The Effect of Bladder and Lumbar Stimulation Technique for Collection of Urine in Newborns

Rajbanshi Mamta[1, *], Karn Basant Kumar[2], Yadav Upendra[2], Shah Sunita[3], Yadav Satish[4]

[1]Department of Nursing, Yeti Health Science Academy, Maharajgunj, Kathmandu, Nepal

[2]Department of Child Health Nursing, B. P. Koirala Institute of Health Sciences, Dharan, Nepal

[3]Norvic Institute of Nursing Education, Maharajgunj, Kathmandu, Nepal

[4]Department of Pediatric and Adolescent Medicine, B. P. Koirala Institute of Health Sciences, Dharan, Nepal

Email address:

rajbanshi.mamta2017@gmail.com (R. Mamta)

[*]Corresponding author

Abstract: Background: Sign and symptoms of urinary tract infections (UTI) are not specific in infants and young children, fever being the commonest sign. Therefore, collecting urine samples for culture is required to diagnose or exclude UTI. Obtaining a clean catch urine sample in neonates and infants is a great challenge as it is unpredictable, time consuming and requires lot of patience. Objectives: The objectives of the study were to determine the effect of bladder and lumbar stimulation technique (BLST) for collection of midstream urine in newborns and to evaluate contamination rates of urine samples collected. Methods: An experimental research was conducted in BPKIHS, Dharan, Nepal including total of 54 term newborns. Urine culture was indicated for different reasons to the admitted newborns. They were randomly assigned either to the experimental group or the control group. Twenty-five minutes after feeding, the genitals and perineal area of the babies were cleaned. The newborns were held under the armpits with legs dangling. Bladder and Lumbar stimulation technique was only applied to the newborns in the experimental group. Success was defined as collection of urine sample within 5 minutes (<300s) of starting the stimulation maneuver in the experimental group and of holding under the armpits in the control group. Results: The success rate of urine collection was significantly higher in the experimental group (88.88%) than in the control group (25.92%) p<0.001. The median time for sample collection was 1.07 minutes (64.2s) [IQR=1.52minutes (91.2s)] in experimental group and 1.52minutes (91.2s) [IQR= 2.78 minutes (166.8s) for control group (p=0.069). Contamination was not found in urine samples collected by BLST in experimental group. Conclusion: The study suggests that bladder and lumbar stimulation technique is safe, quick and effective way of collecting midstream clean catch urine in newborns.

Keywords: Bladder and Lumbar Stimulation Technique (BLST), Supra Pubic Aspiration (SPA), Urinary Tract Infections (UTI)

1. Introduction

Urinary tract infection is one of the most important sources of infection in children under 5 years of age [1]. During the first year of life, the male to female ratio is 3-5:1. UTI is an invasion and multiplication of micro-organisms in the urinary system. It is identified by growth of a significant number of organisms of a single species in urine, in the presence of symptoms [2].

UTI is defined as recovery of any organism from a suprapubic specimen, at least 50,000 colony-forming units per milliliter (cfu/ml) from a catheterized specimen or at least 100,000 cfu/ml from a clean-catch urine specimen. Most UTIs are caused by a single organism; the presence of two or more organisms usually suggests contamination [3].

Sign and symptoms of UTIs are not specific in infants and children, fever being the commonest sign. Therefore, collecting urine samples for culture is required to diagnose or exclude UTI.

Various techniques of urine collection are present such as catheterisation, supra-pubic aspiration, bag/pad urine and mid stream/ clean catch urine collection [4].

1.1. Catheterisation and Suprapubic Aspiration

In neonates and infants, urine samples are preferably obtained by suprapubic aspiration or urethral catheterization. They are uncommonly performed in neonates because of an invasive procedure. Invasive methods for obtaining clean urine such as SPA and bladder catheterization are aggressive and have a high failure rate in newborns due to the anatomical characteristics and irregular voiding pattern [5].

1.2. Bag Pad Urine Collection

Among a wide range of invasive and noninvasive clinical interventions of urine collection, the most common noninvasive technique is urine collection using sterile bags, which is associated with significant patient discomfort and contamination of samples [6]. However, it is difficult to interpret the results of bag/ pad urine, because of unacceptably high false positive rates and is therefore not recommended. Bag specimen can be a useful indicator of absence of infection, if no growth or very scanty growth is found.

1.3. Mid Stream Clean Catch Urine Collection

Obtaining a clean catch MSU sample in neonates and infants is a great challenge as it is unpredictable, time consuming and requires a lot of patience [7]. According to NATIONAL INSTITUTE OF HEALTH AND CLINICAL EXCELLENCE clinical guidelines issued in 2007, clean catch urine (CCU) sample is recommended method for urine collection. A CCU sample is the method used in adults and toilet trained children but is not suitable for newborns as they do not have a sphincter control. Contaminated urine is common in non-invasive samples collected from infants and children who are not toilet trained [8].

Few studies hypothesize that the use of some stimulation technique that facilitate emptying of bladder in situation of bladder dysfunction could facilitate the collection of midstream urine samples in newborns, and developed a new non invasive technique based on bladder stimulation and lumbar paravertebral massage maneuver [5, 6, 7].
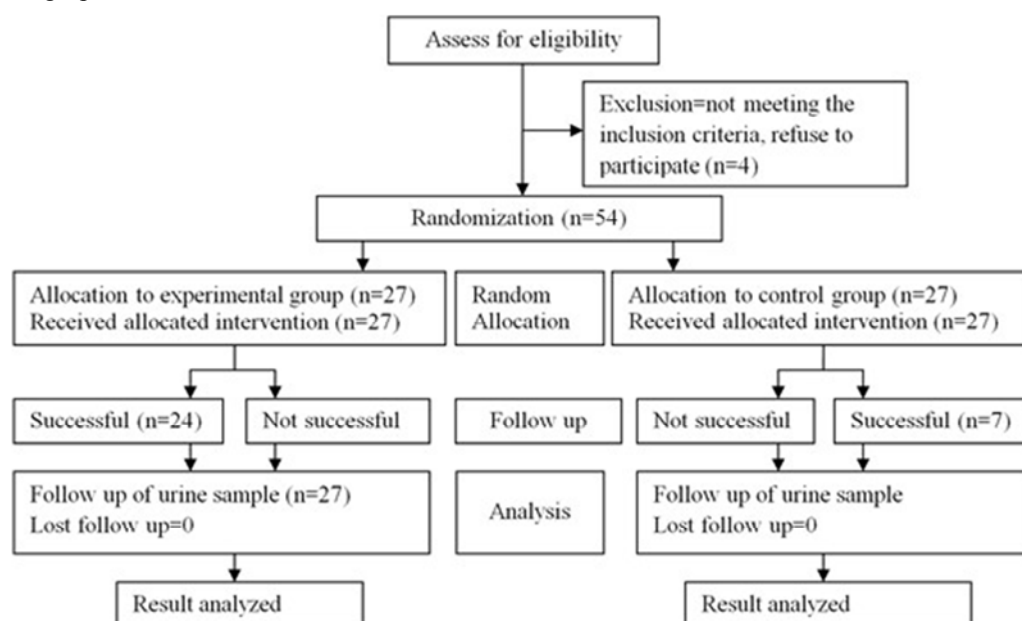

Figure 1. Study Flow Chart.

2. Methods

This is an experimental study carried out in B.P. Koirala Institute of Health Sciences, Dharan, Nepal. The study was conducted in pediatric emergency, pediatric wards (unit I and II), neonatal intensive care unit (NICU), nursery and neonatal ward of B.P. Koirala Institute of Health Sciences, Dharan, Nepal over the period of one month (January, 2015). Study population was newborns age less than 28 days with the total sample size of 54 and 27 in each group (EG and CG). The Sample size was calculated using power and sample size formula (version 3.0.34). Sick newborns (poor feeding, dehydration, History of congenital urinary tract anomalies, newborns who are critically ill and neurologically depressed) were excluded from the study.

Consecutive sampling technique was used in the study. Consecutive numbers were assigned to the patients on enrollment. A randomization list was generated to produce two parallel groups (1:1 ratio) of patients with the help of a software program. A sequentially generated number with the experimental group n=27 and control group n=27 was written in a sealed envelope which was prepared prior to the enrollment.

Technique

Two people are needed to perform the procedure.

Newborns were either breast-fed or formula fed providing formula intake appropriate to the age and weight of the newborn and 25 minutes later, their genitals were cleaned with warm water and dried with sterile gauze. If available a parent / guardian or a nurse held the newborn under the armpits with legs dangling and the examiner begin to stimulate the bladder by gently tapping the suprapubic area at a frequency of 100 taps per minute for 30 seconds. As shown in *Figure 2a*. This is followed by stimulation of the lumbar paravertebral zone (lumbo-sacral region) in the lower back with a light circular massage for 30 seconds (this two maneuver were performed alternately, as shown in *Figure 2a, Figure 2b* and *Figure 2c*. The two stimulation maneuvers were repeated until micturition begins and a urine sample was caught in sterile container (*Figure 2d*) in the experimental group while in the control group the newborns were just held with their legs dangling for 5mins.

Success was defined as collection of urine sample within 5 minutes (<300s) of starting the stimulation maneuver in the experimental group and of holding under the armpits in the control group. Secondary variables were the time taken to obtain the sample and contamination rate of the urine samples collected. The sample collection time was defined as the time from the beginning of the stimulation procedure (ie, suprapubic bladder stimulation) to the beginning of sample collection in EG and holding of the newborns with legs dangling to the beginning of sample collection in CG. Contamination was defined as the presence of two or more organisms in the urine culture.

a

b

c

d

Figure 2. There are four figures illustrated here: Suprapubic Bladder stimulation, Paravertebral Lumbar Massage (lumbo-sacral massage), baby passing urine and mid-stream urine Collection in Figure 2a, 2b, 2c and 2d respectively.

Data compilation and analysis was done using SPSS 16.00 version. Data were analyzed using descriptive and inferential statistics. Appropriate Non parametric test (chi square test), Categorical variables were compared using Pearson's chi-square or Fisher's exact test. Quantitative variables were compared using student's t test or by the mann-whitney U test to find out the association between the dependent and independent variables.

3. Results

A total of 54 term newborns were included in the study, 37 males and 17 females. Median Postnatal age in days (Range) for EG and CG were 5 (2-24) and 5 (1-26) respectively. The Mean weight of the population was 2.79 ±0.59. More than half (51.2%) of the newborns were born by normal vaginal delivery in EG, whereas 54.5% of the newborns were born by normal delivery in the CG. More than half (59.5%) of the newborns were male in CG and majority (70.6%) of newborns were males in the EG. There was significant difference in the male and female population in the two groups (p=0.04).

The table below shows the success rate of two groups.

Table 1. *Success Rate (n=54).*

Group	Success		No success		P value
(*)	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	
Experimental Group (n=27)	24	88.9	3	11.1	**P<0.001**
Control Group (n=27)	7	25.9	20	74.1	

*= Pearson's Chi square test (with continuity correction).

Table one shows that the urine samples were successfully obtained within 5 minutes (<300s) from 24 babies (88.9%) in the EG and from 7 babies (25.9%) in the CG. The success rate of urine collection was significantly higher in the EG (88.9%) than in the CG (25.9%) p<0.001.

The median sample collection time was 0.52mins (31.2s) in male, whereas it was 1.82mins (109.2s) in females in the EG. There was significant difference in the sample collection time in two genders in the EG (p=0.008). The median sample collection time was 1.52mins (91.2s) in males, whereas it was 1.02mins (61.2s) in females in CG. Urine culture was not found positive in any patient in the study group when cutoff value for positive urine culture was defined as $\geq 10^5$ cfu/ml. Contamination was also not detected in the urine samples collected by BLST, Contamination rate was 1.9% (1/54) in the whole study group, i.e. one baby in the control group with no success had urine sample contaminated. No adverse effect was observed during the study except that the controlled crying was observed in all the babies.

4. Discussion

Urine sample collection in infants and neonates has always been difficult. Invasive methods for obtaining clean urine such as SPA and bladder catheterization are aggressive and have a high failure rate in newborns due to their anatomical characteristics and irregular voiding pattern [5]. Obtaining a mid-stream clean catch urine collection is tedious, unpredictable, time consuming and requires lot of patience [7]. Hence a method of mid- stream urine sample collection involving suprapubic tap and lumbosacral massage is worthwhile in children who have not attended continence [6].

Herreros et al. hypothesized that the use of some stimulation technique that facilitate emptying of bladder in situation of bladder dysfunction could facilitate the collection of midstream urine samples in newborns, and developed a new non invasive technique based on bladder stimulation and lumbar paravertebral massage maneuver [6]. Traditionally, micturition in newborn was believed to occur spontaneously or recognized as spinal cord reflex. Recent studies have shown that cortical centers are responsible for the arousal reaction associated with voiding reflex in both healthy preterm and normal infants. Maturation of central and peripheral nervous system gradually makes the micturition under voluntary control. The detrusor muscle is innervated by the parasympathetic pelvic nerves (S2–S4). The spinal micturition reflex is a simple arch reflex. Distended bladder walls stimulate efferent fibres going to the medulla, the arch reflex is produced in S2–S4, and afferent fibres stimulate the detrusor muscle which contracts to pass urine. This reflex is voluntarily inhibited and controlled in continent individuals by the cortex, but not in newborns. In neonates, it can be triggered [6, 7, 8]

The study finding showed that the success rate in obtaining a urine sample was higher in the experimental group (88.9%) than the control group (25.9%) (p<0.001). This result is consistent with the result of the study done by Atluntas A et al., where the success rate in EG and CG was 78% and 33% (p<0.0001) respectively [5].

The finding is similar to the study done by Herreros et al, where the technique was successful in 86.3% of neonates. The finding is also supported by the prospective feasibility study done by Nepal A, in which the success rate of urine collection was 91% [6, 7].

The finding of the study showed that the median time for sample collection was found to be 1.07 min (64.2s) and 1.52min (91.2s) in the EG and CG respectively (p=0.069). The finding is similar to the study done by Atluntas et al, where the median time was 60s in the EG and 91.2s in CG. The study finding showed no significant difference in the median time between the EG and CG (0.069) which was contradicting with the study done by Atluntas (p<0.001) [5]. However, the person collecting urine has to be alert so as not to spill the urine because sometimes the amount of urine is very less and there are chances of missing it.

The study revealed that there was significant difference in median time according to gender in the EG (p=0.008) this finding is not supported by the study done by Atluntas et al. where the median time was not found to be significantly different (p=0.779) [5]. No studies have been found that supports this finding. So, the finding of the study is the matter of further investigation. This might be the result of the significantly higher number of males than the females in the study (higher referral of males in the tertiary hospitals in low income countries).

The Urine culture was not found positive for any samples in both the study groups. This finding contradicts the study findings of Atluntas A et al. where urine culture was positive in two patients in the EG, and in none of the patients in the CG [5].

Contamination rate was also evaluated and compared in both the groups. Contamination was not found in the urine samples collected by BLST technique in the EG. However, 3.70% sample (1/27, one urine sample) was contaminated in the CG. Crying was observed in almost all neonates enrolled in the study. It is also similar to the study finding of Herreros et al. and Nepal A, where 2% sucrose syrup was given to prevent/lessen the crying and neonates were observed to have controlled crying. However there was no complication that

required the termination of the study [5, 6, 7].

5. Conclusion

Bladder and Lumbar Stimulation technique is an effective in the newborns to collect the mid-stream clean catch urine. The study also suggest that bladder and lumbar stimulation technique is safe, quick and effective technique in obtaining clean catch urine sample in newborns and no contamination was found in the urine collected by this technique. The technique may be useful in collecting urine samples in neonates for purposes other than urine culture also.

6. Limitation

The study did not perform any other urine collection method in the experimental and control group, concomitantly. Therefore, no comparison was done in the contamination rates for urine samples collected via this technique with the contamination rate of sterile bag urine, Clean catch urine and Supra pubic aspiration. The study did not monitor the vital signs of neonates during micturition to observe the effect of bladder stimulation and lumbar paravertebral massage on parasympathetic activity as they cried. Since two experienced person (one for performing the procedure and the next to hold the newborn) was needed 5 mins each, yet 10 mins in all was needed to obtain urine sample from a newborn using this technique. This time seems to be quite long to practice.

Acknowledgements

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Ethical Consideration

Formal approval was taken from the Institutional Ethical Review Committee of BPKIHS. Purpose of the study was briefly explained to the parents/guardians of the study participants and verbal as well as written consent was taken. Every precaution was taken to protect the rights of the participants. Confidentiality was maintained throughout the study.

References

[1] Whiting P, West wood M, Bojke L, Palmer S, Richardson G, Cooper J et al. clinical effectiveness and cost effectiveness of tests for diagnosis and investigation of urinary tract infection in children: a systematic review and economic model. Health technology assessment 2006; 10 (36): 1-179.

[2] Indian Pediatric Nephrology Group, Indian Academy of Pediatrics. Indian Pediatrics 2001; 38: 1106-1115.

[3] Shaikh N, Morone NE, Bost JE, Farrell MH. Prevalence of urinary tract infection in childhood: a meta-analysis. Pediatr Infect Dis J 2008 April; 27 (4): 302-8.

[4] Ahmed SM, Swedlund SK. Evaluation and treatment of urinary tract infections in children. Am Fam Physician 1998; 57: 1573–80,1583–4.

[5] Atluntas N, Tayfur A. C, Kocak M, Razi H C, Akkurt S. Midstream clean-catch urine collection in newborns: a randomized controlled study. Eur J Pediatr 2015; 174 (5): 577-82.

[6] Herreros Fernandez ML, Gonzalez Merino N, Tagarro Garcia A, Perez Seoane B, Serna Martinez M, Contreras Abad M et al. A new technique for fast and safe collection of urine in newborns. Arch Dis Child 2013; 98: 27–29.

[7] Nepal A, Basnet R, Acharya R, Shrestha S, Koirala S, Poudel A et al. A Technique for Fast and Safe Collection of Urine in Newborns. Journal of Kathmandu medical college 2016; 5 (3): 82-83.

[8] Urinary tract infection in children: diagnosis, treatment and long term management. NICE clinical guideline 2007; 54: 1-35.

[9] Prasad RS, Smith SJ, Wright H. lower abdominal pressure versus external bladder stimulation to aid bladder emptying in multiple sclerosis: a randomized controlled study. Clin Rehabil 2003 feb; 17 (1): 42-47.

[10] Davis P, Greenwood R, Benger J. Randomised trial of vibrating bladder stimulator- the time to pee study. Arch Dis Child 2008; 93: 423–424.

[11] Karacan C, Erkek N, Senel S, Akin Gunduz S, Catli G, Tavil B. Evaluation of urine collection methods for the diagnosis of urinary tract infection in children. Med Princ Pract 2010; 19 (3): 188–191.

[12] Kalager T, Digranes A. Unusual complication after suprapubic bladder puncture. Br Med J 1979; 1 (6156): 91–92.

[13] Taylor M R, Dillon M, Keane CT. Reduction of mixed growth rates in urine by using a "finger tap" method of collection. British Medical Journal 1986; 292: 990.

[14] Chang SL, Shortliffe LD. Pediatric urinary tract infections. Pediatr Clin North Am (2006); 53 (3): 379–400.

[15] Beeson PB. The case against the catheter. Am J Med 1958; 24 (1): 1–3.

[16] Boshell BR, Sanford JP. A screening method for the evaluation of urinary tract infections in female patients without catheterization. Ann Intern Med 1958; 48 (5): 1040–1045.

[17] Urine collection from a child. Children's Emergency Dept & Medical Photography and Illustration 2008.

[18] Fowler C J, Panicker J N, Drake M, Harris C, Harrison SCW, Kirby M et al. A UK Consensus on the Management of the Bladder in Multiple Sclerosis. J Neurol Neurosurg Psychiatry 2009; 80: 470–477.

[19] Wen J G, Wang Q, Zhang X. Normal voiding pattern and bladder dysfunction in infants and children. Life Science Journal 2007; 4 (4): 1-9.

[20] Das Gupta P, Haslam C, Goodwin R, Fowler CJ. The "queen square bladder Stimulator": a device for assisting emptying of Neurogenic Bladder. British Journal of Urology 1997 Aug; 80 (2); 234-237.