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Original Research Article

Value of Dipstick Urinalysis in Evaluating Patients with Bladder Outlet Obtsruction

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Abstract: The study of voided urine is valuable in the management of many health conditions and remains basic to any clinician. Its importance in evaluating patients with bladder outlet obstruction (BOO) needs to be emphasized. In BOO, Urine outflow from the bladder is impeded resulting in changes in the characteristics of normal urine. We studied dipstick urinalysis results of 152 patients diagnosed with cancer of the prostate (Cap), Benign prostatic hyperplasia (BPH) and Urethral Stricture who presented in our follow-up clinic between March and May 2016. Data from this and clinical characteristics of the patients was analyzed using the SPSS Version 20.0 software. In the results, macroscopic appearance suggested evidence of abnormality in 50.9%, urinary PH was acidic in 82.9% (Acidic urine is normal for most individuals), specific gravity showed evidence of renal insufficiency (1.010) in 18.4%, significant proteinuria was seen in 28.4%, ascorbic acid in 0.7%, urobilinogen was normal in all the samples tested, leucocyte esterase was positive in 30.5%, hyperglycaemia without glycosuria was found in 31.70% (13/41) and there was a significant statistical association between the presence of nitrite and leucocyte esterase.

Keywords: Dipstick urinalysis, Bladder Outlet Obstruction.

INTRODUCTION

Urinalysis is a study of voided urine. It requires 3 types of examination namely direct observation for colour, odour and clarity, the use of dipstick and microscopic analyses. For the purpose of this study, we will concentrate on direct observation and dipstick urine analysis. Urine dipstick analysis has the advantage of being a convenient and rapid test usually determined within few minutes of sample collection. It can be done at bedside, doctors office, emergency department and urgent care facilities and results obtained without delay. It is also very cost effective and may not require any specific training to perform. However, Dipstick urinalysis can give both false positive and negative results. In general, examination should be done within 30-60 minutes of sample collection [1] and the strips should not be exposed to air as it will change colour and cause erroneous results. Interpretation of results should be done with caution and in most cases collaborated with patients symptomatology and microscopic examination and culture. It is actually a screening test for some conditions and diagnostic for others. Bladder outlet obstruction is a condition where there is impedance of urine flow from the bladder to the urethra [2]. Most commonly occurs in middle aged and elderly men due to Cap, BPH and urethral stricture [3]. The consequence of this is urinary stasis in the bladder and the upper urinary tract with urinary tract infection, stone formation, hydroureteronephrosis and renal failure. Hence the routine use of urinalysis in the evaluation of these patients. It can also alert the clinician of the presence of systemic illness affecting the kidneys aside from being used for general health evaluation and monitoring of disease states.

In this study, we reviewed one hundred and fifty-two (152) urinalysis results of men who were being evaluated for symptoms of BOO and inferred that, this exercise had been worthwhile in guiding protocols for further investigations and treatments of these patients.

MATERIALS AND METHODS

This is a retrospective study of urinalysis results of 152 patients who were being evaluated on account of symptoms of BOO. Data was collected between March and May 2016 during their follow-up visit in the urology clinic. Exclusion criteria included patients with known functional obstruction (e.g. diabetic cystopathy, spinal cord injuries), post operative urinary retention, traumatic urethral conditions. Results of urinalysis and various diagnostic modalities such as prostate specific antigen (PSA), prostate biopsy, retrograde urethrogram and micturating cystourethrogram were extracted from their case notes.

Data was analysed using SPSS Version 20.0 and results used for the discussion.

RESULTS

One hundred and fifty two (152) urinalysis results of patients were reviewed. They were all males with a mean age of 63.84±12.051 years (Range 18-87 years). Patients with Cap were older than others with a mean age of 67.70±9.201 (Range 48-87 years). BPH patients were more in number 80(52.6%) than in other groups.

Table-1: Mean age at diagnosis

Diagnosis	Mean age (years	Range (years)
Cap	67.70±9.201	48-87
BPH	65.26±8.293	50-80
Urethral Stricture	49.91±18.478	18-83

Table-2: Frequency of Diagnosis

Diagnosis	Frequency (n)	Percent (%)
Cap	50	32.9
BPH	80	52.6
Urethral Stricture	22	14.5

Table-3a: Frequency of Variables

Variables	Characteristics	Frequency (n)	Valid percent (%)
(i) Appearance:	Clear	75	49.3
	Cloudy	57	37.5
	Turbid	17	11.2
	Bloody	3	2.0
(ii) PH:	Acidic (<7.0)	126	8.29
	Neutral (7.0)	13	8.6
	Alkaline (>7.0)	13	8.6
(iii) Specific gravity:	Normal	63	42.9
(1.003-1.030)	Fixed	27	18.4
	Low	11	7.5
	High	46	31.3
(iv) Protein [9]			
	Nil (<10mg/dl)	95	62.9
	Trace (10-30mg/dl)	13	8.6
	1+ (>30mg/dl)	21	13.9
	2+ (~100mg/dl)	16	10.6
	3+ (~300mg/dl)	4	2.6
	4+ (~1000mg/dl)	2	1.3
(v) Glucose:			
	Negative	146	96.1
	Positive	6	3.9
(vi) Bilirubin:			
	Negative	149	98.0
	Positive	3	2.0
(vii) Blood:			
	Negative	87	57.2
	Positive	65	42.8
(viii) Ketones:	Negative	150	98.7
	Positive	2	1.3
(ix) Nitrites:			
	Negative	134	88.2
	Positive	18	11.8
(x) Ascorbic Acid:			
	Negative	151	99.3
	Positive	1	0.7
(xi) Urobilinogen:			
	Negative	152	100.0
(xii) Leucocytes:			
	Negative	105	69.5
	Positive	46	30.5

Table-3b: Glycosuria and Fasting blood sugar (n=41)

	Fasting blood sugar		
(xiii) Glucose in urine:	Normal	High	Total
Negative	28	11	39
Positive	0	2	2
Total	28	13	41

Table-4: Association between the presence of Nitrites and leucocytes

	Leucocytes			
Nitrites	**Normal**	**High**	**Total**	**Statistical Values**
Negative	100	33	133	X^2=16.683
Positive	5	13	18	DF=1
Total	105	46	151	P value=0.000*

There is statistical significant association between the presence of nitrites and leucocyte esterase (P=0.000*).

DISCUSSION

Urinalysis is often done as part of general health evaluation. It can also be used to screen for and assist in the diagnosis and monitoring of disease conditions. It is a simple procedure, fast, cost effective and may not require special training to perform it. It pit falls must also be appreciated in the aspect of giving false positive and negative results. Therefore, its interpretation must be collaborated with patients' symptomatology and further goal-directed tests to guarantee proper patient's management

Urinalysis requires 3 types of examination namely direct observation for colour, odour and clarity, dipstick analysis which incorporates plastic strips with attached reagent pads tests for substances in urine such as protein, glucose, ketones, nitrites, leucocytes, bilirubin and others like urobilinogen, blood and PH of urine and then microscopic examination. The later is a step further because it can detect clinically significant abnormalities that are not detected by dipstick examinations.

This study focuses on the value of macroscopic and dipstick urinalysis in the evaluation of patients with symptoms of BOO. Urinalysis is an invaluable tool in the armamentarium of tests designed to evaluate this set of patients. In bladder outlet obstruction, there is impedance of urine flow from the bladder to the urethra leading to progressive increase in the volume of residual urine in the bladder. Retention of urine in the bladder can lead to a constellation of abnormalities affecting the bladder, the ureters and the kidneys and may also cause systemic complications as renal failure and uraemia. Therefore, urinalysis is central and gives clinical information about urine appearance, urine composition which can also collaborate with some of the symptoms experienced by these patients.

We studied 152 urinalysis results of men diagnosed with Cap (32.9%), BPH (52.6%) and Urethral Stricture (14.5%) with a mean age of 63.84±12.051 (Range 18-87 yrs). About half of the patients had urine reported as clear and amber in colour and about the other half had reports of cloudy, turbid and bloody urine (Table 4). The normal colour of urine is amber and clear due to the presence of a pigment called urochrome [4] but may be darker in concentrated urine. However, food substances, drugs and some medical conditions can influence the colour of urine and so macroscopic reports must be done in the light of this. Cloudy urine may be due to precipitated phosphate crystals in alkaline urine, it may also be due to urinary tract infection, stones, food, drugs and dehydration state. Turbid urine is also determined by substances in urine such as crystals, bacteria, casts, cellular debris or significant proteinuria. Bloody urine may signal urogenital malignancy, trauma to the urinary tract or evidence of blood dyscrasias. Therefore, as a starting point to dipstick urinalysis, urine colour could be a pointer to undiagnosed pathologies in the urinary tract and even systemic diseases and will direct further line of management. Urinary PH was acidic in the majority of the patients (82.9%) and less than 20% had both neutral and alkaline PH. Urinary PH generally reflects serum PH except in conditions where the kidneys are unable to acidify urine as in renal tubular acidosis. In most individuals, urine PH is acidic due to the body's metabolic activity. The serum PH as well as the PH of urine may be influenced by diets. Diets rich in protein and acidic fruits can cause acidic urine and also diets rich in citrus fruits, legumes and vegetables can cause alkaline urine [5, 6]. Urinary PH determination can help in the diagnosis of urinary tract infection (UTI) and urinary calculi. Alkaline urine in the presence of UTI may suggest the presence of urea splitting organisms e.g. proteus and klebsiella and further strengthens the need for culture and bacterial confirmation. In alkaline urine, triple phosphate crystals (magnesium, ammonium, phosphate crystals) can aggregate to form struvite stones. On the other hand, uric acid, cysteine stones can form in acidic urine. Urine specific gravity (SG) was within normal range in less than half of the men and in more than half of them, it was either high, low or fixed (same as serum SG). (Table 4 iii). Urine SG measures urine concentration. It is a reflection of the ability of the kidneys to concentrate urine and also

assesses the hydration state of an individual. It compares the amount of solute in urine to pure water[7]. Urine SG equals that of the glomerular filtrate (1.010) in intrinsic renal insufficiency, it is <1.010 in relative hydration and >1.020 in relative dehydration states [8]. In this study, about 18.4% of the patients with fixed SG can be further assessed for renal insufficiency with renal function test and radionuclide scan for differential renal function aside from dealing with the primary pathology in the prostate and or the urethra. SG can also be elevated in diabetes mellitus (DM) and in syndrome of inappropriate anti-diuretic hormones, radioactive dyes administration and so results should however be interpreted with caution. Low SG may reflect excessive hydration of these patients with intravenous fluids apart from indicating a direct inability of the kidneys to concentrate urine that usually results from the mechanics of bladder outlet obstruction.

Urinary protein was negative in about two third of the patients and the remaining third had various levels of proteinuria (Table 4 iv). Proteinuria is defined as urinary protein excretion of more than 150mg per day (10-20mg/dl). In healthy individuals with intact glomerular capillary walls, serum proteins are not normally filtered except those with a molecular weight less than 20,000 Daltons. After filtration, the low molecular weight proteins are reabsorbed and then metabolized by the cells of the proximal tubules into amino acids and used by the body. Proteins that appear in urine in small amounts are normal constituents. In BOO, the persistent back pressure effect of urine to the kidneys can disrupt the glomerular filtration haemodynamics resulting in varying degrees of proteinuria and dipstick urinalysis is vital in assessing this and also in directing further line of managements. However, dipstick urinalysis can only detect albumin and not other urine proteins. Therefore this test is only specific and not sensitive. Interpretation of results should also be done in light of the urine concentration; being over-estimated in concentrated urine and vice versa in dilute urine. It is also of general knowledge that urine specimen containing bacteria may give a positive protein reaction on dipstick examination indicating a UTI and warranting further evaluation with urine microscopy and culture.

Glycosuria was positive in 6(3.9%) patients. This test is mandatory to further assess the glycaemic level of these patients with a fasting blood sugar since the symptomatologies of DM are also observed in patients with BOO. Glucose filtered at the glomerulus is normally reabsorbed by the cells of the proximal tubules. Less than 0.1% of filtered glucose load may appear in urine and dipstick urinalysis is not sensitive enough to detect this. The renal threshold for glucose is between 180-200mg/dl and when this is exceeded, glycosuria occurs. Alternatively, glycosuria may occur when serum glucose levels are normal as in conditions of failure of renal tubular reabsorption of glucose or in pregnancy where there is increased renal blood flow that overwhelms the reabsorptive capacity of the tubules. Others may also have a high renal threshold for glucose with hyperglycaemia and no glycosuria as was seen in 13 out of 41 patients in our study.

Urinary bilirubin was positive in only 3(2.0%) patients. Bilirubin normally does not appear in urine and it is a screen for abnormal hepatobiliary function. Bilirubin, a bye product of the breakdown of heme moiety of haemoglobin is normally conjugated in the liver and secreted into bile. Elevated plasma levels may be due to impaired secretion from the liver into bile which is therefore filtered by the kidneys and consequently appear in urine. Positive bilirubin in urine may guide further assessment of liver function. In BOO caused by advanced Cap, this could be a pointer to liver metastasis and the need for staging investigations with abdominal computed tomography scan to direct treatments. Both bilirubin and urobilinogen should be interpreted together. Normal urine contains only small amount of urobilinogen. This was reported in all the patients. It is usually elevated in hepatobiliary disease and decreased or absent in bile duct obstruction. Either condition will guide further investigations.

Blood in urine (haematuria) is usually frightening to both patients and care-giver. Even a single episode should not be ignored. Urine normally contains a few red blood cells. Microscopic haematuria is generally defined as one to ten red blood cells per high power field (hpf) of urine sediments[10]. However, American Urological Association gives a standard definition for clinically significant microscopic haematuria as 3 or more red blood cells per hpf on microscopic evaluation of urinary sediment from 2 or 3 properly collected urinary specimen [11, 12]. The urine dipstick tests for the peroxidase activity of erythrocytes, not for the actual presence of the physical red blood cells which is also positive in the presence of myoglobin and haemoglobin. Visualization of intact red blood cell (rbc) or rbc cast on microscopic examination of urine sediment can distinguish haematuria from other conditions. This will also direct further tests. Haematuria was positive in about 42.8% and this in the presence of BOO will warrant aggressive investigations to rule out urinary tract malignancies with excretory urogram, abdominopelvic ultrasound and CT Scans, urine cytology, urethro-cystoscopy and exclude UTI with urine microsopy and culture and stone work-up to rule out urolithiasis.

Ketone is a bye product of fat metabolism and should not normally appear in urine. It was detected in 1.3% of the patients and this result should warrant further investigations to rule out uncontrolled DM in the course of managing theses patients with BOO. However, carbohydrate-free diets as well as starvation can cause ketonuria. Nitrite in urine is not a normal finding. It was positive in 11.8% and signifies the

presence of bacteria that can convert dietary nitrates to nitrites and many gram negative bacteria are capable of this conversion. However, not all bacteria can convert nitrate, so that a negative result does not rule out UTI [13], but a positive result is very helpful in directing further tests e.g. urine microscopy and culture. False positive may be seen on strips exposed to air and false negative in people with UTI who eat nitrate-deficient diets.

Leucocyte was positive in a third of the patients. Neutrophils produce leucocyte esterase either as whole cell or lysed. When the number of white blood cells (WBC) in urine increases the results become positive [14]. A positive result indicates pyuria and pyuria implies a UTI. However, sterile pyuria can occur in tuberculous infection, viral infections, nephrolithiasis, foreign body, corticosteroid use, exercise, bladder tumour and balanitis. While pyuria warrants urine microscopy and culture, negative cultures should not be overlooked because WBC's are not present in normal urine. In this study, there was a significant statistical association between the presence of nitrite and leucocytes ($P<0.05$).

Vitamin C was positive in only one patient. It's importance as a reducing substance is that, it can interfere with a number of dipstick tests. Elevated urine concentration of Vitamin C can cause false negative dipstick test for blood, glucose and leucocyte esterase in urine samples tested within four hours of ingestion.

Dipstick urinalysis howbeit simple and fast to perform with ability to screen and diagnose some health conditions may in most cases need to be collaborated with patients' symptoms and further tests to validate its results. Again, dipstick urinalysis is fraught with false positive and negative results that put some limitations to its solo use in some conditions. Ranging from colour observations, it could be misleading if a good clinical history is not known about the patients diet, drugs or medical condition. The specific gravity of urine will also need specific clarifications for its valid interpretation. Urine collected after contrast administration and concentrated urine will give a false evaluation of SG and will not reflect a true integrity of the concentrating ability of the kidneys. Again, reagent on most dipstick tests is sensitive to albumin and may not detect low concentrations of Bence Jones proteins and γ-globulins. These proteins can be best detected by using the Sulfosalicyclic acid test (SSA) limiting the use of dipstick for all urine proteins.

Additionally, dipstick urinalysis employs glucose oxidase and peroxidase which is only specific for glucose and does not react with lactose, galactose and fructose or reducing metabolites of drugs. Clinitest and Benedict quantitative tests are used for the detection of these reducing sugars[14]. Positive results for blood does not differentiate whether the reaction is due to red cells, haemoglobin, myoglobin or red cell casts, this can be settled by the use of microscopic examination of urine sediments. Dipstick urinalysis detects conjugated bilirubin with possible false positive reactions in the presence of medications like Rifampicin and non-steroidal anti-inflammatory drugs. Ictotest is more specific for detecting bilirubin and its primary use is in the detection of false positive dipstick reactions.

Dipstick urinalysis reliably detects ketone concentration of 40mg/dl or more and lower concentrations are missed. These lower values are detected by Acetest tablets. Levels as low as 20mg/dl are detectable. It is also important to note that these tests are useful for interpretation in the presence of urine glucose.

Dipstick urinalysis detects nitrites and suggests organisms that can convert dietary nitrates to nitrites, but can not detect non-nitrite producing bacteria which may produce false negative reaction in the presence of these bacteria. Urine microscopy and culture is a better indicator of these organisms. Leucocyte esterase indicates pyuria and implies a UTI but, pyuria without bacteriuria (sterile pyuria) may occur and indicate other organisms that do not grow on standard techniques e.g. Chlamydia, Mycobacterium tuberculosis.

CONCLUSION

So much have been achieved in the use of dipstick urinalysis in outpatient clinics, in laboratories and in emergency room care despite its limitations. Adequate knowledge of the patient's clinical history, medications and diets should be deployed to make its interpretation reliable. Adherence to the instructions about the storage and handling of the test strips should be emphasized in order to avoid air contamination and poor results.

However, there are advanced tests to confirm each parameter on dipstick results. We have found a good use of this test in the evaluation and management of our patients with BOO. Being easy and fast to perform, it has been very useful for screening and diagnosing some diseases in our urology clinic and emergency department. Confirmatory tests are only requested when indicated.

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