Kidney case study

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Case 1

A 35 year old sportsman visits his doctor complaining of back and side pain. The doctor asks him for a 24hr urine sample and the results are in the table below.

The urine colour was yellow and not cloudy, volume was 900ml/24hr. Microscopic analysis suggest crystals.

(a) What is the diagnosis and give general reasons. (30 Marks)

(b) For each value in the table explain how that value helped in your conclusion. (40 Marks)

(c) What other tests could you do to confirm the diagnosis and explain why you would select these tests (30 Marks)

	Case 1
Specific Gravity	1.020
pH	5. 5
Leukocyte (Leu/µL)	neg
Blood(Ery/	> 100

µL)	
Nitrite	neg
Ketones(mg/dL)	130
Bilirubin	neg
Urobilinogen	normal
Protein(mg/dL)	300
Glucose	normal

Diagnosis

In our case study, the analysis of the 24-hour urine sample shows some abnormalities in the urine. The conclusive diagnosis, based on the results of the urinalysis conducted on the 35-year-old sportsman’s urine, is that the individual is suffering from chronic kidney disease. Several abnormalities observed through urinalysis are associated with elevated levels of the concentrations of urinary biomarkers that are related to kidney injury. In our case study, the urinalysis results indicated high levels of proteins, ketone bodies, and blood which are all abnormalities and indicators of kidney failure (Simerville et al., 2005).

The normal value of protein in urine is <150 mg/d. The presence of elevated proteins in urine is referred to as proteinuria. It is normal for individuals to have large quantities of protein in the blood and the primary blood protein is called albumin. A healthy kidney will filter out waste and excess fluid from the blood, but it will allow nutrients such as proteins to pass through and go back to the bloodstream. However, when the kidneys aren’t functioning properly, they allow some proteins (specifically albumin) to pass through their filters and join urine. Having albumin in the urine is a sign a kidney disease or nephrotic syndrome and is referred to as albuminuria or generally proteinuria (Simerville et al., 2005).

However, proteinuria isn’t an outright indication of a kidney condition; this scenario can also suggest the presence of other medical conditions such as diabetes and high blood pressure.

Urinalysis from a healthy individual should have no presence of ketones or ketone bodies; our case study shows that there is an abnormal presence of ketones at the concentration of 130 mg/dl. The building up of ketones in the blood is referred to as ketosis; this condition happens when the body runs out of carbohydrates and opts to break down fats as an alternative energy source. Ketosis is primarily associated with kidney failure because there is evidence that it can tax the kidneys and lead to damage of kidney tissue. High levels of ketones in the blood cause an increase in blood acidity; this consequently makes the kidney to overwork to regulate blood acidity. This scenario overburdens the kidneys and damages the kidney tissues.

According to Yamagata et al. (2008), the presence of blood in the urine is clinically referred to as hematuria and can be an indication that something is wrong with the kidneys. There are two types of hematuria: Gross hematuria is when blood is visible in the urine while microscopic hematuria is when it can be observed under the microscope. Glomerulonephritis, which is a type of chronic kidney disease, is the inflammation of the filtration system of the kidney. One of its common symptoms is microscopic hematuria.

Discussion

Specific gravity measures the concentration of urine, and it indicates the ability of the kidney to concentrate urine. It is a comparison of the amount of pure water in the urine with the amount of solutes. The values for normal urine is in the range of 1. 005 – 1. 025. Low values may be an indication of the presence of urea, glucose or alkalinity. On the other hand, high values may indicate high amounts of ketoacids or proteins. In our case study, the value for specific gravity was in the normal range (Simerville et al., 2005).

The normal pH values are in the range of 4. 5 – 8. Acidic or alkaline urine is an indication of some medical condition; this is because any abnormalities in the acid-base balance of the blood will directly affect the pH values of urine.

White blood cells (Leukocytes) contain an enzyme called leukocyte esterase; this enzyme is released when the WBCs are broken down in a process called lysis. In normal tests, there are too few WBCs for a positive result (Yamagata et al., 2008).

The presence of blood in urine isn't normal (normal values are <3 RBCs). However, the urinalysis results from our case study indicated a vast presence of blood in the subject's urine. This is called hematuria and, as explained earlier, it is associated with kidney damage.

In normal cases, nitrites aren't detected in urine. Urinary nitrates are oxidized to nitrites by bacteria in urine. Thus, a positive test for nitrites indicates the presence of bacteria capable of such conversion while a negative test, such as our case study, indicates an absence of bacteria in urine.

Ketones in the urine aren't a regular occurrence. Ketones occur when an individual has ketosis which consequently leads to ketonuria. Ketonuria is an indication of kidney disease or damage.

Usually, bilirubin shouldn't be in urine. Bilirubin in urine is mainly associated with certain liver conditions such as jaundice or hepatitis.

Urobilinogen is a result of the metabolism of bilirubin by bacteria in the intestines. It is normal for a small amount of urobilinogen to be excreted through urine (Simerville et al., 2005).

Glucosuria is the presence of glucose in urine. The primary cause of this condition is diabetes or at times pregnancy. Otherwise, the levels of glucose in healthy individuals is <130 mg/d.

Other Diagnostic Tests

According to Stevens et al. (2006), kidney disease has no early symptoms until it is in an advanced stage. Thus testing is an essential tool in the diagnosis and early detection of the disease. Other than the urine test described above, medical professionals also use a blood test to aid in the diagnosis.

This blood test checks whether the kidneys are functioning well. The test estimates explicitly the amount of blood that passes through the filtration system of the kidneys (known as the glomeruli) every minute. The collected blood sample is sent to the laboratory and tested for creatinine which is a waste product of creatine. Creatine is a chemical product made by the body to facilitate the supply of energy. The levels of creatinine are combined with other factors to estimate the rate of filtration by the glomeruli. These factors include age, gender, ethnicity, height, and weight (Stevens et al., 2006). The range of GFR is 60 while any value less than 60 indicates the presence of kidney disease. Kidney failure returns values of less than 15 in the GFR, which calls for dialysis or a kidney transplant.

The GFR is more accurate as compared to urinalysis. This is because urinalysis largely depends on the ability of the medical professional to interpret the resulting colors. Accuracy and high levels of concentration are required to interpret the resulting colors correctly.

References

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2. Stevens, L. A., Coresh, J., Greene, T. and Levey, A. S., 2006. Assessing kidney function—measured and estimated glomerular filtration rate. *New England Journal of Medicine* , *354* (23), pp. 2473-2483.
3. Yamagata, K., Iseki, K., Nitta, K., Imai, H., Iino, Y., Matsuo, S., Makino, H. and Hishida, A., 2008. Chronic kidney disease perspectives in Japan and the importance of urinalysis screening. *Clinical and experimental nephrology* , *12* (1), pp. 1-8.