Urine Analysis Screening Among School Children from El-Gharbiya Governorate for Prediction of Asymptomatic Urinary Abnormalities

Thesis

Submitted for Partial Fulfilment of Masters Degree

In Pediatrics

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2015

Acknowledgement

Before and above all, thanks to "ALLAH" to whom I always pray to bless my work.

At first I would like to express my sincere thanks to, ***Assist Prof. Shereen Saad El-Sayed,*** *Assistant Professor of Pediatrics, Faculty of Medicine, Ain Shams University, for her guidance, valuable advice, helpful directions in the initial steps of this work and continuous purposeful encouragement during the conduction of this work.*

I would like also to express my thanks to ***Prof.*** **Nermeen Helmy Mahmoud,** *Professor of Clinical Pathology, Faculty of Medicine, Ain Shams University, for her sincere supervision, continuous help and valuable guidance.*

A great deal of my gratitude goes to the children and their perantes for their kind cooperation and patience.

At last I have a special thanks to my family who deserves all thanks and gratitude.

Asmaa Fawzy Ahmed Elbana

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List of Abbreviations

ANA	Antinuclear antibody
ANCA	Antineutrophilic cytoplasmic antibody titers
APGN	Acute poststreptoccocal glumerulonephritis
ASB	Asymptomatic bacteruria
CFU	Colony-forming units
CKD	Chronic kidney disease
DMSA	Dimercaptosuccinic acid
ESRD	End stage renal disease
GN	Glomerulonephritis
HPF	High power field
HSP	Henoch–Schonlein Purpura
HUS	Hemolytic uremic syndrome
IH	Isolated hematuria
LE	Leukocyte esterase
MH	Microhematuria
MHA	Microangiopathic hemolytic anemia
NPP	Negative predictive value
NS	Nephrotic syndrome
PPV	Positive predictive value
RBCs	Red blood cells
RTA	Renal tubular acidosis

SG	Specific gravity
SLE	Systemic lupus erythematosus
SPSS	Statistical package for social science
tHUS	Typical HUS
TMA	Thrombotic microangiopathy
UACR	Urine albumin to creatinine ratio
UPCR	Urine analysis for protein to creatinine ratio
US	Ultrasonography
USG	Urine-specific gravity
UTI	Urinary tract infection
VCUG	Voiding cystourethrogram
VUR	Vesicoureteric reflux
WBCs	White blood cells
WHO	World Health Organization

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Introduction

Chronic kidney disease (CKD) is now being recognized worldwide as an important problem in children. The overt stage of CKD is the end stage renal disease (ESRD). CKD represents a developing process that is initiated by various causes, all with the common end result of persistent and usually progressive damage of varying severity to the kidneys. These patients have a continuous decline in renal function and hence are said to have progressive renal failures character ***(Hogg et al., 2003).***

Clinical presentation of Chronic kidney disease (CKD) is quite varied and dependent on the underlying renal disease. Children and adolescents with CKD from chronic glomerulonephritis (GN) and membraneopro-liferative GN may present with edema, hypertension, hematuria and proteinuria ***(El Nahas and Bello, 2005).***

Acute renal failure is a clinical syndrome in which sudden deterioration in renal function results in the inability of the kidneys to maintain fluid and electrolyte homeostasis ***(Lamiere et al., 2005).***

To reduce the number of patients with both end stage renal disease (ESRD) and cardiovascular disease, effective screening and treatment methods for CKD should be established ***(Levey et al., 2005).***

The school urine analysis screening could detect chronic renal disease in its early stage. Early detection using school urine analysis screening and confirmatory diagnosis by renal biopsy seems to be helpful for assessment of prognosis and intervention of chronic renal disease progression ***(Cho et al., 2001b).***

Most cases of primary chronic GN is first manifested as asymptomatic proteinuria and/or hematuria. For early detection of glomerulonephritis, urine analysis has been considered one of the best methods ***(Keane, 2000).***

Urine analysis remains the best device for screening at the present time and this is the method for which most data are available. Urine is usually screened for evidence of blood, protein, glucose or bacteria. Hematuria, proteinuria and/or glucosuria are probably most often related to renal pathology. Bacteria may result in renal pathology but its origin is in lower urinary tract ***(Walker et al., 1977).*** The level of proteinuria is one of the strongest predictors for renal function deterioration ***(Iseki, 2003)***.

There is evidence that a screening program may open the way for the early management of these diseases, especially where treatment is already established ***(Kitagawa, 1988).***

Nowadays dipsticks tests are widely used as the simplest and cheapest method for detecting urinary abnormality. When urine tests are positive in school screening test, a second test is performed in the same manner. When urinary abnormalities are found again, urine analysis is taken under the microscope, so urine analysis plays an important role in the detection and diagnostic work up of patients with renal diseases ***(Patel, 2006).***

Aim of the Work

To measure the prevalence of abnormal urinary results finding by screening healthy Egyptian students in El-Gharbia Governorate from 7-15 years for asymptomatic proteinuria, hematuria, pyuria, glucosuria, or Leucocyturia to detect the prevalence of renal disease and to improve its outcome.

Urine Analysis

Urine analysis, a simple and inexpensive test, is the cornerstone in the evaluation of the kidney function ***(Hajar et al., 2011).*** Observation of urine has been used for more than 6000 years, by many civilizations, to diagnose a variety of ailments ***(Bolodeoku and Donaldson, 1996).*** Hippocrates wrote about urine examination as early as 400 BC and correctly identified urine as a filtrate of blood ***(Bright, 1836).***

Serious renal diseases may be present without any symptoms. Proteinuria as well as hematuria may be the only early signs of renal disease (membranous nephropathy, membranoproliferative glomerulo-nephritis, post infectious glomerulonephritis, IgA nephropathy and others) ***(Hajar et al., 2011).***

Also, the presence of detectable nitrites in urine has been used to diagnose urinary tract infection. Urinary tract infection is very common in children with severe consequences on the kidney function leading to chronic kidney disease and hypertension if left untreated ***(Gorelick and Shaw, 1999)***.

Urinalysis (routine and microscopy) typically consists of reagent strip (dipstick) analysis and microscopic evaluation of a sample of urine. Dipstick analysis detects the following: urine-specific gravity (USG), pH, leukocyte esterase, nitrites, protein, glucose, ketones, urobilinogen, bilirubin, blood and hemoglobin. Microscopic analysis detects cells and formed elements, such as casts and crystals, which provide further diagnostic clues ***(Coad et al., 2012).***

The basic dipstick method is the most rapid screening procedure that could be helpful in the early detection of renal or urinary tract diseases among apparently healthy or asymptomatic subjects in the hope of preventing and retarding progression to chronic renal failure ***(Sekhar et al., 2010).***

A school urine screening program can detect chronic renal disease in its early stage. When mass screening is used, the initial aggressive diagnostic procedures such as, renal biopsy may be avoided. In addition, a regular follow up for those children with abnormal screen is warranted ***(Park et al., 2005).***

Mass urine screening tests have been performed routinely and through to be of benefit in number of Asian countries ***(Lin et al., 2000).*** In Asia, Japan was the first country to start a national urinary screening programme for school children aged 6 to 14 years on an annual basis in 1973 ***(Murakami et al., 1991).***

Taiwan initiated a national programme in 1990 covering children from 6 to 15 years old ***(Lin et al., 2001)***. While Korea's programme began in 1998 for children from 6 to 18 years ***(Cho et al., 2001b).***

In the united states, mass screening of asymptomatic children has not been shown to be cost effective. However, these differences in the effectiveness of mass screening between population may be due to different incidence rates of renal diseases or to different approaches to an abnormal urine screening test ***(Cho et al., 2001b).***

The American Academy of Pediatrics previously recommended a screening urinalysis at four time points during childhood, however, the current recommendation is to obtain a screening urinalysis only once at the early school age and yearly in sexually active adolescents ***(Murakami et al., 2005).***

Abnormal urine analysis:

A- Physical examination

1- Colour

Table (1): Normal urine varies from colourless to dark yellow.

Common Causes of Urine Discoloration		
Colour	**Pathological causes**	**Food and drug causes**
Brown	Bile pigments, myoglobin	Levodopa, metronidazole, nitro-furantoin, some antimalarial agents, fava beans
Brownish-black	Bile pigments, melanin, methaemoglobin	Cascara, levodopa, methyldopa, senna
Green or blue	Pseudomonal urinary tract infection (UTI), biliverdin	Amitriptyline, indigo carmine, IV cimetidine, IV promethazine, methylthioninium chloride, triamterene
Orange	Bile pigments	Phenothiazines, phenazopyridine
Red	Hematuria, hemoglobinuria, myoglobinuria, porphyria	Beets, blackberries, rhubarb, phenolphthalein, rifampicin
Yellow	Concentrated urine (orange to gold in dehy-dration)	Carrots, cascara

(Simerville et al., 2005).

2- Odour

The normal odour is described as urinoid. In concentrated specimens this can be strong but does not imply infection, which has a more pungent smell. Alkaline fermentation causes an ammoniacal smell, and patients with diabetic ketoacidosis produce a urine that may have a sweet or fruity odour. Other causes of abnormal odours are cystine decomposition (a sulphuric smell), gastro-intestinal-bladder fistulae (a faecal smell), medications (eg, vitamin B6), and diet (eg, asparagus) ***(Simerville et al., 2005).***

3- Turbidity

Cloudy urine may be due to: Contamination with vaginal mucus or epithelial cells. Excess phosphate crystals precipitating in alkaline urine (no clinical significance). Pyuria secondary to infection **(*Alper and Curry, 2005)*.** Chyluria (presence of chyle/lymph in the urine - usually secondary to filariasis) ***(Tandon et al., 2004)*.** Hyperuricosuria secondary to a diet high in purine-rich foods ***(Marangella, 2005)*.** Lipiduria ***(Klahr et al., 1967)*.** Hyperoxaluria ***(Laube et al., 2005)***.

4- Urine volume

- ***Polyuria*** is defined as urine volume is more than 2 ml/kg/hour or as daily urine volume more than 2 liters/day ***(Herget, 2005).*** It may be due to diabetes mellitus, diabetes insipidus. Renal polyuria develops in case of back progress of nephritic edema, chronic renal failure ***(Makama, 2010)*.**
- ***Oliguria*** is defined as daily urine volume is less than 400 ml/m2/day ***(Herget, 2005).*** Renal oliguria is one of the most significant manifestations of renal failure. There are also extra renal causes of oliguria such as massive profuse bleeding, diarrhea, poisoning, cardiac failure and shock ***(Makama, 2010)*.**
- ***Anuria*** is defined as daily urine volume which is less than 30 ml/m2/day ***(Herget, 2005)*.** It can be renal, the kidneys don't form the urine due to considerable damage of their tissues or post renal (mechanical). The urine is produced, but it doesn't go into the bladder because of upper tract or bladder neck obstruction ***(Makama, 2010)*.**
- ***Nocturia,*** the normal correlation of daytime and nighttime urine volume is 2:1. This is because of bigger fluid intake and physical activity, urine excretion is more intensive during daytime. If the night urine volume is bigger, it is a manifestation of decreased renal function ***(Makama, 2010)*.**

5- pH

The range is 4.5 to 8, but urine is commonly acidic (i.e 5.5-6.5) due to metabolic activity. Acidic urine (low pH) may be caused by diet (eg, acidic fruits such as cranberries) and uric acid calculi ***(Shekarriz and Stoller, 2002).*** Urine pH generally reflects the blood pH but in renal tubular acidosis (RTA) this is not the case. In type 1 RTA (distal) the urine is acidic but the blood alkaline. In type 2 (proximal) the urine is initially alkaline but becomes more acidic as the disease progresses. Alkaline urine (high pH) is seen in the initial stages of type 2 RTA and also with infection with urease-splitting organisms, and may be associated with the formation of stag-horn calculi ***(Akagashi et al., 2004)***.

6- Specific gravity

Specific gravity (SG) <1.008 is dilute and >1.020 is concentrated. Increased SG is seen in conditions causing dehydration, glycosuria, renal artery stenosis, heart failure (secondary to decreased blood flow to the kidneys), inappropriate antidiuretic hormone secretion and proteinuria ***(Kavouras, 2002).*** Some dipsticks give falsely high readings in the presence of dextran solutions and IV radiopaque dyes, but this varies, so check the manu-facturer's leaflet ***(Simerville et al., 2005).*** The usefulness of SG in identifying dehydration in infants has been brought into question ***(Steiner et al., 2007)***.

Decreased SG is seen in excessive fluid intake, renal failure, pyelonephritis, and central and nephrogenic diabetes insipidus ***(Kavouras, 2002)***. False low readings are associated with alkaline urine (eg, a high-citrate diet) ***(Simerville et al., 2005).***