

# Yield of Suprapubic Aspirate versus Bag Collection in Diagnosis of UTI in Children 0 to 6 Months of Age

Lubna Riaz, Muhammad Aslam, Waqar Hussain, Anita Lamichhane, Ahsan Ahmad, Fatima Zeeshan  
*Department of Paediatrics, Shaikh Zayed Hospital, Lahore*

## ABSTRACT

**Objective:** To evaluate the accuracy of urine sample collection methods among children suspected of having urinary tract infection. **Subjects and Methods:** Urine samples were collected in infants 0 - 3 months of age presenting with features of sepsis. Two methods of collection were used, one was bag attached to perineal skin and the other was suprapubic aspirate. Within 30 minutes of collection, all specimens were sent to the laboratory, refrigerated and processed according to standard hospital microbiological procedures. Urine samples were analyzed using routine culture techniques. **Setting:** This cross sectional study was conducted at Shaikh Zayed hospital Lahore. The duration of study was six months. A total of 100 cases fulfilling the inclusion criteria were included in this study. Results were analyzed according to SPSS 16. **Results:** Out of 100 patients (n=100) 17 had positive bag culture, only 4 out of 17 had culture positive by SPA, so there were 13 false positives while using bag collection method. **Conclusion:** Suprapubic aspiration showed the positive yield in 4 SPA which does not indicate contamination and sterile urine bag showed the highest contamination rate among the two methods of urine sample collection. So urine bag leads to unnecessary treatment burden on the child and family. Therefore we cannot rely on bag samples for diagnosis of urinary tract infections specially the bag collection method because the specificity of bag collection method is very low.

**Key Words:** UTI (urinary tract infection), urine bag, clean catch, urethral catheterization, suprapubic aspiration (SPA)

## INTRODUCTION

Suprapubic aspirate is a procedure to obtain uncontaminated bladder urine. It is easy to perform in the emergency department and is associated with minimal complications. Huze and Beeson first published this practice in 1956 as an alternative to more traditional methods of obtaining urine for analysis and culture. Their findings suggested that Suprapubic catheterization and aspiration was superior to clean-catch or transurethral (via catheterization) collection of bladder urine for bacteriologic study. The sensitivity of the aspirated urine for bacteruria on urinalysis via this method approaches 100% and is rarely associated with contamination<sup>1</sup>

Urinary tract infection is a serious bacterial

infection in about 7% of infants and children <2 years of age<sup>2</sup>. Its prevalence is about 7 to 9 % in younger than 3 months of age and it decreases to about 2% for both males more than 3 months of age and females of more than 12 months<sup>3</sup>. UTI is bacterial infection of mucosal surface of urinary tract anywhere from renal parenchyma to urethra<sup>4</sup>.

The symptoms of UTI are complex and depend upon age. In the first three postnatal months, the symptoms are nonspecific i.e. lethargy, jaundice, poor feeding and failure to thrive. In infants 3 to 12 months of age symptoms are more specific to urinary tract such as dysuria, hematuria and increased frequency.<sup>4</sup>

The standard method used to diagnose UTI is the culture of urine obtained by invasive methods such as Suprapubic aspirate (SPA), transurethral

catheterization or non invasive like clean catch midstream sample or urine bag collection<sup>5</sup>. The most frequent and best-studied agent of urinary tract infection (UTI) is *Escherichia coli*<sup>6</sup>.

Early appropriate diagnosis and treatment of UTI is very important as it is a chronic cause of morbidity in children. Long term complications are hypertension, proteinuria and decreased renal function all due to scarring<sup>5</sup>.

Early treatment of UTI is very important to prevent these complications. The accurate diagnosis of UTI is necessary to ensure appropriate therapy for infected children and to avoid unnecessary therapy and prevent hospital admission for non infected children<sup>5</sup>.

A urine culture result is considered as ‘the gold standard’ for diagnosis of UTI, but collecting uncontaminated urine samples is difficult. The sterile urine bag is a noninvasive and easy alternative although this method results in a high contamination rate<sup>5</sup>.

## OPERATIONAL DEFINITIONS

A positive urine culture was defined as the growth of a single pathogen of more than  $10^5$  colony forming units (CFU)/ml in a sterile urine bag or growth of a single gram negative organism on Suprapubic aspirate or  $>10^3$  colony forming units of gram positive organisms.

Symptomatic bacteriuria is defined as upper and lower urinary tract symptoms or nonspecific symptoms and urine culture with significant colony counts.

Asymptomatic bacteriuria is defined as significant urinary bacterial colony count in asymptomatic patient.

Complicated bacteriuria is defined as urine culture with significant bacterial counts and associated urological abnormalities.

Contaminated samples were defined as growth of non-pathogenic organism (*Lactobacillus* species, coagulase negative staphylococcus), growth of two or more organisms and positive urine culture where simultaneous ‘gold standard’ SPA had no growth.

## MATERIALS AND METHODS

This is a cross sectional study conducted at the department of pediatrics, Shaikh Zayed Federal Post Graduate Medical Institute, Lahore, Pakistan from 1<sup>st</sup> march to 31<sup>st</sup> august 2012 with the prior approval of the study protocol; from the ethical committee of the institutional review board of the concerned hospital. All the infants between 0-3 months, both male and female (both circumscised or not) having complain of poor feeding, lethargy, jaundice, crying during micturition documented fever  $>38^{\circ}\text{F}$  were included. All the infants who fulfilled the following criteria were excluded from the study:

- Children more than 6 months of age
- With urine collection methods other than bag and SPA
- With structural anomalies of urinary tract
- Recent h/o of antibiotic use for any purpose in last 3 months
- Previously documented urinary tract infection
- Children on indwelling catheters or on intermittent catheterization
- Children with complicated bacteriuria
- Asymptomatic bacteriuria

### Data collection

One hundred children were included in this study out of which 60 were male and 40 were female. The urine was collected both by bag collection and by suprapubic aspirate method from the inclusion group. Urine bags were placed by trained nurses, using standard perineal cleansing procedures. Within 30 min of collection, all specimens were sent to the laboratory, documented on blood agar and eosin methylene blue (EMB) medium by standard loop method and incubated at  $37^{\circ}\text{C}$  overnight. Urine samples were analyzed using the criteria established.

## RESULTS

It was observed that only 4% of urine samples obtained by Suprapubic aspiration and 17% samples by urine bag method were positive on culture (Table 1).

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**Table 1: Culture yield of urine samples taken by Suprapubic aspiration (SPA) and bag method (n=100)**

Urine sample	Culture positive		Culture negative		P value
	No.	%	No.	%	
SPA	4	4	96	96	< 0.001
Bag method	17	17	83	83	

\*Comparison of positive culture by the two methods.

**Table 2: The comparison between culture yield of urine samples obtained by SPA versus urine bag method.**

Parameter	Result	Standard error	95% confidence interval
Sensitivity of bag	100%	0	-----
Specificity of bag	86.5%	3.4	83.1-89.9
PPV of bag	23.5%	4.2	19.3—27.7
NVP of bag	100%	0	-
Accuracy	87%	3.4	83.6-90.4

PPV: Positive Predictive Value

NPV: Negative Predictive Value

## DISCUSSION

Urinary tract infection (UTI) is one of the most common infections of childhood. It concerns the parents, and may cause permanent kidney damage. Febrile infants younger than 3 months are an important subset of children who may present with fever without a localizing source. Workup of fever in these infants should always include evaluation for UTI.

Urine bag specimens are not appropriate in the diagnosis of UTI in infants. Invasive methods of urine collection are occasionally required to obtain urine samples from infants unable to void on command. Improper urine specimen collection can lead to contamination, and a clinical dilemma regarding which infants and children to treat, and how extensively to investigate them for suspected UTI? Under-resourced hospitals and clinics face the additional challenges related to limited means and expertise to adequately collect and process urine samples<sup>5</sup>.

SPA (Suprapubic aspirate) is considered the ‘gold standard’ method of urine collection; the least likely to be contaminated. SPA samples have less than a 5% chance of having intermediate growth, and using AAP (American Academy of Pediatrics) guidelines for interpreting urine culture results, have close to 100% specificity for excluding UTI's. The major drawbacks of using SPA as a method of urine collection include the invasiveness of the test, and possible failure to obtain a sample using this technique<sup>7</sup>. Success rates for obtaining SPA samples range from 25% to 98%, though many of these studies included children greater than two years of age who would no longer be considered for SPA and in whom a higher failure rate might be expected. Increased success has been reported using bladder ultrasound and waiting 60 min after an infant last void prior to attempting SPA. The invasiveness of SPA may be of concern to parents, though few adverse sequelae have been reported following this procedure. Transient microscopic hematuria is the most common complication of SPA, and is of no clinical significance<sup>5</sup>.

Since children under two years with suspected urinary tract infections (UTIs) cannot control urination, urine cultures in such children are usually performed via urine bags. This method is noninvasive but has a high contamination rate. The contamination rate of urine culture in the examined patients was 37.9%.

All methods used to collect urine samples can result in contamination with bacteria from outside the bladder. This can lead to an inaccurate diagnosis, involve unnecessary treatment or require a sample to be repeated which has implications for patient care and cost-effectiveness<sup>8</sup>.

In one study contamination rates for clean catch urine, SPA, catheterize specimen urine, bag specimen urine collection in children less than two years were compared which showed 26% in clean catch urine, 12% in urine bag collection method and 1% in SPA<sup>9</sup> which is in accordance with our study having contamination rate of 13% in urine bag collection method specimen. Another study conducted in Turkey four methods of urine sample collection were evaluated between 0-10 years with suspected UTI. Contamination rate for bag specimen urine was 43.9% as compared to SPA that

is 9%<sup>10</sup>. In neonates ultrasound guided SPA improves diagnostic yield of obtaining a urine specimen from 60% to almost 97%. This study concludes that bag urine specimens are not useful for diagnosing UTI and should always be followed up with another method with young children to confirm the diagnosis. Bag specimen urine is highly specific for ruling out UTI<sup>3</sup>.

The noninvasive bag Sample is often seen as the most attractive option for nurses, physicians, and parents despite the well-known risk (30% to 70%) of obtaining a contaminated result on urine Suprapubic aspiration is reported to have the lowest contamination rates and is acknowledged to be the gold standard for diagnosing UTI in children In many ill children the bladder may not be fully distended, which may explain the low success rate of Suprapubic aspiration in this setting<sup>1</sup>.

In a cross-sectional study, 119 consecutive infants (aged 3 to 28 days) with fever who were referred to Children's Hospital Medical Center in Tehran between September 2004 and March 2005 were included. Urine was collected simultaneously by bag and Suprapubic aspiration. The rate of culture contamination differed markedly according to the method of urine culture. Suprapubic aspiration specimens were sterile in 92.4%. Pathogenic bacteria were isolated in 7.6%. No bacterial isolates were deemed to be contaminants. Only 8.5% of bag specimens were sterile. Of non-sterile cultures, 36.9% of bacterial isolates were deemed to be pathogenic and 54.6% contaminants. Pyuria and bacteruria were more frequent in specimens obtained by bag than urine from suprapubic aspiration. The existence of a urinary tract anomaly was the main predictor for a positive culture in urine obtained by suprapubic aspiration. Contamination rates and rates of Pyuria and bacteriuria are remarkably higher for urine obtained by bag specimens than for urine obtained<sup>1</sup>.

### CONCLUSION

Suprapubic aspiration showed the lowest contamination rate while sterile urine bag showed the highest contamination rate among the two methods of urine sample collection. So urine bag leads to unnecessary treatment burden on the child

and family. Therefore we cannot rely on bag samples for diagnosis of urinary tract infections as the specificity and PPV of bag method is low.

### RECOMMENDATIONS

It is recommended that UTI should be diagnosed appropriately and immediately with accurate method of urine collection especially in infants who are unable to void on command. False positive and false negative results obtained by inappropriate method causes adverse outcome that is delayed diagnosis a, treatment, unnecessary stay in hospital and un necessary investigations cause lots of problems. To overcome this, inappropriate method like bag specimen urine must be followed by more reliable method like SPA before starting investigation and treatment.

We therefore recommend that a large multicentred trial should be done to identify the best method of urine collection to make appropriate guidelines.

### REFERENCES

1. Al-orifi F, McGillivray D, Tange S, Kramer MS. Urine culture from bag specimens in young children: are the risks too high? *J Paed* 2000;137;221
2. Freedman AL. Urological diseases of America project :trends in resource utilization for urinary tract infections in children *Urol*. 2005;173:949-54
3. Shaikh N, Morone NE, Bost JE, Farrell MH. Prevalence of urinary tract infection in childhood a meta-analysis. *Pediatr Infect Dis J*. 2008;27:302-8
4. Feld LG, Mattoo TJ. Urinary Tract Infections and Vesicoureteral Reflux in Infants and Children. *Pediatric Rev*. 2010; 31:451-63
5. Long E. Evidence behind the WHO guidelines: Hospital Care for Children: What are appropriate methods of urine collection in UTI? *J Trop Pediatr* 2007;53: 221-224
6. Johnson JR. Microbial virulence determinants and pathogens of urinary tract infections. *Infect Dis Clin* 2003; 17: 261-78
7. Downs SM, for the American Academy of

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- Pediatrics, committee on Quality improvement, urinary tract sub-committee Technical reports; UTI in febrile infants and young children. Pediatrics 1999; 103:e54 [PubMed]
8. Rogers, J., Saunders, C. Urine collection in infants and children. Nursing Times 2008; 104:40–2.
  9. Tosif S, Baker A, Oakeley E, Donath S, Contamination rates of different urine collection methods for the diagnosis of UTI in young children: J Paed Child Health 2012.[PubMed]
  10. Karacan C, Erkek N, Senel S. Evaluation of urine collection method for the diagnosis of UTI in children .Med Prin Pract. 2010; 19: 188-91.
  11. Hosseini, Milan SM, Ataei, Neamatollah; Sharifzadeh, Maysam, Khotaei, Taj G. Urine culture obtained from bag specimens and suprapubic aspiration in neonates J Pediat Infect Dis 2009;4:289-93

Waqar Hussain,  
Professor  
Department of Paediatrics,  
Shaikh Zayed Hospital,  
Lahore.

Anita Lamichhane,  
M.D. Student  
Department of Paediatrics,  
Shaikh Zayed Hospital,  
Lahore.

Ahsan Ahmad,  
Senior Registrar,  
Department of Paediatrics,  
Shaikh Zayed Hospital,  
Lahore.

Fatima Zeeshan  
Trainee Registrar,  
Department of Paediatrics,  
Shaikh Zayed Hospital,  
Lahore.

**The Authors:**

Lubna Riaz,  
Senior Registrar,  
Department of Paediatrics,  
Shaikh Zayed Hospital,  
Lahore.

Muhammad Aslam,  
Associate Professor  
Department of Paediatrics,  
Shaikh Zayed Hospital, Lahore.

**Corresponding Author:**

Muhammad Aslam,  
Associate Professor  
Department of Paediatrics,  
Shaikh Zayed Hospital,  
Lahore.  
E-mail: dr.aslam0849@hotmail.com