Pediatrics and Neonatology (2011) 52, 161—164

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journal homepage: http://www.pediatr-neonatol.com

BRIEF COMMUNICATION

Dipstick Urinalysis Screening of Healthy Neonates☆

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Received Apr 4, 2010; received in revised form Sep 5, 2010; accepted Oct 28, 2010

Key Words
dipstick;
healthy neonate;
urinalysis

Background: Renal disease may accidentally be discovered during urinalysis. This study was conducted to examine the usefulness of dipstick urinalysis screening in healthy neonates for the diagnosis of underlying renal disease and to study the magnitude of abnormal urinalysis in apparently healthy neonates.
Methods: In this descriptive study, voided urine samples were obtained from 400 apparently healthy neonates and tested using urine dipstick. The reaction of dipstick strip was read visually by a trained nurse. In cases with an abnormal urine analysis, a second screen test was performed within a week, and for those with persistent abnormalities, complete diagnostic tests were done.
Results: On the first urinalysis, 375 (94%) subjects were normal and 25 (6%) had abnormalities: 23 had proteinuria (5.75%), one was blood positive (0.25%), and one was both protein and blood positive (0.25%). Male neonates had a higher proportion of proteinuria than female neonates ($p = 0.038$). In the second examination, proteinuria was found in five (1.25%) neonates, but the proportion of other abnormalities did not change. In follow-up investigations, ureteropelvic junction obstruction and vesicoureteral reflux were recognized in two infants who had blood-positive or combined blood- and protein-positive results on their first tests.
Conclusion: The findings of this study show that dipstick test during neonatal period could be used for early diagnosis of renal diseases.

☆ This work was supported by a grant from the Zanjan University of Medical Sciences.
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1875-9572/$36
doi:10.1016/j.pedneo.2011.03.012

1. Introduction

Urinalysis is one of the most commonly ordered clinical tests in pediatrics. This is partly because of the ease of urine collection and testing.[1] Two main types of urinalysis are currently performed. These include (1) the dipstick (reagent strip) and (2) the basic (routine) urinalysis, which adds a microscopic examination of urine sediment to the reagent strip urinalysis.[2]

Dipstick urinalysis provides information about multiple physiochemical properties of urine.[2] Urinary abnormalities are commonly detected in children and could be the result of a wide range of conditions.[3] In most cases, these are transient or the result of a false-positive reading.[2] Certain precautions limit the number of false-positive reading.[1]

Besides its apparent simplicity, the urinary dipstick is one of the most important advances in the current diagnosis procedure in pediatric nephro-urology. This test represents the best way to approach the most frequent conditions, that is, urinary tract infection, hematuria, and proteinuria.[4] In view of the obvious practical advantages, the most common test for hematuria is currently a reagent strip.[5] Proteinuria is used to screen for underlying kidney disease and serves as a marker of disease progression.[6] Dipstick tests are easy to perform, give an immediate result, are relatively cheap,[7] and require less sophisticated training of personnel[2]; therefore, they are used to screen asymptomatic patients.

Mass urinary screening of school children has been done in a number of Asian countries, in an effort to detect and treat renal disease in children while still in the asymptomatic phase. Since the onset of urinary mass screening, many of the otherwise asymptomatic cases of glomerulonephritis have been detected in the Asian pediatric population.[8–10]

There is no doubt that urinary screening program in school children will allow an early detection of diseases. Are these urinary screening programs helpful in neonates?

Afflictions of the kidney in the neonates may be traced to specific inherited or congenital problems, or to intrauterine or postnatally acquired events.[11] The aim of this study was to evaluate the usefulness of urine dipstick testing as a primary means of screening otherwise healthy neonates for the diagnosis of underlying renal diseases.

2. Methods

This descriptive study was conducted from September 2007 to March 2008 on voided urine samples from 400 apparently healthy neonates born in Vali-e-Asr Hospital in Zanjan (a city in northwest of Iran). Full-term, breast-fed newborn infants, without maternal or personal pathological antecedents, with normal perinatal period, were only included. Neonates with antenatally diagnosed hydronephrosis or other anomalies were excluded from the study.

Random spot urine sample for analysis was obtained by collecting the urine into urine bags during the first 3 days after birth. Informed consent was obtained from the parents.

Dipstick method was used for urinalysis. The reaction of dipstick strip was read visually by a trained nurse. The results of dipstick tests were recorded as (−) for trace; (1+), (2+), and (3+) for protein; and (−) or (+) for others (blood, keton, glucose, nitrite and others). Protein (1+) or more and positive results for others were considered as abnormal that require follow-up urine examination.

For those with abnormalities, a second screening was performed within 1 week, and those with persistent abnormalities were referred to the Pediatric Nephrology Clinic for further investigations and follow-up. The following data were recorded for each neonate: sex, weight, type of delivery (cesarean section or normal vaginal delivery), and dipstick results.

The analysis was performed using SPSS (version 11.5; SPSS Inc., Chicago, IL, USA). The χ^2 test was used to determine if the observed cell frequencies differed significantly. Differences with a p value less than 0.05 were accepted as statistically significant.

3. Results

In this study, urine samples collected from 400 healthy newborn infants were tested using urine dipstick. There were 218 male (54.5%) and 182 female (45.5%) neonates. The average weight of the newborns was 3064 ± 477 g. The mean urine specific gravity was 1.007 ± 0.005.

On the first urinalysis, 375 (94%) samples were normal and 25 (6%) neonates had abnormalities (proteinuria, positive blood). In the second analysis within 1 week, the rate of proteinuria was decreased (1.25%), but the rate of positive blood did not change. Comparison between these abnormalities in the first and second examination is shown in Table 1.

Proteinuria showed a statistically significant difference according to sex. As shown in Table 2, the male neonates had a higher proportion of proteinuria and a more significant proteinuria than female neonates ($p = 0.038$). In contrast to proteinuria, there was no difference in blood-positive results between male and female neonates ($p > 0.05$) (Table 3).

The results showed no difference between abnormalities and type of delivery or birth weight ($p > 0.05$) (Table 3). Indeed, the type of delivery (cesarean section or normal vaginal delivery) or birth weight had no effect on proteinuria and positive blood results. In follow-up investigations ureteropelvic junction obstruction and vesicoureteral reflux were recognized in two infants who had blood-positive or both blood- and protein-positive results, respectively.

4. Discussion

This study was done to assess the usefulness of dipstick urinalysis screening in neonates and to study the magnitude of abnormal urinalysis in apparently healthy neonates.

Table 1 The results of first and second urinalysis

Abnormalities	First	Second
	n (%)	*n* (%)
Protein positive	23 (5.75)	5 (1.25)
Blood positive	1 (0.25)	1 (0.25)
Protein and blood positive	1 (0.25)	1 (0.25)
Total	25 (6)	7 (1.75)

Table 2 Proteinuria according to sex in the first analysis

Protein (mg/100)	Female	Male	Total
	n (%)	*n* (%)	*n* (%)
0	176 (96.7)	200 (91.7)	376 (94)
30 (1+)	5 (2.7)	16 (7.3)	21 (5.3)
100 (2+)	1 (0.5)	1 (0.5)	2 (0.5)
300 (3+)	0	1 (0.5)	1 (0.3)
Total	182	218	400

$p = 0.038$.

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%), but the rate of other abnormalities did not change. In follow-up visits, by complementary diagnostic tests, vesicoureteral reflux and ureteropelvic junction obstruction were diagnosed in two neonates (with blood positive).

The main cause of proteinuria in newborns is physiological. Transient physiological proteinuria may be observed during the first days of life; at the end of first week, it is generally decreased to normal amount.[11] In our findings, proteinuria also decreased in the second examination.

Studies with multivariate analysis looking at the predictors of proteinuria in the school population showed that low body weight was a significant predictor of persistent proteinuria. In fact, low body weight was associated with a 1.8-fold greater risk of proteinuria.[12] Low renal mass may result in earlier manifestation of renal disease. In a recent study, there was no significant statistical association between weight and proteinuria. This may relate to the narrow range of weight in our newborns. The average weight of our newborns was 3064 ± 477 g because we included only full-term newborns.

Most of the studies also demonstrated that coexisting hematuria and proteinuria correlated with a high risk of severe renal disease.[10,13] This association was confirmed in our study.

Table 3 Dipstick abnormalities according to sex, delivery, and weight

Variable	Total *n*	Protein (+)	Blood (+)
Sex			
Female	182	6	0
Male	218	18	2
Delivery			
Normal vaginal delivery	282	17	1
Cesarean section	118	7	1
Weight (g)			
<3000	232	15	1
>3000	168	9	1

NVD = normal vaginal delivery; C/S = cesarean section.

In follow-up visits and further investigations, we diagnosed two newborns with underlying kidney disease, who potentially benefited from early identification. Mass urine screening is thought to be of benefit in a number of Asian countries.[8–10] Japan was the first country to start a national urinary screening program for school children on an annual basis in 1973.[14] Taiwan initiated a national program in 1990[15], whereas Korea's program began in 1998.[10] Since the onset of urinary mass screening, many of the otherwise asymptomatic cases of glomerulonephritis have been detected in the Asian pediatric population. The main objective of mass urinary screening program in school children is to detect renal disease in its early stages, allowing treatment, so as to delay or even prevent the onset of renal insufficiency.[16]

In one study, examination of urine was performed in full-term and prematurely born infants. Persistent proteinuria, leukocyturia, or hematuria was found in none. They concluded that routine screening of full-term infants does not appear to be indicated.[17] Simonetti and Konrad also suggested that urine screening is not very useful and should be performed only at the age of 5 years or in sexually active adolescents.[18] In another study, urine samples of 1000 patients aged 1–55 years were tested. Proteinuria was present in 2.3%, hematuria in 4.8%, pyuria in 10.2%, and glycosuria in 2% of the patients. They suggested that urine analysis should be performed in all patients to identify the presence of unrecognized renal diseases, which may benefit from simple therapeutic measures.[19]

In the United States, mass screening of asymptomatic individuals has not been shown to be cost effective.[1] Difference in the effectiveness of mass urine screening between populations may be because of different incidence rates of renal disease or different approaches to an abnormal urine screening test.

Newborn screening seems to be one of the rarest health care interventions that is beneficial to patients and, in many cases, cost saving. Over the long term, funding comprehensive newborn screening programs is likely to save money for society.

4.1. Limitation

Many of abnormalities that were found in dipstick urinalysis were transient or false-positive results. In addition, the urinary screening program will not detect renal disease where there is no abnormality in urine.

In conclusion, in spite of advanced methods for prenatal diagnosis, such as ultrasonography and molecular biology, some of these diseases may be missed or undiagnosed. This study showed that with dipstick test during neonatal period and later by following the abnormal infants, one could diagnose renal diseases early. However, it is suggested that other studies be conducted to evaluate the cost efficiency of this screening program. If there is cost efficiency and an early diagnosis of renal disease, we can use this test along with other neonatal screening tests.

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