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LABORATORY PROCEDURE
ΕΡΓΑΣΤΗΡΙΑΚΗ ΜΕΘΟΔΟΣ

Urine colour variation in internal diseases according to Enrico Cauchi

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ΑΡΧΕΙΑ ΕΛΛΗΝΙΚΗΣ ΙΑΤΡΙΚΗΣ 2020, 37(Συμπλ 2):104 – 107

V. Savica,[1,2]
G. Duro,[1]
G. Bellinghieri[2]

[1]National Research Council (CNR), Institute for Research and Biomedical Innovation (IRIB), Palermo
[2]Academia Peloritana dei Pericolanti at University of Messina, Messina, Italy

In ancient times, urine was considered an important element for both religious tradition and for diagnostic procedures. Over time, several researchers reported on how urine variation may help in diagnosing different diseases. In 1933, Enrico Cauchi, member of the Medical Council of Malta, collected all comprehensively organised information in his book "Fisiologia e Patologia dell' urina", edited by A. Wasserman, Milano, Italy. Following the suggestions of "Urological Curves" by Augusto Murri, Enrico Cauchi reported all different data at that time about urine colour variation.

Η αλλαγή στο χρώμα των ούρων στις παθολογικές ασθένειες σύμφωνα με τον Enrico Cauchi

Περίληψη στο τέλος του άρθρου

Key words

Augusto Murri
Enrico Cauchi
Tuberculosis
Urine colour variation
Urological curves

1. INTRODUCTION

Uroscopy was systematically used in Ancient Greek times, when philosophers and doctors focused their attention on urine and blood.[1–3] Hippocrates suggested that the colour of urine derived from the mixing of the colours of the four humours: the red of the blood, the white of the phlegm, the dark yellow of yellow bile, the greenish of black bile.[1] Moreover, he suggested human temperament as conditioning urine colour variation: citrine and tenuous in choleric, white and tenuous in phlegmatic, white and dense in melancholic, red and dense in bloody temperament.[1,3]

Over time, several researchers reported on how urine colour variation may help in diagnosing numerous diseases.[2] In 1933, Enrico Cauchi, member of the Medical Council of Malta collected all comprehensively organised information in his book "Fisiologia e Patologia dell' urina", edited by Wasserman, Milano, Italy. He followed the suggestions of Augusto Murri according the so called "Urological Curves".[4]

Augusto Murri always insisted on the urine test evaluation and recommended that doctors use the so-called "Urological Curves" in their practice. He stated that the urine test is important not only for the diagnosis but also for the prognosis of many generalised and local diseases.[4] The most frequent pathologies at the beginning of the twentieth century were tuberculosis, typhus, cancer and helminthiasis.

2. MATERIAL AND METHOD[4]

2.1. Urine colour variation tests for tuberculosis

Moritz and Weisz developed a urine test for diagnosing tuberculosis, using a 5 mL solution of fresh unfermented urine and 15 mL of distilled water. The solution was divided into two equal parts; 3 drops of potash permanganate were added to one part of the solution while the other was used as a control. The test was considered positive if the urine solution was gold or canary yellow or greenish yellow or orange yellow in colour. These colours where associated by some authors with other infectious diseases.[4]

Comas L. and Martinez A. developed a test for tuberculosis using in a 5 mL testing tube of albumin-free urine mixed with a 2% solution of potassium ferrocyanide. To the mixture, boiled ½ mL of 3.3% ammonium chloride

solution was added. The test was considered positive if at the bottom of the tube a blue precipitate appeared while the remaining solution was green: after few hours, another Prussian blue precipitate was formed.[4]

Russo M. developed a urine test for incipient miliary fevers using four drops of methylene blue added to 4–5 mL of albumin-free urine. The test was considered positive when a light green colour appeared.[4]

2.2. Urine colour test variation for typhus

Russo M. developed a urine test for abdominal typhus using a solution of methylene blue mixed with 1% distilled water; subsequently 4–5 drops of this solution were added to 5 mL of urine. The test was considered positive if the urine became intense green, mint green or emerald green. Some authors disagreed with the results of Russo and Wiener test, suggesting that the urine colour variation was not due to chemical reactions but to the reagent used.[4]

Wiener G. mixed 4 mL of urine with 4 mL of ether, adding 2 mL of distilled water, 3 drops of Jenner's liquor and 10 drops of 1% permanganate solution. The test was considered positive if the urine showed an intense green colour. In malaria, this urine colour test turned blue.[4]

Another urine test was developed by Petzetakis M. who used 15 mL of filtered urine added to a 5% iodine alcoholic solution. The test was considered positive if the urine became yellow gold.

Moretti E. showed the same yellow gold colour of the urine treating the urine with lead acetate added to ammonium sulfate.[4]

De Silvestri G. 4 performed a urine test mixing 3 mL of albumin-free urine in a testing tube containing 2 mL iron perchloride and 4–5 drops of pure sulfuric acid. A brown red ring appeared in positive tests.

2.3. Urine colour test variation for cancer

Davis A. mixed 50 mL of albumin-free urine with hydrochloric acid in a glass; after heating it up he added 15 mL of pure sulphuric ether. After 24 hours, the ether was extracted and the solution was placed in a porcelain capsule left in the air. A light yellow or brown-yellow precipitate appeared in positive tests.[4]

Salomon D. and Saxel F.[4] performed a colour variation test using a 100 mL albumin-free urine solution added to 10 mL of hydrochloric acid. This solution was boiled in a Becker container adding 200 mL of boiled water and 10 mL of barium chloride at 10% concentration if the urine specific weight was less than 1,020 while barium chloride if the urine specific weight was greater than 1,020. The Becker container was placed in boiling water for 6 hours and then left to rest for 24 hours. The solution was then filtered and placed in an Erlenmayer flask adding 3 mL of Merck perhydrol and boiled for 15 minutes. The test was considered positive when a brown precipitate of barium sulphate appeared.

2.4. Urine colour test variation for pancreas diseases

Cammidge PJ[4] reported that in pancreas diseases urine showed a so-called Cammidge reaction and recommended removing albumin and sugar from urine before performing the test.

Licini C. developed the urine colour variation according to Cammidge showing controversial results using the following method: Firstly, albumin and sugar were removed from the urine. Then, 20 mL of clear urine were mixed with 1 mL of hydrochloric acid and the solution was boiled in a sand bath for ten minutes. Subsequently, the urine was left to cool down and distilled water was added to bring the solution back to 20 mL. The solution was filtered: 4 g of powdered lead carbonate were added and it was then filtered again; 4 g of tribasic lead acetate were added and it was then filtered again; 2 g of sodium sulphate were added and it was then filtered again. The solution was boiled in a sand bath, filtered and let to cool. A 10 mL solution is taken and 8 mL of distilled water is added, plus 80 mL phenylhydrazine hydrochloride plus g 2 sodium acetate and 1 mL acetic acid at 50% concentration. Finally, the solution is boiled for 10 minutes in a sand bath and then fully filtered. Positive tests showed yellow gold rosettes and small needle-shaped crystals that dissolved in a 33% sulphuric acid solution.

2.5. Urine colour test variation for heart diseases

Ehrlich P. reacted a urine sample with dimethylaminobenzaldehyde in a hydrochloric solution, showing that in heart patients the urine colour test ranged from pink to red. The intensity of the urine colour adding formolus depended on the severity of the cardiac disease. The urine colour variation was considered to define the prognosis of heart diseases: the prognosis was considered favourable when the urine colour returned to normal colour, while in cardiac instability urine colour returned transiently to normal colour. Prognosis was considered serious when the urine did not return to normal.[4]

2.6. Urine colour test variation for peritoneal diseases

Sgampati P. used a two-phase test:[4]

- 8–10 mL of urine were placed in a test tube, adding 3 mL of pure nitric acid. A red yellow ring appeared at the contact point between the urine and nitric acid and after another dark ring appeared.
- This test phase aims to confirm test positivity; to this end, 3 mL of chloroform were added to the solution after 24 hours. The chloroform was first blue and then, if the urine test was positive, it turned ruby.

2.7. Urine colour test variation for flu

Aradas T. used two test tubes. Then 1 g methylene blue was placed dissolved in distilled water and alcohol to reach 100 mL of solution. In one test tube, 5 mL of filtered urine were added to 5 drops of the prepared solution and in another test tube 5 mL of distilled water were added to 5 drops of the same solution. The test was considered positive when the tube with the urine showed a green to bottle green solution colour.[4]

2.8. Urine colour variation test for helminthiasis

Jefinoso B. used a mixture of 10 mL albumin-free urine and a 10 mL solution of mercury nitrate. The test was considered positive for roundworms, tapeworms and pinworms if a grey sediment was observed. This sediment can become dark to black according to disease severity.[4]

2.9. Urine colour test variation for liver diseases

Roch M. suggested the following method: After breakfast in the morning and after taking 0.04 mg of sodium salicylate, the urine was collected between 9–11 am and 10–3 pm. A few drops of 1% iron perchloride solution were added to the urine. A violet cloud appeared when the test was positive.[4]

2.10. Urine colour test variation for kidney diseases

According to Becker H.J. a small amount of urine was mixed with kaolin to make a slurry fluid that was then filtered. The urine became yellow or brownish when the test was positive.[4]

Kronberger's urine test variation for distinction between normal and pathological urine. He mixed 10 mL urine with 1 mL of Lugol's solution, 1 mL of gentian solution (1:200) and 10 mL of absolute alcohol. Normal urine showed a blue-violet colour while pathological urine showed a red colour.[4]

3. CONCLUSIONS

The data reported in Enrico Cauchi's book allow the deduction of epidemiological data on the frequency of common diseases at the beginning of the twentieth century. The most common pathologies in that period were tuberculosis, typhus, cancer and helminthiasis. No efficient laboratory tests were developed in that period and the study of urine colour variation was considered a useful test for diagnosing various internal diseases. The data he reported serve to affirm that a simple urine examination today is very useful and a modern concept[5] considering that it is possible to examine urine using sophisticated technology. For us, the ancient interest in urine examination is akin to going back to the future. Thus the application of current technology, i.e. mass spectrometry, will allow avoiding delays in diagnosis, therapy and diagnosis, at a low cost.

ΠΕΡΙΛΗΨΗ

Η αλλαγή στο χρώμα των ούρων στις παθολογικές ασθένειες σύμφωνα με τον Enrico Cauchi

V. SAVICA,[1,2] G. DURO,[1] G. BELLINGHIERI[2]

[1]National Research Council (CNR), Institute for Research and Biomedical Innovation (IRIB), Palermo,
[2]Academia Peloritana dei Pericolanti at University of Messina, Messina, Ιταλία

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Στην αρχαιότητα, τα ούρα θεωρούνταν σημαντικό στοιχείο τόσο για τη θρησκευτική παράδοση όσο και για διαγνωστικές διαδικασίες. Με την πάροδο του χρόνου, πολλοί ερευνητές ανέφεραν πως η αλλαγή των ούρων μπορεί να βοηθήσει στη διάγνωση διαφόρων ασθενειών. Το 1933, ο Enrico Cauchi, μέλος του Ιατρικού Συμβουλίου της Μάλτας, συνέλεξε όλες τις πληροφορίες, διεξοδικά οργανωμένες, στο βιβλίο του "Fisiologia e Patologia dell' urina", που εκδόθηκε από τον A. Wasserman στο Μιλάνο, Ιταλία. Σύμφωνα με τις προτάσεις των «Ουρολογικών Καμπυλών» του

Augusto Murri, ο Enrico Cauchi ανέφερε όλα τα στοιχεία που ήταν γνωστά εκείνη την εποχή σχετικά με την αλλαγή του χρώματος των ούρων.

Λέξεις ευρετηρίου: Αλλαγή χρώματος ούρων, Augusto Murri, Enrico Cauchi, Ουρολογικές καμπύλες, Φυματίωση

References

1. SAVICA V, CALÒ LA, SANTORO D, MONARDO P, MALLAMACE A, BELLINGHIERI G. Urine therapy through the centuries. *J Nephrol* 2011, 24(Suppl 17):S123–S125
2. SAVICA V, RICCIARDI CA, BELLINGHIERI P, DURO G, RICCIARDI B, BELLINGHIERI G. The historical relevance of urine and the future implications. *G Ital Nefrol* 2018, 35(Suppl 70):128–130
3. SAVICA V, DURO G, BELLINGHIERI G. Between the utility and hazards of phosphorus through the centuries. *G Ital Nefrol* 2016, 33(Suppl 66):S66.31
4. CAUCHI E. *Fisiologia e Patologia dell'urina.* Opera Medica, A. Wasserman, Milano, 1933
5. CONSOLO F, SAVICA V, BELLINGHIERI G. *L' esame delle urine-significato fisiopatologico.* Edit Bios, Cosenza, 1986

Corresponding author:

V. Savica, Via E. Geraci, 23, 98123 Messina, Italy
e-mail: visavica@tin.it