

Screening study of dipstick urinalysis of healthy neonates delivered in tertiary care hospital, from Vadodara, Gujarat

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Received - 21 May 2019

Initial Review - 28 June 2019

Accepted - 07 October 2019

ABSTRACT

Background: Urinary dipstick is one of the most important advances in the current diagnostic procedure in pediatric nephrourology. Dipstick test is easy to perform bedside test, gives an immediate result, is relatively cheap, and require less sophisticated training of personnel; so could be used for asymptomatic patients. **Objectives:** The objectives of the study were to evaluate the usefulness of urine dipstick bedside screening test for diagnosis of underlying congenital kidney disease in otherwise healthy neonates. **Materials and Methods:** The study was conducted from April 2018 to November 2018. A total of 900 healthy newborns were enrolled. Random spot urine samples were obtained within first 72 h of life. Dipstick test was performed using Siemens Multistix 10SG and positive or negative reading for biochemical parameters was recorded and compared with laboratory test. Newborns with 1st positive dipstick test were issued screen positive cards and called for follow-up on 7th day of life for 2nd dipstick test. Those with persistent 2nd dipstick positive were further investigated to rule out any congenital anomaly. **Results:** Of total 900 neonates, 504 (56%) were males and 396 (44%) were females. Of the total newborns, 441 (49%) were positive for proteinuria, 2 (0.2%) for nitrites, and 54 (6%) for leukocytes during 1st dipstick urinalysis. Urine routine microscopic evaluation showed 450 (50%) positive for protein and 322 (35%) positive for pus cells. On subsequent follow-up of positive cases, only 2 (0.5%) newborns were positive for proteinuria on 2nd dipstick ($p=0.7061$). **Conclusion:** Bedside dipstick urine test as a screening test was not useful in otherwise healthy neonates due to renal immaturity in first few days of life.

Key words: *Healthy neonates, Proteinuria, Screening, Urine dipstick test*

Urinalysis is one of the most commonly prescribed clinical tests in pediatrics. This is partly due to the ease of urine collection and non-invasive testing. Two main types of urinalysis are currently being performed. These include (1) the basic (routine) urinalysis (gold standard) which adds a microscopic examination of urine sediment to the reagent strip urinalysis and (2) the dipstick (reagent strip) test [1].

Dipstick urinalysis provides information about multiple physiochemical properties of urine. Urinary abnormalities are commonly detected in children and could be the result of a wide range of conditions [2]. Dipstick tests are easy to perform, give an immediate result, are relatively cheap, and require less sophisticated training of personnel; therefore, they are used to screen asymptomatic patients [3]. In view of the obvious practical advantages, it is currently the most common test for hematuria [2]. Proteinuria is used to screen for underlying kidney disease and serves as a marker of disease progression.

The most common indication for an ultrasound survey of the fetal genitourinary tract is the presence of oligohydramnios. Another important indication is a positive family history of renal disease because fetal urinary tract abnormalities have been

reported in 8% of pregnancies in women with a family history of renal anomalies [4]. Kidney disease could affect neonates in various ways, ranging from treatable disorders without long-term consequences to life-threatening conditions. Kidney disease in neonates can be due to birth defects, hereditary diseases, urine blockage or reflux, and bladder outlet obstruction such as posterior urethral valve and acute kidney injury or infections [5].

The urine output and its quality might be affected in these diseases, which could be cloudy dark, bloody, or foul-smelling urine. In infections, dipstick test might be nitrite positive. Congenital kidney diseases and hydronephrosis could be diagnosed by antenatal ultrasonography (USG) but it is not possible in all cases. Afflictions of the kidney in the neonates might be traced to specific inherited or congenital problems or to intrauterine or postnatally acquired events [6]. Perinatal events such as fetal distress, perinatal asphyxia, sepsis, and volume loss might lead to ischemic or anoxic injury. The neonates are at a particular risk for ischemic injury due to their low glomerular filtration rate and relative hypoxia at baseline [7].

About 17% of newborns void in the delivery room, approximately 90% void by 24 h, and 99% void by 48 h. The rate

of urine formation ranges from 0.5 to 5.0 ml/kg/h at all gestational ages. The most common cause of delayed or decreased urine production is improper recording of initial void or inadequate perfusion of the kidneys. Delay in micturition might also be due to intrinsic kidney abnormalities or obstruction of the urinary tract [8].

During the first few days of life, proteinuria can be detected in 76% of healthy newborns. Conditions affecting renal blood flow and tubular function, such as dehydration or perinatal asphyxia, frequently result in transient but significant proteinuria. However, proteinuria with levels >30 mg/dl in concentrated urine persisting beyond the 1st week of life suggests glomerular and/or tubular injury and requires further evaluation [9]. Normal newborns do not have hematuria, hemoglobinuria, or myoglobinuria. Hematuria in a neonate with an umbilical artery catheter in place should alert the clinician to the possibility of aortic or renal artery thrombosis [10]. Glycosuria is commonly present in premature babies of <34 weeks' gestation. The tubular reabsorption of glucose is <93% in infants born before 34 weeks' gestation compared with 99% in infants born after 34 weeks' gestation. Glucose excretion rates are highest in infants born before 28 weeks' gestation [11].

Dipstick method is the cheapest and easiest to perform bedside test to look for renal conditions. Various dipstick tests are available in market. Strips used in this study are Siemens 10 SG Multistix which test for protein, blood, leukocyte, pH, specific gravity, ketones (acetoacetic acid), nitrites and glucose, bilirubin, and urobilinogen [12]. The strips are intended to assist in the diagnosis of kidney functions and urinary tract infections (UTIs). The sensitivity of dipstick test for protein, glucose, blood, leukocyte, and nitrites is 80–88%, 100%, 92%, 70–78%, and 30%, respectively [13]. The aim of the study was to evaluate the usefulness of urine dipstick bedside screening test for diagnosis of underlying congenital kidney disease in otherwise healthy neonates.

MATERIALS AND METHODS

The study was conducted from April 2018 to November 2018 over a period of 8 months after taking approval from the Institutional Ethics Committee on Human Research at tertiary care level hospital, Gujarat. A total of 900 neonates qualifying inclusion criteria were enrolled in this study after taking written informed consent from the parents. The study sample included neonates who had completed full-term of 37–42 weeks, with weight >2.5 kg, with <72 h of life, breastfed newborns, and with normal perinatal period. The exclusion criteria were neonates <37 weeks, weight <2.5 kg, sick neonatal intensive care unit admission or with antenatal diagnosed hydronephrosis or other renal abnormalities.

Random spot urine sample for urinalysis was obtained by collecting the urine into pediatric urobag within first 72 h of life and tested using Siemens Multistix 10SG dipstick test and same sample was sent for routine and microscopic urinalysis which is the gold standard test. Newborns with 1st positive

dipstick test were subjected to follow-up after 7 days of life and repeat 2nd dipstick and urine routine and microscopic test were performed. Those with persistent second dipstick abnormalities were further investigated for detailed congenital renal disorders in the form of urine culture, USG abdomen kidney, ureter, and bladder (KUB), blood urea nitrogen, serum creatinine, complete blood count, and C-reactive protein.

The data were collected and entered into the password-protected Excel sheet. The analysis was performed using MedCalc Version 18.11. Chi-square test was used to determine if the observed cell frequencies differ significantly or not. Differences with $p < 0.05$ were taken as statistically significant.

RESULTS

In our study of 900 neonates, 504 (56%) were males and 396 (44%) were females. Mean age for obtaining urine sample for dipstick was 33.79 ± 16.14 h. The mean birth weight was 2863.14 ± 275.62 g and the mean gestational was 39.03 ± 1.22 weeks. Proteinuria in first dipstick test was found in 441 (49%) of 900 newborns, of which only 2 (0.5%) were positive by second dipstick test.

Of the total 441 newborns with positive first dipstick test, 398 (90%) came for follow-up, and 43 (10%) newborns were lost to follow-up. In urinalysis of total 900 newborns, 2 (0.2%) newborns had pH 6, 767 (85.2%) had pH of 6.5, and 131 (14.6%) had pH 7. In urine analysis for specific gravity, 562 (62.4%) had structural protein (SP) ≤ 1.015 and 338 (37.6%) had SP ≥ 1.020 . Of the total newborns, 441 (49%) were positive for proteinuria in first dipstick test and 459 (51%) were negative for proteinuria in first dipstick test.

In our study, two were positive for nitrite in dipstick test and corresponding urine routine microscopy for pus cells was positive in 322 newborns, though positive predictive value (PPV) and specificity were 100%. A total of 898 newborns were negative for nitrite dipstick test and corresponding urine routine microscopy for pus cells were negative in 578 newborns having negative predictive value (NPV) of 64.36%. Sensitivity was only 0.62%, so this test could not be used as a screening test.

In our study, 54 were positive for leukocyte by dipstick test and urine routine microscopy for pus cells was positive in 322 newborns. Of the 846 newborns with leukocyte negative by dipstick test, 578 were negative for pus cells by routine microscopy test. Although PPV and specificity were 100%, NPV was 68.32% and sensitivity was 16.77% only; therefore, this test could not be used as a screening test.

A total of 441 newborns were positive for proteinuria by dipstick test 1, of which 398 came for the follow-up and only 2 (0.5%) were positive in second dipstick test. Although specificity and PPV are 99.5%, sensitivity was 49% and NPV was 46.32% only; therefore, dipstick could not be used as screening test. On the first urine analysis, 441 (49%) of the neonates had proteinuria and 2 (0.2%) had nitrite positive with proteinuria. In our study, glucose, ketone, and blood were negative in all

newborns. On second urine analysis, only 2 (0.5%) were positive for proteinuria and negative for nitrites, glucose, ketones, and blood.

One of the two newborns, with second urine analysis, was positive for proteinuria on 7th day of life and developed fever for which he was admitted. Corresponding urine routine and microscopy showed protein+2, 30–40 pus cells but urine culture was negative for any organism. Other investigations including septic screen and USG KUB were also normal. Patient was treated as culture negative UTI and discharged after 7 days of antibiotics. Another newborn, with second urine analysis positive for proteinuria, was asymptomatic and corresponding urine routine microscopy shows protein+2. Other investigations including septic screen, urine culture, and USG KUB were also normal.

DISCUSSION

Of total 900 newborns, 441 were positive for proteinuria in first dipstick test and corresponding 450 newborns were positive for proteinuria in urine routine microscopy which was not statistically significant. This implies that there was no difference between dipstick and urine routine microscopy, as both show equal sensitivity of proteinuria. Of total 900 newborns, only two had persistent proteinuria and only one of them had developed UTI without any underlying congenital anomaly or obstructive uropathy on further detailed evaluation. Other newborn remained asymptomatic despite proteinuria. No congenital renal disease was detected on further evaluation. The results were similar to previous other studies wherein most of the results were negative for nitrites and leucocytes [14,15]

In a similar study by Falakflaki *et al.*, on the first examination, 25 (6%) of the total neonates had abnormalities: 23 had proteinuria (5.75%), one was blood positive (0.25%), and one was both protein and blood positive (0.25%). On the second examination, proteinuria was found in five (1.25%) neonates, but the rate of other abnormalities did not change. In follow-up visits, by complementary diagnostic tests, vesicoureteral reflux and ureteropelvic junction obstruction was diagnosed in two neonates (with blood positive) [16], which is in contrast to this study.

The main cause of proteinuria in newborns is physiological due to renal immaturity. Transient physiological proteinuria might be observed during the 1st days of life; which is reversible at the end of 1st week [16]. The study had certain limitations. It was a time bound study and so for screening purpose, large sample size could not be taken.

CONCLUSION

From this study, we recommend that urine dipstick is not useful in screening of otherwise healthy neonate for diagnosis of underlying congenital kidney disease, due to high false positivity rate in <72 h of life probably due to proteinuria related to renal immaturity.

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Funding: None; Conflict of Interest: None Stated.

How to cite this article: Solanki JR, Meshram K. Screening study of dipstick urinalysis of healthy neonates delivered in tertiary care hospital, from Vadodra, Gujarat. *Indian J Child Health*. 2019; 6(10):526-528.

Doi: 10.32677/IJCH.2019.v06.i10.002