Scholar Publishing Group
International Journal of Health and Pharmaceutical Medicine
https://doi.org/10.38007/IJHPM.2022.030204
ISSN 2789-8393 Vol. 3, Issue 2: 36-46

Urine Red and White Blood Cells Detected by Dry Chemical Method under Microscope

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Keywords: Urine Stem Chemistry, Microscopic Examination, Red Blood Cells, White Blood Cells

Abstract: The method of stem chemistry is simple and fast, but it will be affected by some factors, resulting in false positive and false positive results of red blood cells and white blood cells. On the other hand, microscope examination is not only complicated but also prone to human errors. In order to improve the efficiency and accuracy of urine determination, this paper compared the results of red blood cells and white blood cells in stem chemistry and urine microscopy, in order to explore whether stem chemistry can completely replace microscopy to detect red blood cells and white blood cells in urine. In this paper, 310 urine samples were detected by dry chemistry and microscopy respectively, and the results of two methods were analyzed. The results showed that in 310 urine samples, 116 were positive in dry chemistry, 40 were positive in microscopic examination, the positive rate was 34.5%, 193 were negative in dry chemistry, 192 were negative in microscopic examination, the coincidence rate was 99.5%, 98 were positive in dry white blood cells, 75 were positive in microscopic examination, 23 were negative in microscopic examination. The positive control rate of the two methods was 76.5%, 212 cases were leukocyte negative and 195 cases were microscope negative. The results showed that the red blood cells with positive stem chemistry and the white blood cells with positive stem chemistry should be examined under the microscope.

1. Introduction

With the development of science and technology, automation technology is widely used, and it is no exception in the field of medicine. In the urine test, the main hospitals also widely favor the urine dry chemical analyzer, which is not only convenient and pollution-free, but also the error caused by human factors is relatively small, and the repeatability is relatively good. This method has become an important part of urine test, but from another point of view, the clinical test cannot completely rely on the dry chemical test, because there are many other factors in the test process, which will affect the accuracy and reliability of the test results of the dry chemical analyzer. As a

result, the results are not only test errors, but also may be misdiagnosed, so the hospital In the actual operation process, the detection method of microscope cannot be completely ignored.

In order to compare the results of chemical method and microscopic method, Esteghamati used dry chemical method to analyze false negative and false positive. He used dry chemistry and microscope to analyze 1036 fresh urine samples. The result of white blood cell count was taken as the analysis result and the result of microscope as the standard. The results showed that the positive rates of the false negative rate and the false negative rate were 9.36% and 5.41%, respectively. It can be concluded that the method is fast and convenient, but the false positive rate is high. Esteghamati's research has certain limitations, and the selected data may be accidental, so the reliability is not high [1]. Sun discussed the similarities and differences between using instrumental analysis method and microscopic method to determine the components of urine cells. In order to provide the basis for improving the quality of urine analysis, he used UF-100 automatic urine sediment analyzer, ma-4280kb dry chemical urine analyzer and Olympus CX21 microscope. Sun used three methods to detect 710 urine samples, and the results were compared and analyzed. Sun's results showed that the urine sensitivity of leukocytes and erythrocytes increased when they were connected in parallel, while the specificity increased when they were connected in serial. Sun's research has certain reference value, but the accuracy of the test results needs to be improved [2].

Dry chemistry and microscopic examination are the two most commonly used methods for the diagnosis of urinary system diseases. Among them, dry chemistry examination method is affected by many factors, which is easy to lead to false positive and false negative, so it will lead to missed diagnosis or misdiagnosis, and microscopic examination has defects, its operation is very complex, and the results of the two methods are different. On this basis, this paper uses these two methods to detect urine samples respectively, and finally combines the two methods to detect, in order to explore the impact of different detection methods on the detection results.

2. Examination of Urinary System Diseases

2.1. Diagnosis Method of Urinary System Diseases

The early diagnosis of urinary system diseases is through urine detection, which can make a reasonable evaluation of the follow-up diagnosis and prognosis. Through the evaluation of the visible components in urine, the result value can be used as the evaluation standard of patients' physical condition. Urinalysis usually includes morphology and the number of red blood cells and white blood cells, which can be used to determine whether a patient has hematuria, inflammation, kidney disease, bacterial infection, etc. [3]. As we all know, in the current routine urine test, the common test methods are dry chemical method and urine sediment analysis method. With the continuous development of subsequent clinical medical test technology, dry chemical method test has been unable to meet the current medical level at this stage. Therefore, the combination of dry chemical method and urine sediment is often used as routine urine test, so that the disease detection rate can be improved.

On the other hand, the use of automatic urine analyzer for routine urine detection has gradually replaced the manual dry chemical test strip and centrifugal urine sediment detection. This method has many advantages. Generally speaking, it is simple, fast and repeatable. The application of this method can effectively reduce the detection application time and improve the diagnosis efficiency, It can also save valuable time. However, during the actual clinical application of dry chemistry, the measurement of the results is not completely accurate, because during the detection period, it will be affected by the related metabolites and drugs, so that the urine color and character will change to a certain extent, so that some patients' urine protein concentration level is high, thus affecting the accuracy and authenticity of the test results, and false positive and false negative phenomena will

appear. In addition, a large amount of vitamin C in urine will also affect the results, which will increase the content of glucose, occult blood, bilirubin and nitrite in urine. When the urine contains enzymes that are easy to heat, myoglobin or bacterial urine will cause occult blood and false-positive reaction, while the use of different test paper will usually affect the test results, including source, quality, sensitivity, etc., but it is not entirely dependent on the results of chemical test for comprehensive analysis [4].

Compared with the routine urine dry chemical method, the principle of urine sediment microscopic examination is different. Urine is photographed in real time from multiple angles by the urine sediment analyzer, and whether there is any abnormality is judged by classifying the tangible components [5].

2.2. Routine Urine Chemical Examination

(1)PH

The pH of normal urine was 4.5-8, the average was 5.5-6.5. The pH of urine between 4.5-5.5 is acid urine, and 6.5-8 is alkaline urine. As we all know, in general, when metabolic alkalosis or respiratory alkalosis occurs, the urine will be alkaline [6]. Alkaline urine can also be seen in infected urine and those who eat a lot of vegetables and calcium oxalate stones with renal tubular acidosis. After eating, the change of urine pH value is due to the large amount of gastric acid secretion after eating, which causes the body fluid to become alkaline, forming the so-called "alkaline tide".

Protein

+ / - is commonly used for qualitative examination of urinary protein. Then, ± means protein content <0.1g/l, + is 0.1-0.5g/l, while 2 + is 0.5-2.0g/l, 3 + means 2.0-5.0g/l, and 4 + means > 5.0g/l. Meglumine diatrizoate, a large amount of urate, penicillin, aspirin and so on will make the protein qualitative false-positive, and the cause of proteinuria is generally glomerular, tubular and excess. Tubuloproteinuria is also common because the tubules are unable to reabsorb normally filtered low-molecular-weight proteins. Generally speaking, proteinuria of renal tubules rarely exceeds 2-3 g / day, and it is often accompanied by other proximal renal tubules dysfunction, as well as diabetes, amino acid urine, phosphate urine and uric acid. Protein excess can cause albuminuria, which can return to normal after lying down and resting. In the final analysis, the reason is that the pressure of renal vein increases when standing, so it can generally recover by itself [7].

Urine sugar

We know that almost all the sugar removed from glomerular filtration will be absorbed into proximal tubules, so fasting of fasting sugar in normal people is not advisable. Diabetes is very common, usually manifested as urine glucose. Generally speaking, if the filtered sugar exceeds the reabsorption capacity of renal tubules (the renal threshold of serum sugar is about 10 mmol / L), urine glucose may also be positive. In addition, urine contains a lot of vitamin C, salicylic acid and naphthenic acid, which can also cause false positive.

Bilirubin and urobilinogen

Bilirubin is divided into direct bilirubin and indirect bilirubin. There is no bilirubin in the urine of normal people, only a small amount of urobilinogen. Direct bilirubin is formed by the combination of bilirubin and glucuronic acid in hepatocytes. It usually enters the small intestine through the bile duct and is converted into bilinogen in the urine.

2.3. Microscopic Examination of Urinary Sediment

The examination of urinary sediment is to examine the urinary sediment through a microscope, so as to determine various pathological components in the urine, such as cells, castings, crystals,

bacteria and parasites. The examination of urine sediment can be divided into the microscopic examination of unpainted urine sediment and stained urine sediment. Take 0.2 ml of urine sediment, gently shake the centrifuge tube to completely mix the sediment components, take 20 ml of urine sediment, drop it on the slide, and cover with 18 × 18 mm cover slide, and observe the urine sediment under the microscope with 10×10 lens to observe the complete appearance and composition of the components. After that, 10×40 lenses were used to calculate the number, so as to observe and determine the cell composition. Observe the minimum and maximum values visible in 10 fields of vision, then calculate the average value of each field of vision and record the results. The type of the tube is identified with a high magnification lens, and the reading is observed with a low magnification lens, 20 fields of view are observed, the average value of one field of view is calculated, and the results are recorded. Centrifugation is more sensitive, and the positive rate of this method is high. It is the current routine test, the routine use of internal medicine and urology professional patients. On the other hand, the method of mixing a drop of urine is easy to operate, but the positive rate is low and easy to miss. This method is usually used in nervous system diseases.

Urine sediment quantitative examination is a method of screening and counting urine within one hour. This method mainly takes fresh morning urine of patients, after mixing, directly drops it into human blood cell counting pool, so as to count the number of red blood cells, white blood cells, epithelial cells and tube types in 5 grids, and get the result [8].

One hour urine sediment count, the operation method of this method is: first let the patient urinate, then accurately collect three hours urine, and put it in a clean and dry container for inspection. In this process, the urine volume of 3 hours should be accurately measured and fully mixed. Take 10ml of mixed urine, place it in a graduated centrifuge tube, centrifugate it at 1500r / min for 5min, and then suck it with a straw. Among them, 9ml of upper urine is left and fully mixed.

2.4. Urine Automatic Chemical Analyzer

Chemical analysis is a method of adding a liquid sample directly to a dry reagent and using the water in the sample as a solvent to trigger a specific chemical reaction. This method can simultaneously measure the pH value of urine, protein, glucose, ketone body, occult blood, bilirubin, urine choline, nitrite, leukocyte, specific gravity, etc. In recent years, ll urine test band has appeared. In addition to the 10 elements listed above, it can also measure the level of vitamin C in urine [9]. When LED with different wavelengths is used to illuminate the color change test strip, reflected light will be generated. The reflected light is received by the photoelectric cell, the optical signal is converted into electrical signal, and the electrical signal is sent to the analog-to-digital converter, which is converted into numerical value, controlled by the microprocessor and automatically displays the results. Generally, in a specific concentration range, the color depth of the test strip is directly proportional to the substance under test, while the surface is inversely proportional to the intensity of the reflected light. The specific operation method is to extract and mix urine for about 10 hours, and then measure the chemical composition of urine on the urine analyzer for 10 times. After the test, the sample was centrifuged at 1500 r/min for 5 min, the supernatant was discarded, and then about 0.2 ml was collected for smear and examined with a microscope. The measurement range of urine dry chemistry analyzer is pi-15-7, specific gravity (SC) is 1.015-025, protein (pro) is negative, glucose (Glu) is negative, keto (ket) is negative, bilirubin (bil) is negative.

Now, in many countries, automatic chemical urine analyzer has been widely used, which is a routine method in clinical trials. This method can be displayed in a few minutes after the start of the scale, and is very suitable for emergency sample measurement [10].

2.5. Urine Sediment Analyzer Inspection

Microscopic examination of urine components is time-consuming and time-consuming, unable to quantify, affected by factors, without a single substance for quality control, and difficult to carry out indoors. Urine composition analyzer has the characteristics of rapid examination, small error, high accuracy and high safety.

Currently, there are two main types of urine analyzers:

(1) Urine composition analyzer (by image type)

The principle of this method is basically similar to that of the manual microscope, that is to say, the digital camera system takes photos of each laminar flow sample while maintaining the quantitative urine sediment under the microscope with contrast, and then the computer analyzes the image to determine the size and shape of the formed components, the contrast of texture characteristics, and the automatic recognition of urine components by using the shape recognition software And classification. In addition, the stored image of each sample can be re evaluated manually by computer [11].

(2) Automatic urine composition analyzer combined with flow cytometry and electrical impedance detection

During the test, urine samples for quantitative inhalation were diluted, heated and dyed, and then sprayed into the circulating pool of the membrane by hydraulic pressure. When the sample enters the flow cell of the shell liquid from the outlet of the sample nozzle, it will be surrounded by the shell liquid without particles, so that the formed components pass through the detection area of the argon laser of the flow cell in turn along the central vertical axis. After irradiation with an argon laser beam, each of the formed components produces different levels of fluorescence intensity, and the fluorescence intensity is proportional to the combination of the formed components and dyes. The device converts the captured light signal and electrical impedance into electrical signal, and comprehensively recognizes and calculates the size, volume and length of corresponding cell chromatin by analyzing various signals, and forms quantitative reports of red blood cell, white blood cell, bacterial and tube types and other components, as well as histogram and scatter diagram of components [12].

Automatic urine composition analyzer and dry chemical urine analyzer have many values, the main values are as follows:

1) It can not only detect bacteria without nitrate reductase, but also provide the actual content of bacteria in urine.

2) Urine analyzer is used in the urine test of dry urine chemistry and RBC analysis, and its test results can be used to evaluate the status and type of bleeding.

3. Subjects, Test Methods and Standards

3.1. Experimental Instruments

The instruments and reagents used in this paper are: binocular microscope, uritest500b urine analyzer, uritesta11 urine dry chemical test band with anti VitC interference function.

3.2. Research Object

In this study, 310 outpatients and inpatients of a hospital were selected. Of these patients, 155 were male and 155 were female. There was no gender difference. The age of the patients was 49 years old, the youngest was 22 years old, and the average age was 32 years old. During the experiment, we kept the fresh urine of the patients according to the accurate steps and requirements.

3.3. Test Method

(1) Analysis of leukocytes by dry chemical method

We select 10 ml urine sample, after shaking, put the test strip into the urine sample until it is completely immersed, take out the test strip after immersion, wipe the test strip to show the residual urine, then put the test strip in the urine analyzer for automatic detection until the final analysis is completed.

(2) Detection of leukocytes under microscope

We select 10 ml fresh urine sample, shake the urine to make it fully mixed, and put it in a centrifuge tube, and then centrifugate it at a speed of 1500R/min for 5 minutes. After centrifugation, take a drop of urine sediment, clean the sediment from the plate, then wash the sediment from the edge into the quantitative counting plate, observe with low power microscope, count in detail with high power microscope, count the white blood cells in 10 visual fields, and record and report the lowest and highest observed values.

3.4. Judgment Criteria

(1) Criteria for results of dry chemical method

After the strip test, the white blood cells were positive according to the following criteria: the number was + or above. Red blood cell positive criteria: number of + and above.

(2) Determination of urine sediment analyzer

The determination standard of urine sediment analyzer was: in the positive test, the red blood cell was >7×109/L, while the white blood cell was >10×109/L. In the negative group, RBC≤7×109/L, WBC≤10×109/L.

3.5. Statistical Methods

In order to make the data more convincing, we use software to process the data. Spss19.0 statistical software is selected by the software. Among them, the count data is represented by [n%%]. The comparison uses χ 2 test. When the $P<0.05$ between the data, it means that these data are different, that is to say, statistically significant.

4. Analysis of Test Results

4.1. RBC Positive by Dry Chemical Method

The results of RBC positive by dry chemical method are shown in Table 1.

Table 1. Comparison of the results of the detection of red blood cells in 310 cases of urine by dry chemical method and microscopy

Dry chemistry	n	Microscopy(n)	
		Negative	Positive
-	193	192	1
+/-	14	10	4
+	67	46	21
2+	18	10	8
3+	19	8	11

It can be seen from Table 1 that 116 of 310 samples were positive for RBC by dry chemical method, 40 of them were positive under microscope, 76 of them were negative, and the positive coincidence rate was 34.5%. In addition, 193 cases of RBC were negative by dry chemical method,

192 cases were negative by microscopy, 1 case was positive, and the negative coincidence rate was 99.5%. On the other hand, the results of the dry chemical test for the presence of negative red blood cells in urine are basically the same as those of the microscopic test, and the results of the positive test (116 cases) are significantly higher than those of the microscopic test (40 cases), especially when the results of the dry chemical test are (+ / -) or (+), the difference between the two methods is more obvious.

RBC in urine can be detected not only by dry chemical method, but also by free hemoglobin. On the other hand, microscopy is a different principle. This method is to take sediment from urine by centrifugation and count RBC directly under the microscope. After the above analysis, we can know that there is a reason for the difference between the two methods in RBC detection. The main reason is the secretion and some oxide pollution caused by urinary tract infection. These substances will cause the false-positive of dry chemical analysis. In addition, myoglobin and nephropathy in these substances will cause RBC fragmentation in urine. Not only that, hemolysis Hemoglobinuria caused by sexual diseases can also cause false positive. On the other hand, if the specific gravity of urine is too low, the pH value (the pH value of urine is lower than that of blood) and the urine sample are placed for too long. These two reasons will also cause the test results of the two methods to be different. Generally speaking, if the specimen is placed too long, it will lead to the dissolution of RBC in low pH value and low specific gravity urine, which will directly affect the results of microscopy. If there is a small amount of fresh red blood cells in the urine, the dry chemical method will be negative, but the microscopic examination is positive. Therefore, we know that RBC dry chemical method is positive in urine, but it is negative in microscopic examination. This test result cannot be directly considered as false-positive. We need to consider urinary infection, specimen placement time and hemolysis to judge.

4.2. WBC Positive by Dry Chemical Method

The results of WBC positive by dry chemical method are shown in Table 2.

Table 2. Comparison of the results of the detection of leukocytes by dry chemical and microscopic methods in 310 cases of urine

Dry chemistry	n	Microscopy(n)	
		Negative	Positive
-	212	195	17
+/-	18	7	11
+	48	18	31
2+	22	0	22
3+	10	0	10

It can be seen from Table 2 that there are 98 cases of WBC positive by dry chemical method, 75 cases of WBC positive by microscopic examination, 23 cases of WBC negative by both methods, and the positive coincidence rate is 76.5%; 212 cases of WBC negative by dry chemical method, 195 cases of WBC negative by microscopic reexamination, 17 cases of WBC positive by dry chemical method, and 92.0% of WBC negative coincidence rate. The results of WBC by dry chemistry were positive in 42 cases and negative in 25 cases. This result shows that when WBC is negative by dry chemical method, the result by microscope is not necessarily negative. In addition, when the amount of WBC in urine is more than 2 + or 3 +, the results of the two methods are basically consistent. However, when WBC is small (+ / - and +) or negative, the results of the two methods are quite different, and it is difficult to find the corresponding relationship. If we want to find out the reason, it should be because the experimental principle and reporting method of the two methods are different.

4.3. Urine Sediment, Microscopic Examination and Dry Chemical Method

192 of them were divided into three groups and examined by three different ways. The results are shown in Figure 1.

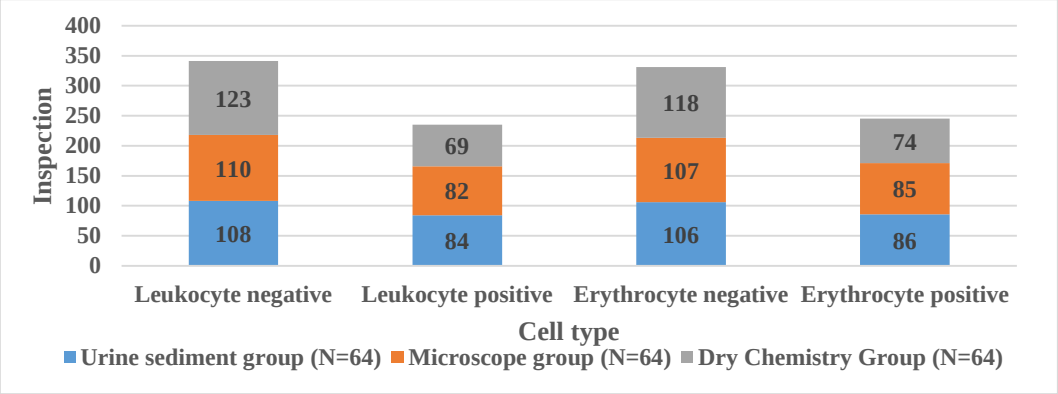

Figure 1. Comparison of positive detection of red blood cells and white blood cells among the three groups

It can be seen from Figure 1 that the number of positive leukocytes in the urine sediment group is 84, 108, 82 and 110 respectively, the number of positive leukocytes in the microscope group is 82 and 110 respectively, the number of positive leukocytes in the dry chemical method group is 69 and 123 respectively, the number of positive erythrocytes in the urine sediment group is 86 and 106 respectively, and the number of positive erythrocytes in the microscope group is 85 and 107 respectively, There were 74 positive and 118 negative erythrocytes in the dry chemical method group, and the positive detection rate of erythrocytes and leukocytes in the urine sediment group and the microscope group was higher than that in the dry chemical group, with a statistically significant difference ($P<0.05$), but there was no difference in the positive detection rate of erythrocytes and leukocytes between the microscope group and the urine sediment group, $P>0.05$.

The X2 value and P value feedback of the three groups of methods to generate the error diagnosis are shown in Figure 2.

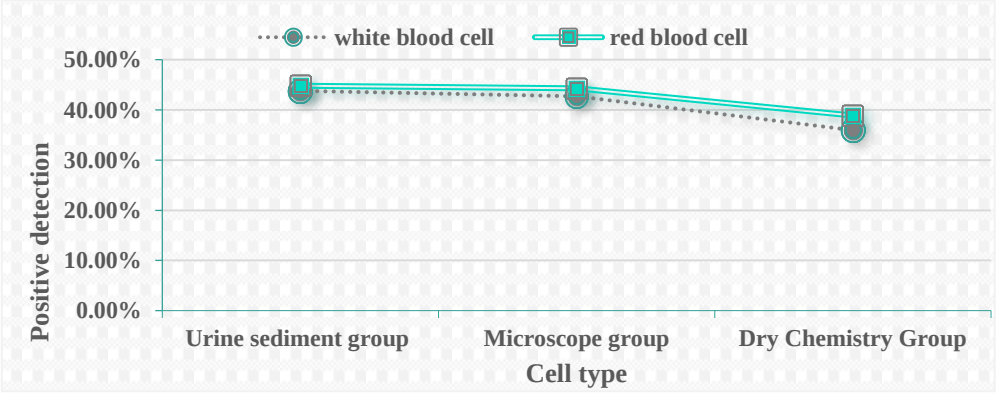

Figure 2. Positive detection of red blood cells and white blood cells under different detection methods

It can be seen from Figure 2 that for patients undergoing routine urine test, the detection rate of white blood cells (43.75%) and red blood cells (44.79%) by urine sediment automatic analyzer are higher than that by dry chemical method (35.94%) and red blood cells (38.86%), $P < 0.05$.

4.4. X2 Value and P Value of Dry Chemical Test, Microscopic Test and Combined Test for Diagnosis Error

X2 and P values of method 1 (dry chemical test) and method 2 (microscopic test) and their combination are shown in Figure 3.

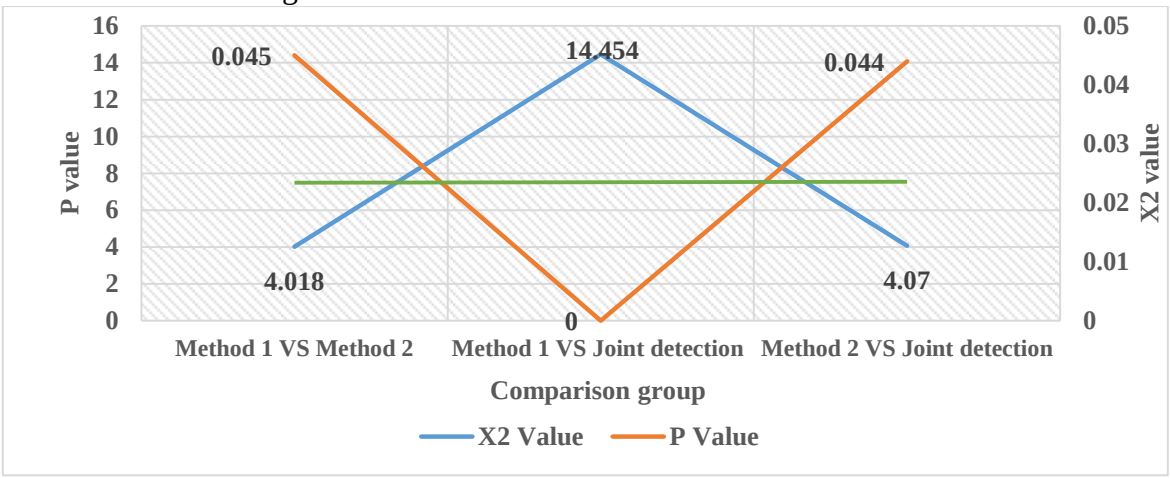

Figure 3. X2 and P values of three groups of diagnostic errors

It can be seen from Figure 3 that: the dry chemical method is 4.018, P value is 0.045; the dry chemical method is 14.454, P value is 0.00; the mirror method is 4.07, P value is 0.044. It can be seen that the correlation between dry chemical detection and microscopic detection is not strong.

4.5. Comparison of Dry Chemical Test, Microscopic Test and Joint Test in Diagnosis of Errors

Under the microscope, urine samples are analyzed directly by the microscope. Although this method is standard, it is very complex, time-consuming and prone to various human errors. The results of dry chemical method are easy to deviate when disturbed, and only the physical and chemical properties of urine can be detected; comparatively speaking, the microscopic detection can directly detect the number of white blood cells in urine samples, but it cannot be counted when the white blood cells are destroyed or disintegrated. Therefore, a group of experiments combining the two methods are added at the same time, and good results are obtained. The test results are shown in Figure 4.

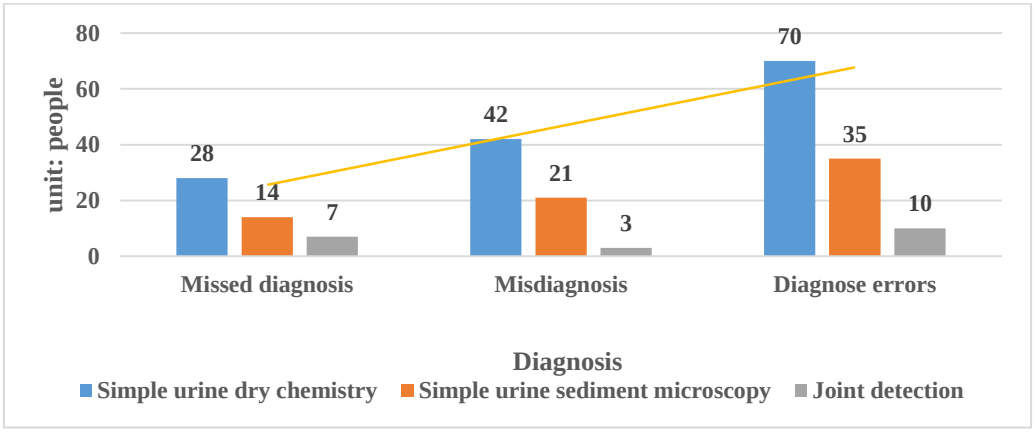

Figure 4. Comparison of three sets of diagnostic errors

It can be seen from the results in Figure 4 that the total number of errors in the detection of urine dry chemistry method is 20, with an error rate of 22.7%, the total number of errors in the detection of urine sediment microscopy method is 10, with an error rate of 11.36%, and the total number of errors in the combined detection method is 3, with an error rate of 3.41%. It can be seen that the accuracy of the combined diagnosis is higher.

5. Conclusion

With the continuous development of social market economy, the quality of life of the people in our country is improving day by day, but at the same time, there are many bad eating habits and living habits, which increase the risk of urinary system diseases, and endanger people's health and life safety. Routine urine test is an important part of the hospital's diagnosis, treatment and health services. It can comprehensively check the urinary system functions such as bladder function, ureter function and kidney function. It can also reasonably judge whether there is inflammation, bleeding and infection in people. At present, urine sediment test, microscope test and dry chemical test are mostly used in clinical routine urine test. The test results of each test technology have certain differences, which is easy to affect the diagnosis and treatment process of patients. In order to further guarantee the life safety of patients undergoing routine urine test, it is necessary to actively analyze the application value of different test technology.

In this paper, through the experimental analysis, the conclusion is as follows: Although the dry chemical method is convenient to detect urine cells, it cannot completely replace the microscopic examination. In the RBC negative test, the results of dry chemical method and microscope are basically consistent, so the WBC measured by dry chemical method is 2+/3+ and it can be detected without microscope again. In other cases, it is necessary to combine the dry chemical method with the microscopic examination, and obtain the final examination results according to the specific conditions of the specimen.

Therefore, for patients undergoing routine urine examination, active use of urine sediment analyzer and microscopic detection method can effectively improve the positive detection rate of patients, help patients to formulate a scientific clinical treatment plan, and treat patients as soon as possible. It has a positive role and excellent use value, and is also very important in clinical publicity.

Funding

This article is not supported by any foundation.

Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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