

Urine examination by urine test strips, case studies in laboratory medicine

วิโรจน์ ไหววนิชกิจ¹

Abstract:

Urine examination by urine test strips, case studies in laboratory medicine

Wiwanitkit V.

Department of Laboratory Medicine, Faculty of Medicine,

Chulalongkorn University, Bangkok, 10330, Thailand

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Urinalysis can reveal diseases that have gone unnoticed because they do not produce striking signs or symptoms. The most cost-effective device used to screen urine is a paper or plastic dipstick with microchemical test pad. However, a careless doctor, nurse or assistant is entirely capable of misreading or misinterpreting the results. In this article, three case studies of the aberrant results from urine dipstick tests (urine pregnancy test, urine ketone test and urine drug screening) are presented and discussed. The first case is the case of urine pregnancy test with a lack of correspondence between the results of samples. The second case is that of drug interference effect on urine ketone test and the last is the case of urine amphetamine screening with discrepant results. The author also states the importance of quality management in all phases of urine strip testing.

Key words: urine test strips, pregnancy, ketone, amphetamine

¹M.D., Lecturer, Department of Laboratory Medicine, Faculty of Medicine, Chulalongkorn University, Bangkok, 10330, Thailand
รับต้นฉบับวันที่ 17 ตุลาคม 2545 รับลงตีพิมพ์วันที่ 1 เมษายน 2546

บทคัดย่อ:

การตรวจปัสสาวะจัดเป็นการตรวจที่สำคัญทางห้องปฏิบัติการที่สามารถบ่งบอกถึงโรคที่แอบแฝงอยู่ การตรวจปัสสาวะด้วยแถบจุ่มตรวจจัดเป็นการตรวจที่คุ้มค่าสำหรับการตรวจคัดกรอง อย่างไรก็ตามการแปลผล หากขาดความระมัดระวังอาจแปลผลผิดพลาดได้ ในที่นี้ได้นำเสนอและอภิปรายกรณีศึกษา 3 ตัวอย่างเกี่ยวกับการตรวจปัสสาวะด้วยแถบจุ่มตรวจ (การทดสอบการตั้งครรภ์, การตรวจคีโตนในปัสสาวะ และการตรวจคัดกรองปัสสาวะหาสารเสพติด) กรณีแรกเป็นการทดสอบการตั้งครรภ์ที่ให้ผลไม่สอดคล้องกันระหว่างตัวอย่างสองตัวอย่างจากผู้ป่วยรายเดียวกัน กรณีที่สองเป็นผลรบกวนจากยาต่อการตรวจหาคีโตนในปัสสาวะ ส่วนกรณีสุดท้ายเป็นการขัดแย้งกันของผลการตรวจคัดกรองแอมเฟตตามีนในปัสสาวะ ผู้เขียนได้เน้นถึงการจัดการคุณภาพในทุกขั้นตอนของการตรวจปัสสาวะโดยวิธีแถบทดสอบปัสสาวะ

คำสำคัญ: แถบทดสอบปัสสาวะ, การตั้งครรภ์, คีโตน, แอมเฟตตามีน

Introduction

Urine, which is a waste product of the body, can give us immense information about healthy conditions or disorders of certain organs. In the older days, sophisticated tests were not available for the diagnosis of illnesses. Urine examination was employed to give an idea of a person's health. Urine colour and taste indicated the presence of some of the diseases which are nowadays confirmed by laboratory tests. To have a total body checked up regularly by blood chemical tests is a good habit. However, those tests are very expensive. If you go for a routine urine examination periodically, you can determine where things are wrong and then get more precise and conclusive tests done. Many diseases can be diagnosed by a routine urine examination.¹⁻²

Urinalysis can reveal diseases that have gone unnoticed because they do not produce striking signs or symptoms.³ Examples include diabetes mellitus, various forms of glomerulonephritis, and chronic urinary tract infections. The most cost-effective device used to screen urine is a paper or plastic strip with microchemical test pads. This microchemistry system has been available for many years and allows qualitative and semi-quantitative analysis within one minute by simple but careful observation. The color change occurring on each segment of the pad on the strip is compared to a color chart to obtain results.

However, a careless doctor, nurse or assistant is entirely capable of misreading or misinterpreting the results.³ Therefore, microscopic urinalysis, which requires only a relatively

inexpensive light microscope, must be performed in the same set of analysis to support and for co-interpretation of some of the results obtained by chemical test strips. However, some analysis of urine such as glucose, ketone and urobilinogen are still based on only urine strip tests because these tests cannot be expressed by any feature from microscopic examination; the urine dipsticks are still the single method for screening service. In this article, three case studies of the aberrant results from urine dipstick tests are presented and discussed.

Case studies

Case study 1

A urine specimen from a health check-up program before going aboard was sent to the laboratory for urine pregnancy test. The hCG urine dipstick test was used for laboratory analysis. The test was performed and gave positive result. The result was reported to the physician-in charge. However, the patient noted that she was on the contraceptive pill and requested for repeated urine pregnancy test. The repeated analysis was performed by the same practitioner and the result was negative. A third urine specimen was requested by the laboratory for confirmation of the test result but the patient declined the test.

Case study 2

A clinical pathologist was consulted about an unusual urine examination test. The case was a previously healthy single female who had passed the routine urine examination.

The result of chemical analysis revealed 2 + positive urine ketone. The other urine chemistry tests, including urine glucose sugar, were negative. In this case, all urine chemistry tests were performed using a urine test strip. Her other blood chemistry check up was within normal limits. Her physical appearance was within normal limits. From further history taking, the patient revealed a history of using self-prescribed paracetamol for relieving her fever.

Case study 3

A urine sample was sent to the laboratory for analysis for urine amphetamine. The first urine sample was clear. This specimen was analyzed for the amphetamine by test strip and yielded a positive result. However, after reporting the result, the patient requested to send a second sample for analysis. The second sample was dark yellow color. Analysis of this specimen provided negative result. The laboratory requested a third specimen. The third specimen from the patient was a pale yellow color. After analysis, a positive result was obtained.

Discussion

Urinalysis is a frequently requested laboratory analysis at present. A number of urine test strips have been developed for screening tests, especially for a screening procedure to monitor carbohydrate metabolism, kidney and liver function, acid-base balance and urinary tract infections. However, it is important to remember that a negative urine dipstick test cannot rule out the existing diseases. According to a previous correlation study, there a poor correlation between the microscopic parameters and the corresponding representatives by the urine dipstick. Therefore, the routine microscopic examination is still necessary.

However, some clinical chemistry tests of urine are still based on the urine test strips. In interpretation of the results,⁴ 4 parts, namely a) reagents and supplies, b) precaution, c) specimen collection and holding – pre analytical factors and d) quality control requirements, are required. Since

the urine dipstick test is considered a simple test that can be performed at the bedside, awareness of physicians of these points is necessary.

The first case concerns the urine pregnancy test. A standard laboratory pregnancy test determines the presence of β -HCG in the urine by combining urine and test materials either in a test tube or on a glass slide. In this case the dipstick test was used. The problem is that these was a discrepancy of the results of the two samples. What are the possible causes? Although in this case, the final root cause can be reviewed, three possible factors of this aberrant result are a) the patient factor, b) the analytical test kit factor and c) the performer of the test factor.

Concerning the patient factor, the possible explanation for this scenario might be that the patient could bring the another persons' sample for the second analysis or the patient might have an illegal abortion. In case that the result of the urine pregnancy test could affect the work of the patient as planning to go aboard, the confirmation of correct patient identification is necessary. With the problem of the illegal abortion, the dilemma of the self-urine pregnancy test can be repeatedly emphasized.⁵

Concerning the analytical test kit factor, the expiration of the test kit must be regularly monitored. Indeed the quality control for the urine dipstick is necessary. The quality control is to evaluate the accuracy of testing technique, as well as the function and stability of the products and instrumentation used. Nevertheless, in some cases the problem of analysis can be reviewed using a different procedure.

Concerning the performer of the test factor, inter-observer variation can be expected in any laboratory test. Nevertheless, since the laboratory direction for any urine test strip state the proper time for the reading the results and this might be different in the multi-parameter urine test strips, the inappropriate time of reading can result in aberrant results. Although the automatic reader is used, the author has experienced a difference in the results depending on whether strip was directly inserted into the automatic reader or the strip was partly swabbed for cleaning of the dipping urine specimen.

Looking at the second case, the problem of the urine ketone dipstick was discussed. Ketonuria is the appearance of moderate or high levels of ketone bodies in urine, in which the patient may have developed ketoacidosis. Ketonuria and acidosis are caused by insufficient insulin available to meet the body's needs. Acidosis is a very serious and dangerous condition. If left untreated, a patient could possibly go into a coma and die. It is the cause of 85% of hospitalizations of children and adults with diabetes. Indeed, the urine ketone dipstick test is only a screening tool and is usually forgotten by the physician in performing bedside test although it can be used in the diagnosis of ketoacidosis. However, before making the diagnosis, the other corresponding presentations such as glucosuria, alteration of consciousness and respiration difficulty should be detected. In this case, the single ketonuria result is derived without the other clues. From further history taking, the interference from the recent paracetamol ingestion can be revealed. Since paracetamol is a widely used drug and can be co-used by the diabetic patients, the diagnosis of ketonuria requires an awareness of the history of present drug usage.⁶ In addition to drug interference, ketonuria can also be detected in some febrile disease as well as the other diseases.

Concerning the third case, drug-screening is an important laboratory test in the present day. This screening test is the first step before confirmation of drug abuse of standard HPLC technique in toxicology laboratory. Since drug screening can result in legal consequences, careful specimen collection is necessary. In this case, the various appearances of the urine samples might be interfering with the test; otherwise it is the dilution or non-correspondence of urine specimens. This problem can be resolved by setting the specific protocol for the important urine examinations. However, although the laboratory can set the specific room for the specimen collection, is difficult to observe the patients while they are voiding. Suwansaksri et al,⁷ have proposed that informed consent might be less suitable than enforcement for urine collection for drug screening.

Conclusion

The author reported and discussed three cases relating to urine test strips. Some interesting points are shown in this article.

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