O'Neill P. Pyuria in infancy and the role of suprapubic aspiration of urine in the diagnosis of infection in the urinary tract. Br Med J 1976;2:277-9.

9. Shannon F, Sep E, Rose G. The diagnoses of bacteruria by bladder puncture in infancy and childhood. Aust Paediatr J 1969;5:97-100.

10. Pollack C, Pollack E, Andrew M. Suprapubic bladder aspiration versus urethral catheterization in ill infants. Ann Emerg Med 1994;23:225-30.

11. McCarthy J, Pryles C. Clean voided and catheter neonatal urine specimens, bacteriology in the male and female neonate. Am J Dis Child 1963;106:85-90.

12. Hardy J, Furnell P, Brumfit W. Comparison of sterile bag, clear catheter and suprapubic aspiration in

the diagnosis of urinary tract infection in early childhood. Br J Urol 1976;48:279-83.

13. Roberts K, Downs S, Hellerstein S, Holmes M, Leibowitz R, Lohr J, et al. American Academy of Pediatrics Committee on Quality Improvement, Subcommittee on Urinary Tract Infection. Practice Parameter: The diagnosis, treatment, and evaluation of the initial urinary tract infection in febrile infants and young children. Pediatrics1999;103:843-52.

14. Bonadio W. Urine culturing technique in febrile infants. Pediatr Emerg Care 1987;3:75-8

15. John W. Warren. Catheter- associated urinary tract infections International Journal of Antimicrobial Agents 17 (2001) 299–303

16. Montini G, Toffolo A, Zucchetta P et al. Antibiotic treatment for pyelonephritis in children: multicentre randomised controlled non-inferiority trial. BMJ 2007 Aug 25;335(7616):386

17. Ghiro L, Cracco AT, SartorM, Comacchio S, Zacchello G, Dall'Amico R. Retrospective study of children with acute pyelonephritis. Nephron 2002;90:8-15.

18. Winberg J, Bergstrom T, Jacobsson B. Morbidity, age and sex distribution,recurrences and renal scarring in symptomatic urinary tract infection in childhood. Kidney Int 1975;(Suppl 4):S101-6.

19. Panaretto K, Craig JC, Knight JF, Howman-Giles R, Sureshkumar P, Roy LP. J Pediatr Child Health 1999;35:454-9.

20. Richard Bachur, MD; Marvin B. Harper, MD Reliability of the Urinalysis for Predicting Urinary Tract Infections in Young Febrile Children Arch Pediatr Adolesc Med. 2001;155:60-65

21. Nelson Textbook of Pediatrics 17th edition (May 2003) by Richard E., Md. Behrman (Editor), Robert M., Md. Kliegman (Editor), Hal B., Md. Jenson (Editor) By W B Saunders By OkDoKeY

22. Paediatric Nephrology 5TH Editors: Avner, Ellis D.; Harmon, William E.; Niaudet, Patrick Copyright Â©2004 Lippincott Williams & Wilkins Chapter 53. Urinary Tract Infection Sverker Hansson, Ulf Jodal

23. For medical management of First Urinary Tract Infection in children 12 years of age or less. Cincinnati Guideline

24. Urinary tract infection in children diagnosis, treatment and long-term management National Collaborating Centre for Women's and Children's Health Clinical Guideline August 2007 Funded to produce guidelines for the NHS by NICE

25. Prophylaxis after first febrile urinary tract infection in children? A multicentre randomized controlled non inferiority trial. Giovanni Montini et al. Paediatrics in Press

26. Lohr J, Downs R, Dudley S, Grossman-Donowitz L. Hospital acquired urinary tract infection in the pediatric patient: a prospective study. Pediatr Infect Dis J 1994;13:8-12

27. McGillivray D, Mok E, Mulrooney E, Kramer MS. A head-to-head comparison: "clean-void" bag versus catheter urinalysis in the diagnosis of urinary tract infection in young children. J Pediatr 2005;147:451-6

28. Fahad Al-Orifi, MD, David McGillivray, MD, Susan Tange, MD, and Michael S. Kramer, MD Urine culture from bag specimens in young children: Are the risks too high? J Pediatr 2000;137:221-6

29. Rees L et al. Paediatric Nephrology, Oxford 2007

30. Fisher, Randall G.; Boyce, Thomas G. Moffet's Pediatric Infectious Diseases:A Problem-Oriented Approach, 4th Edition Copyright Â©2005 Lippincott Williams & Wilkins

31. Uri S. Alon Current Pediatric Therapy 18TH Edition Copyright © 2006 Saunders Chapter 147 – Urinary Tract Infection and Perinephric/Intranephric Abscess

32. Matti Nuutinen · Matti Uhari Recurrence and follow-up after urinary tract infection under the age of 1 year. Pediatr Nephrol (2001) 16:69–72