Original Article

Journal of Microbiology and Related Research
Volume 3 Number 2, July - December 2017
DOI: http://dx.doi.org/10.21088/jmrr.2395.6623.3217.9

Study of Automated Urine Analyser Iris IQ 200 in Predicting Urine Cultures

Sodani Sadhna*, Hawaldar Ranjana**

Author Affiliation
*Asst. Professor, Microbiology, MGM Medical College, Indore, Madhya Pradesh 452001, India.
**Sampurna Sodani Diagnostic Clinic, Indore, Madhya Pradesh 452001, India.

Corresponding Author
Hawaldar Ranjana
Sampurna Sodani Diagnostic Clinic, Indore, Madhya Pradesh 452001, India.
E-mail:
drranjana@sampurnadiagnostics.com

Received on 15.09.2017,
Accepted on 25.09.2017

Abstract

Background: Many automated urine analysers like IRIS IQ 200 and IChem Velocity (Beckman coulter) performing automated biochemical and microscopic examination are now available to improve the accuracy and productivity of urine examination and minimize the inter observer variability. It has been specially useful in predicting the growth of microorganisms in urine culture thereby reducing the time from diagnosis to initiation of treatment. *Objective:* The present study was undertaken to evaluate the role of fully automated Iris IQ200 and IChem velocity workstation (Beckman Coulter) in predicting urine infections and those needing culture. *Materials and Methods:* A total of 252 patients coming to our diagnostic centre for urine examination from January to August 2017 were included in the study.Urine was inoculated on blood and McConkey Agar plates with a 0.01 ml calibrated loop and after incubating at 37^0C for 24 hours, bacterial growth and colony identification was carried out by standard protocol. A significant growth was considered with a colony count of 10^4 CFU/ml. *Results*: Leucocyte esterase was positive in 82 (32.5%) cases, nitrite in 23 (9.12%), bacteria in 72 (28.5%) and bacterial growth in culture in 99 (39.2%) patients. Out of these insignificant growth was seen in 22 (22.23%) and significant growth in 77 (77.77%). Out of 99 cases which showed bacterial growth in culture, E.coli was grown in 70 cases with 56 patients showing significant colony count. Klebsiella sps was grown in 21 cases, Enterococcus and Enterobacter sps in three cases, Pseudomonas in two cases. *Conclusion:* Automated urine analysers are good predictors of urine cultures and UTI and have enhanced accuracy due to reporting of leucocyte esterase, nitrite, bacteria and all small particles.

Keywords: iQ 200; iChem Velocity; ASP; Leukocyte Esterase; Nitrite.

Introduction

Urinary tract infection is one of the most frequently encountered medical problem all over the world [1]. It ranges from asymptomatic bacteriuria to severe septic infections. Females are more prone to UTI because of their short urethra as compared to men. UTI are mostly diagnosed by simple and rapid routine urine analysis which includes both biochemical tests for presence of blood and protein as well as microscopic examination for presence of pus cells, RBCs, bacteria and casts [2]. Although simple and affordable, the routine urine examination is time consuming and labour intensive and has a lot of inter observer variation due to subjective interpretation.

© Red Flower Publication Pvt. Ltd.

The European urinanalysis guidelines recommends two steps for urine analysis [3]. In the first step, dipstick is used to analyse the biochemical parameters. If all the parameters are negative, no further microscopy is needed. If dipstick is positive for Hb, protein, leukocytes and nitrite, microscopy is done. But this has a fair chance of missing infections [4,5,6,7]. Many automated urine analysers like IRIS IQ 200 and IChem Velocity (Beckman coulter) performing automated biochemical and microscopic examination are now available to improve the accuracy and productivity of urine examination and minimize the inter observer variability. It has been specially useful in predicting the growth of microorganisms in urine culture thereby reducing the time from diagnosis to initiation of treatment. Currently, there is no standard reference method available for urine microscopy which can provide correct identification of formed elements in urine microscopy.

Manual microscopic examination requires trained Staff with experience. To overcome these shortcomings, automated urine analysers were developed for high volume laboratories to provide both standardisation and improve the turnaround time [8,9].

The present study was undertaken to evaluate the role of fully automated Iris IQ200 and IChem velocity workstation (Beckman Coulter) in predicting urine infections and those needing culture.

Material and Methods

A total of 252 patients coming to our diagnostic centre for urine examination from January to August 2017 were included in the study in all ages and both the sexes. Mid stream Urine samples were collected according to standard protocol in wide mouth, leak proof sterile containers. Each sample was subjected to urine analysis within one hour of collection. Urine was inoculated on blood and McConkey Agar plates with a 0.01 ml calibrated loop and after incubating at 37°C for 24 hours, bacterial growth and colony identification was carried out by standard protocol. A significant growth was considered with a colony count of 10^4 CFU/ml. Routine urine analysis was carried out on IRIS iQ 200 and iChem Velocity (Beckman Coulter) using unspun urine specimens for presence of WBCs, leukocyte esterase, nitrite, bacteria and all small particles (ASP).

iQ 200 was calibrated by iQ focus , iQ negative and iQ positive controls (IRIS diagnostics)every day before running the urine samples.

Patients on antibiotic therapy and cathetrised patients were excluded from the study.

Results

A total of 252 urine specimens were analysed for the presence of leucocyte esterase, nitrite, WBCs, bacteria and ASP on iQ 200 in both sexes and all age groups. The patients were divided into less than 20, 21-40, 41-60, 61-80 and more than 80 years of age in both sexes. There were 95 (37.6%) males and 157 (62.4%) females. The male to female ratio was 0.60:1. (Table 1). Bacterial growth was observed in 99 (39.2%) cases while in 153 (60.8%) cases the urine was sterile. Maximum cases 72 (28.57%) were in 21-40 years of age with 54 females and 18 males, followed by 69 patients (27.3%) in 41-60 years of age with 27 males and 42 females. In 0-20 years of age, there were 22.22% cases, 19.84% in 61-80 and least (1.98%) above 80 years of age (Table 1).

WBCs; Leukocyte Esterase; Nitrite and Bacteria

In presence of 0-5 WBCs/hpf 22 cultures were positive for bacterial growth. Out of these, 13 showed insignificant bacterial growth (< 10^4 CFU/ ml) and 9 cases showed significant growth(>10^4 CFU/ ml).

When pus cells were between 6-10 /Hpf , Leukocyte esterase was positive in 5 cases. 5 had bacterial growth in culture out of which 2 had significant growth.

When WBCs were 11-20 /hpf, leukocyte esterase was present in 12 cases, nitrite in one and presence of bacteria in 6 cases, out of which 5 showed bacterial growth in culture out of which 4 had significant colony count.

When WBCs were between 21-30 /hpf, leukocyte esterase was present in 10 cases, 2 had nitrite positivity and presence of bacteria in 9 cases. Out of these 21 cases showed bacterial growth in culture with significant colony count in 17 patients. In 12 cases bacteria was not detected by iQ200 but had culture positivity.

When WBCs were more than 30/hpf, it was observed that 57 cases had leukocyte esterase positivity, 20 had nitrite present in the urine and all the 57 ases had bacteria in their urine, detected by iQ200. Out of these 57 cases, 46 showed significant bacterial growth in culture (Table 2).

Leucocyte esterase was positive in 82 (32.5%) cases, nitrite in 23(9.12%) , bacteria in 72(28.5%) and bacterial growth in culture in 99(39.2%)patients. Out of these

insignificant growth was seen in 22 (22.23%) and significant growth in 77 (77.77%). Out of 99 cases which showed bacterial growth in culture, E.coli was grown in 70 cases with 56 patients showing significant colony count. Klebsiella sps was grown in 21 cases, Enterococcus and Enterobacter sps in three cases, Pseudomonas in two cases. (Table 3).

Table 1:

Showing Demographic Data of Patients				
Age in years	**Male**	**Female**	**Total**	**Percentage**
0 to 20	18	38	56	22.22
21 to 40	18	54	72	28.57
41 to 60	27	42	69	27.3
61 to 80	29	21	50	19.84
>80	3	2	5	1.98
TOTAL	95	157	252	
percentage	37.6	62.4		

Table 2:

showing relative distribution of patients w.r.t. biochemical parameters						
Pus cell	**Leukocyte Esterase**	**Nitrite**	**Bacteria**	**Culuture Positive**	**Colony count >10⁴/ml**	**<10⁴/ml**
0 to 5	1			22	9	13
6 to 10	2			5	2	3
11 to 20	12	1	6	5	4	1
21 to 30	10	2	9	21	17	4
>30	57	20	57	46	45	1
total	82	23	72	99	77	22
percentage	32.5	9.12	28.5	39.2	77.77	22.23

Table 3:

Showing Bacterial Growth			
Colony	**<10⁴/ml**	**>10⁴/ml**	**Total**
Kebsiella	7	14	21
Enterococcus	1	2	3
Pseudomonas	0	2	2
Enterobater	0	3	3
E.Coli	14	56	70
Total	22	77	99

Fig. 1:

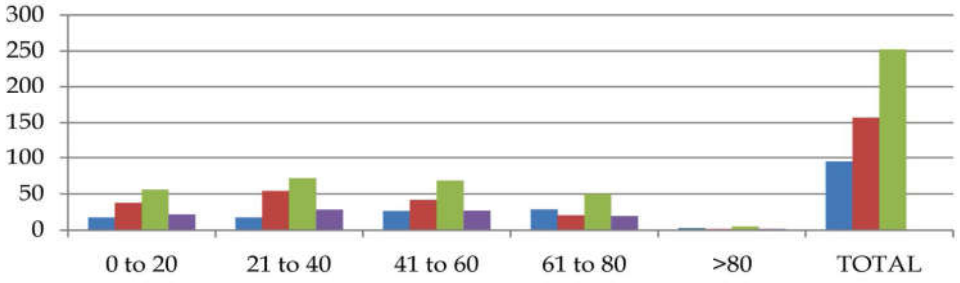
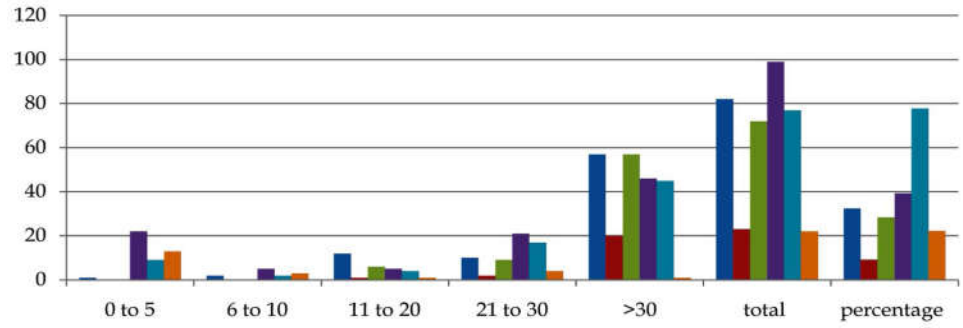


Fig. 2:



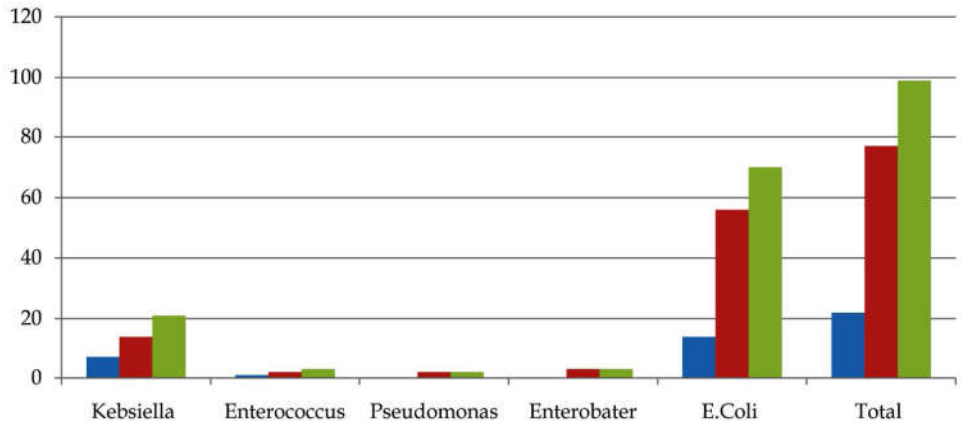


Fig. 3:

Discussion

Iris IQ200 and IChem velocity (Beckman Coulter) have been introduced in medical laboratories in recent times for complete examination of urine which has resulted in improved standardization of urine analysis and more efficient working. The main purpose of automated urine analysers is to minimize the number of urine samples subjected to culture by screening normal from abnormal specimens. This in turn can reduce the financial burden and labour cost involved in culture and also minimize the turnaround time significantly.

The integrated IRIS iQ 200 and iChem Velocity (Beckman Coulter)automated urine analyser works on the principle of flow digital image capture technology and uses an autoparticle recognition software (APR) to identify particles in urine. The urine is aspirated in the analyser which is then focused hydrodynamically between the two layers of suspending fluid(planar flow) forcing the particles to orient in a single plane which faces a microscopic objective lens and a digital camera which captures at least 500 different fields for particles. The APR software then classifies these particles into WBCs, RBCs, squamous cells, casts, crystals, WBC clumps, bacteria, yeast cells, mucus, sperms etc. These images are then screened and saved for reporting. Chemical analysis is carried out by relectance spectroscopy which includes Ph, Specific gravity,nitrite and leucocyte esterase [10].

In our study we found a good correlation between abnormal urines with respect to presence of WBCs, leukocyte esterase,nitrite and presence of bacteria. Base on these findings, the instrument flags those specimens which require culture. We observed that as the number of WBCs increased, bacteria and leukocyte esterase showed positivity in increasing numbers. When WBCs were more than 30 /hpf, bacteria were present in all the 57 cases and culture showed significant bacterial growth in 46 cases (80.7%) based on the flagging by the instrument.

Sturenberg et al in 2014, analysed 963 urine specimens on the iQ200 system and concluded that when WBCs were more than 25/ul and bacterial count was more than 5 bacteria/ul ,the sensitivity was 98.9%.They concluded that approximately 30.4% to 35.9%samples can be excluded from being cultured by iQ200 microscopy [11]. Broeren MA et al observed that culture savings effect was greatly reduced to 20% of which 14%were false negative results as compared to 52% by using a cut off value of >/=10^5CFU/ ml [12]. Ami P. Shah et al in their study observed that sensitivity for pyuria was 84.5% by IRIS iQ200 [13]. They analysed 703 urine spevcimens and concluded that the sensitivity and PPV for urine culture was 79.5% and 37.5% respectively. In similar studies carried out by Noyan et al in 2014, it was observed that there was a good correlation between iQ200 results and culture positivity when WBCs, leukocyte esterase, nitrite and all small particles were taken into consideration [14]. On the other hand, Akin et al did not find a significant correlation between iQ200 and culture results [15]. Parta et al also found that ASP did not increase specificity ,sensitivity and NPV of bacterial cultures [16].

Capelletti et al observed that ASP and leukocytes are efficient tools for screening urine specimens for bacterial cultures [17].

Conclusion

The results of our study show a good correlation between iQ 200 and culture results. The main purpose of using automated urine analysers is to reduce the number of samples subjected to urine culture.These analysers decrease the turnaround time and financial

burden on the patients by avoiding unnecessary urine cultures . So, it can be concluded that automated urine analysers are good predictors of urine cultures and UTI and have enhanced accuracy due to reporting of leucocyte esterase, nitrite, bacteria and all small particles.

Conflict of Interest: None

References

1. Tanagho E.A., McAninch J.W. Smith's general urology. Sixth edition. Lange Medical Books, NY, 2004.
2. Delanghe J.R., Kouri T.T., Huber A.R., et al. The role of automated urine particle flow cytometry in clinical practice. Clin Chim Acta 2000;301:1-18.
3. European Urinalysis Guidelines Scand. J Clin. Lab. Investig., 2000;60(Suppl 231):S1-S86.
4. T. Shaw Jr, S.Y. Poon, E.T. Wong" Routine urinalysis". Is the dipstick enough? J Am. Med. Assoc., 1985; 253:1596-1600.
5. P. Laine, E. Toivonen, K. Eklund, U. Hohenthal, S. Siren, T. Maki Rapid dipstick urinalysis in the internal medicine clinic: what is missed?J. Intern. ed., 1997;242:271-273.
6. W.L. Deville, J.C. Yzermans, N.P. van Duijn, P.D. Bezemer, D.A. van der Windt, L.M. BouterThe urine dipstick test useful to rule out infections. A meta-analysis of the accuracy BMC Urol., 2004;4:4.
7. R. Gangaram, P.J. Ojwang, J. Moodley, D. Maharaj The accuracy of urine dipsticks as a screening test for proteinuria in hypertensive disorders of pregnancy Hypertens. Pregnancy, 2005;24:117-123.
8. Lamchiagdhase, K. Preechaborisutkul, P. Lomsomboon, P. Srisuchart, P. Tantiniti, N. Khan-u-ra, B. PreechaborisutkulUrine sediment examination: a comparison between the manual method and the iQ200 automated microscopy analyzer Clin. Chim. Acta, 2005;358:167-174.
9. R.J. Elin, J.M. Hosseini, J. Kestner, M. Rawe, M. Ruddel, N.N. NishiComparison of automated and manual methods for urinalysis. Am. J Clin. Pathol., 1986;86:731-737.
10. Stürenburg E, Kramer J, Schön G, Cachovan G, Sobottka I. Detection of significant bacteriuria by use of the iQ200 automated urine microscope. J Clin Microbiol. 2014;52(8):2855-60.
11. Enno Stürenburg, Jan Kramer, Gerhard Schön, Georg Cachovan, andIngo Sobottka Detection of Significant Bacteriuria by Use of the iQ200 Automated Urine MicroscopeJ Clin Microbiol. 2014 Aug;52(8): 2855–2860.
12. Broeren MA, Bahçeci S, Vader HL, Arents NL. Screening for urinary tract infection with the Sysmex UF-1000i urine flow cytometer. J. Clin. Microbiol. 2011;49:1025–1029.
13. Ami P. Shah, Benjamin T. Enhanced vs automated urinanalysis for screening of urinary tract infections in children in the emergency department, Pediatr Infect Dis J 2014 Mar;33(3):272-5.
14. Tevfik Noyan , Özgül Gözlükaya , Sema Nur Ayyildiz, Yeliz Çetinkol , Fazilet Özenç Çakir , Soner Çankaya Are All Small Particles Parameters in the iQ200 Auto Particle Recognition Software Have Any Benefit on Reduce the Urine Culture Number? Journal of Chemistry and Biochemistry December 2014;2(2).169-177.
15. Akýn OK, Serdar MA, Cýzmecý Z, Genc O. Evaluation of specimens in which the urine sediment analysis was conducted by full-automatic systems and a manual method together with urine culture results. Afr J Microbiol Res 2011;5(15):2145-49.
16. Parta M, Hudson BY , Le TP, Ittmann M, Musher DM, Stager C. IRIS iQ200 workstation as a screen for performing urine culture. Diagn Microbiol Infect Dis 2013;75(1):5–8.
17. Cappelletti P, Poz D, Metus P. Performance of IRIS iQ200 in urinary tract infections (UTIs) screening. Clin Chem 2009;55(6):A27.