

Urine Dipstick of Sputum for the Rapid Diagnosis of Community Acquired Pneumonia

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Abstract: *Introduction:* Community acquired pneumonia (CAP) is responsible for an important part of treatment costs across the world. Even though posterior-anterior lung radiography (PALG) and direct sputum smear microscopy are required or routine diagnoses. The purpose of this study is to determine the diagnostic value of the bedside urine strip tests in CAP.

Methods: Patients who attended the emergency department (ED) between from February 2016 to September 2016 with expectoration complaints and suspicion of pneumonia. The sensitivity, specificity, and accuracy rate of the urine strip tests, direct sputum smear microscopy, and PALG were calculated and analyzed using SPSS 15.0.

Results: During the study period, 100 patients with pneumonia suspicion were evaluated in the ED. The sample was divided into two groups: negative and positive diagnosis of CAP. The leukocytes detecting by urine strip tests are statistical differences between the two groups ($p: 0.003$). The results show that the sensitivity, specificity, and accuracy rate of leukocytes detected in sputum with urine strip tests in the pneumonia diagnosis were 83.3%, 44.2% and 63% respectively.

Conclusion: According to the study, it is believed that the method of determination of leukocytes with urine strip tests in sputum combined with more detailed results. They can become part of CAP diagnosis methods.

Keywords: Pneumonia ■ Sputum ■ Urine strip test

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INTRODUCTION

Community acquired pneumonia (CAP) is responsible for an important part of physician referrals, treatment costs, and work school day losses across the world. CAP is a disease that is frequent in patients referring to emergency rooms, and delays in its diagnosis can cause increases in mortality and morbidity rates.¹

In UK and USA, CAP is ranked in sixth place as a cause of death and ranked first place as an infection related cause of death. In outpatients, mortality rate was measured as 1–5%, whereas in inpatients, the average rate was measured as 12%. In intensive care, patients' mortality rate can reach 40%, especially in elderly patients with diabetes mellitus (DM), chronic lung disease, chronic kidney or liver disease, and frequency and severity of CAP increases.^{1,2}

Several treatment guidelines recommend the use of the confusion, BUN, respiratory rate, blood pressure (CURB 65) and pneumonia severity index (PSI) indices. PSI, which Fine et al. developed, is a good and verified scoring system to evaluate mortality risk.³ Even though PSI is a good system, its routine usage is limited due to its complexity. It is easier to calculate the CURB65 score, but its prognostic accuracy is lower compared to PSI. Both of these indices require additional risk factors and prognostic indicators.⁴

Even though posterior-anterior lung radiography (PALG), direct sputum smear microscopy and supportive blood examination are required or routine diagnosis, these examinations have low diagnostic success rates. Despite advanced diagnostic procedures, the pathogen detection rate is approximately 50–55%. A thorax computer scan, which is the golden standard, is not possible all the time.^{5–7}

Bedside urine strip tests can measure the pH of the urine and show the existence of glucose, erythrocyte, leukocyte, nitrite, and proteins in the urine. Detection of the existence of these materials and cells in sputum can provide additional benefits for diagnosis. The purpose of this study is to determine the diagnostic value of the data acquired from the evaluation of patients who have a suspicion of CAP with bedside urine strip tests and to make faster diagnoses in crowded emergency room units.

Table 1. Additional diseases.

	(%)
Additional disease	73
Diabetes mellitus	22
High blood pressure	45
COPD	37
CAD	8
CHF	18
Asthma	3

COPD, Chronic Obstructive Respiratory Disease; CAD, Coronary Artery Disease; CHF, Chronic Heart Failure.

MATERIALS AND METHODS

This study was undertaken in a research and training hospital with an annual emergency department (ED) attendance of approximately 200,000. The study received prior Human Research Ethics Committee approval.

All patients who attended the ED from February 2016 to September 2016 with expectoration complaints and suspicion of pneumonia aged over 18 years and who were not pregnant were eligible for enrollment. Patients' epidemiological data, routine examination results, direct sputum smear microscopy; results of evaluation with a urine strip test, and a final diagnosis were recorded. The sensitivity, specificity, and accuracy rate of the urine-strip tests, direct sputum smear microscopy, and PALG were calculated and analyzed using SPSS 15.0 (SPSS, Inc., Chicago, IL, USA) with χ^2 testing and 95% confidence intervals.

RESULTS

During the study period, 100 patients with pneumonia suspicion were evaluated in the ED. All 100 patients (41% female, 59% male, mean age 64 ± 12.4 years, range 19–79 years) agreed to participate in the study. 100 patients who were suspected to have pneumonia were divided into two groups as pneumonia patients and non-pneumonia patients. 52 of all patients were diagnosed with pneumonia. 27 (56.3%) of them were male, 21 (43.8%) of them were female patients. Mean age of patients diagnosed with pneumonia was 69.5(19-79). 32 (61.5%) male patients, 20 (38.5%) female patients did not have pneumonia diagnosis. Mean age of non-pneumonia patients was 64 (32-79). There was no statistically significant difference between these two groups as age, gender and additional disease.

Table 2. The relationship between definitive pneumonia diagnosis and the urine-strip test results.

	Diagnosis negative (n:52)	Diagnosis positive (n:48)	p-value
Glucose (n, %)			
Negative	52 (100)	47 (97.9)	0.48
Positive	0 (0)	1 (2.1)	
Bilirubin (n, %)			
Negative	52 (100)	47 (97.9)	0.48
Positive	0 (0)	1 (2.1)	
Ketone (n, %)			
Negative	52 (100)	48 (100)	NA
Positive	0 (0)	0 (0)	
Protein (n, %)			
Negative	41 (78.8)	37 (77.1)	0.832
Positive	11 (21.2)	11 (22.9)	
Nitrite (n, %)			
Negative	23 (44.2)	25 (52.1)	0.432
Positive	29 (55.8)	23 (47.9)	
Erythrocyte (n, %)			
Negative	29 (55.8)	28 (58.3)	0.796
Positive	23 (44.2)	20 (41.7)	
pH Median (Min-Max)	9 (8-9)	9 (6-9)	0.411

Seventy-three percent of the patients had an additional disease, and the most common additional disease was high blood pressure (Table 1). Table 2 shows the relation between the urine strip test results and final pneumonia diagnosis. According to their diagnosis of pneumonia, the

Table 3. Multivariate analysis of leukocyte in urine-strip tests, leukocytes in direct sputum smear microscopy, and PALG pneumonia findings in pneumonia diagnosis.

OR	95% confidence interval			p
	Lower limit	Upper limit		
Urine strip tests	4.017	1.530	10.545	0.005
Microscopy	2.728	1.132	6.576	0.025
PALG	0.974	0.413	2.299	0.953

Urine Strip Test; Leukocyte in Urine Strip Test, Microscopy; Leukocytes in Direct Sputum Smear Microscopy; PALG, posterior-anterior lung radiography.

Table 4. Compliance of definite diagnosis with leukocyte in urine-strip tests, leukocytes in direct sputum smear microscopy, and PALG pneumonia findings.

	P – (n:52)	P + (n:48)	Kappa	p: value	Sens. %	Spec. %	Accu.	PPV %	NPV %	L+	L–
Urine strip (n, %)											
Leukocyte negative	23 (44.2)	8 (16.7)	0.271	0.003	83.3	44.2	63	58	74.2	1.5	0.4
Leukocyte positive	29 (55.8)	40 (83.3)									
Sputum (n, %)											
Leukocyte negative	37 (71.2)	23 (47.9)	0.234	0.018	52.1	71.2	62	62.5	61.7	1.8	0.7
Leukocyte positive	15 (28.8)	25 (52.1)									
PALG (n, %)											
Pneumonia negative	28 (53.8)	23 (47.9)	0.059	0.553	52.1	53.8	53	51	54.9	1.1	0.9
Pneumonia positive	24 (46.2)	25 (52.1)									

PALG, posterior-anterior lung radiography; P +, Pneumonia Positive; P –, Pneumonia Negative; Sens, Sensitivity; Spec, Specificity; Accu, Accuracy; PPV, Positive predictive value, NPV, Negative Predictive Value; L +, positive likelihood ratio; L –, negative likelihood ratio.

samples were divided into two groups as negative and positive diagnosis. All p - values in the table are above the critical 0.05 level, indicating no statistical differences between the two groups (Table 2).

As a result of the multivariate analysis, leukocytes detected in sputum with urine strip tests and leukocytes in direct sputum smear microscopy results were determined as independent factors affecting the definite diagnosis of pneumonia (p:0.005, p: 0.025). There was no correlation between PALG and definitive diagnosis of pneumonia (Table 3).

The results show that the sensitivity, specificity, and accuracy rate of leukocytes detected in sputum with urine strip tests in the pneumonia diagnosis were 83.3%, 44.2% and 63%, respectively. In addition urine strip tests used in leukocyte determination in sputum samples are more sensitive compared to direct sputum smear microscopy (Table 4).

DISCUSSION

CAP is still a serious problem in terms of morbidity and mortality. Delays in diagnosis and treatment increase the complication and mortality rates.⁸ It is easy to diagnose pneumonia in the presence of typical clinical and radiological findings. However, the clinical picture may not be clear in the case of accompanying lung diseases or when the consolidation is not seen radiologically in the early stages and there are no other signs of infection, such as fever or leucocytosis. In the presence of such atypical clinical and radiological findings, it is difficult to diagnose pneumonia.⁹ For this reason, rapid diagnostic methods that can support clinical and radiological findings are being studied. When the guidelines and the literature were

examined, the most common diagnostic methods for CAP diagnosis, besides the history of the patient and the physical examination, were PALG and leukocyte detection with direct sputum smear microscopy, sputum culture with the purpose of determining the effect on patients with severe disease, and thoracic CT.¹ In the literature, no other studies used urine strip tests to examine sputum to detect pneumonia.

In the study, pneumonia diagnosis in patients with expectoration complaints was analyzed. For this purpose, sputum samples were taken from all cases included in the study and examined with both direct examination and urine strips. According to this examination, only approximately half of the cases were diagnosed with pneumonia. In addition, in the majority of cases, leukocytes were not detected in the direct sputum smear microscopy, whereas the existence of leukocytes was positive in the majority of the cases with the urine strip tests.

CONCLUSION

In emergency departments, which are usually the first referral place for patients pre-diagnosed with CAP, diagnostic tests are time consuming and challenging for physicians. According to the study, it is believed that the method of determination of leukocytes-with urine strip tests in sputum samples combined with more comprehensive and detailed results from other studies can become part of CAP diagnosis methods.

APPENDIX A. SUPPLEMENTARY DATA

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jnma.2018.03.008>.

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