



Point-of-care Tests in Pediatric Infectious Diseases Practice

Çocuk Enfeksiyon Hastalıkları Pratiğinde Hasta Yanı Tanı Testleri

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Question : What are the bedside diagnostic tests (point-of-care tests) and what are the roles of them in pediatric practice?

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Answer (Mustafa Hacimustafaoğlu, MD)

With no exact equivalence in the Turkish language, “point-of-care” tests can be referred to as bedside tests, bedside diagnostic tests and chairside tests. In my opinion, the term “bedside diagnostic tests” is the most suitable among all, and hence, the term “bedside diagnostic tests” will be used as “point-of-care tests” in this article.

Bedside diagnostic tests are the tests that ran by doctors or other healthcare personnel at the point where the patient is seen (e.g. outpatient clinic, emergency service, observation room, healthcare center, and etc.) and are completed in a relatively short time. Following patient history and physical examination, these tests are practically important in terms of clinical decision-making, treatment planning, and also they results rapidly and contribute to the prognosis of the patient.

Bedside diagnostic tests are used widely and particularly in pediatric infectious diseases practice.

The bedside diagnostic tests used in pediatric infectious diseases practice can be classified in two major groups (Table 1):

1. Non-specific bedside diagnostic tests: These include host biomarkers CRP, procalcitonin and also hemogram/formula leukocytes, peripheral smear, standard urine analysis, stool smear and microscopy. Some authors state that chest radiography can be regarded in this group if available. These are not aimed at the agent, but are related to the severity of the disease caused by the agent in the host body and can be used nonspecifically in the discrimination of bacteria-viral infections and/or in estimating the severity of the present infection/inflammation in some cases and in deciding upon hospitalization or emergency observation.

2. Bedside diagnostic tests aimed at specific agent: These are agent-specific tests; such as antigen testing for group A beta-hemolytic Streptococcus in throat swab sample, respiratory syncytial virus and/or influenza virus antigen tests in nasal and throat secretions or swab samples, rotavirus and adenovirus antigen in stool samples, and detection of tubercle bacillus in mucus samples (Xpert test). In some cases, some PCR-based tests which gives rapid results in respiratory tract secretion or swab samples are promising for the future and can be classified in bedside diagnostic tests.

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Table 1. Classification of the bedside diagnostic tests

Non-specific (aimed at host response)	Specific (aimed at the agent)
Hemogram/formula leukocyte/peripheral smear C-reactive protein Procalcitonin Standard urinalysis (swab test and microscopy) Stool smear and microscopy (chest radiography)	GAS antigen test RSV antigen test Influenza antigen test Rotavirus antigen test Adenovirus antigen test Others (rapid PCR, Xpert/RIF-TB, and etc.)
GAS: Group A streptococcus, RSV: Respiratory syncytial virus.	

Ideal bedside diagnostic tests should be those that are performed quickly and easily without troubling the child and his/her family (child and family-friendly test), give fast results (generally < 15 min), are cheap and cost effective, and reliable (with high sensitivity and specificity). These tests must contribute positively to the treatment and monitoring of the patient by providing insight for a rational treatment approach. Moreover, these tests provide additional information, particularly in the field of infectious diseases, in terms of antibiotic use and duration. They are of utmost importance in rational antibiotic use. Quick resolution of the patient's problem at the point of examination contributes to the more productive use of healthcare services due to its advantages such as not being transferred to other institutions for laboratory works and not engaging the laboratory and physician for laboratory results. Furthermore, these tests contribute to the rational use of antibiotics with a low cost in small hospitals and healthcare centers where particularly polyclinic services are being given without extensive laboratory facilities and increase the efficiency of healthcare services in these types of healthcare institutions. The pros of these tests include their sufficient and satisfying accuracy and reliability, cost-efficiency, the fact that they are effective for decision-making in patient treatment and follow-up, and that they are standard, easy, patient-friendly, ideally concluded in < 15 mins, and do not demand a high-level of experience.

Practical areas of use of the bedside diagnostic tests in pediatric infectious diseases: Hemogram/formula leukocyte and peripheral smear, CRP, procalcitonin can be used to evaluate bacterial-viral separation and the possibility of serious bacterial infection in a patient presenting with fever. According to the DMSA renal cortical scintigraphy which is the gold standard in acute pyelonephritis; the cutoff values of CRP > 20 mg/L and procalcitonin > 0.5 ng/mL showed 94% and 86% sensitivity and 39% and 74% specificity, respectively. Elevated CRP and procalcitonin levels can also be used in supporting the diagnosis of bacterial pneumonia. In fevers without localizing sign, leukocytosis (> 15.000/mm³) and elevated immature neutrophils (bands) (> 10% or > 1500/mm³) in hemogram, elevated CRP and procalcitonin may support

the presence of a systemic bacterial infection. In addition, presence of toxic granulation and toxic vacuolisation is considered as supportive findings of severe bacterial infection. Standard urinalysis and stool smear and microscopy evaluation are performed according to standard assessments and are useful in rapid diagnosis.

Rapid antigen tests (such as GAS, respiratory syncytial virus, influenza) are tests with fast results (generally < 1 h) that can guide physicians to treatment in children with upper respiratory tract infection (URTI) and acute pharyngitis/tonsillitis/tonsillopharyngitis. The sensitivity and specificity of GAS and RSV rapid antigen tests are sufficiently high. If GAS test is positive, then there is no need for a throat culture. However, if GAS test is negative and the physician still considers the possibility of GAS, then a throat culture may be necessary for a 5-10% culture positivity.

There are different types of influenza rapid antigen tests whose costs, working methods, result time, sensitivity, and specificity differ from one another. Generally, the results can be obtained within hours or even within < 20 mins according to the test used and laboratory facilities. RT-PCR, which is one of the tests extensively used in diagnosis, can differentiate influenza A and B and subtypes of influenza A. Its sensitivity varies between 86-100%. In tests used in the detection of the antigen with direct and indirect immunofluorescent method, the result can be obtained within 1-4 hours, influenza A types can be determined and their sensitivity is 70-100% while specificity is higher. Sensitivity and specificity of PCR and immunofluorescent antigen detection tests are much higher than the below-mentioned antigen tests with normal speeds.

Usual antigen detection methods can typically give results in < 15 mins in influenza, differentiate influenza A and B, and are cheaper and more easily accessible. The sensitivity of these methods have been shown as 54% for influenza A and 53% for influenza B, and specificity as 100% for both influenza types in a metaanalysis. It has been demonstrated that sensitivity in children has been higher (61% versus 43% for influenza A and 33% versus 66% for influenza B) compared to adults. If the test is positive in seasons when influenza prevalence is

Table 2. Bedside diagnostic tests that can be used in pediatric infectious diseases practice

Clinical picture	Bedside diagnostic tests to be used*	
	Non-specific	Specific
Acute pharyngitis/tonsillitis/tonsillopharyngitis	-	GAS rapid antigen test
Influenza	-	Influenza rapid antigen test**
URTI/LRTI/Acute bronchiolitis	-	RSV rapid antigen test
Acute gastroenteritis	Stool smear and microscopy	Rotavirus, adenovirus rapid antigen test
Urinary infection	Hemogram/formul leukocyte, CRP, PCT, standart urinalysis	
Pneumonia	Hemogram/formula leukocyte CRP, PCT	
Fever without localized sign	Hemogram/formul leukocyte, peripheral smear, CRP, PCT	

* These tests are not routinely performed but run if the attending physician sees appropriate with regard to patient history and physical examination findings in order to lead the treatment rationally.
** It should be kept in mind that there may be differences in sensitivity and specificity between influenza rapid antigen tests according to their working principles.

low, false positivity should be considered. False positivity can be seen in individuals taking care of pigs and poultry. Negative result of usual and rapid antigen detection methods does not rule out influenza disease and if the disease is suspected, ensuring diagnosis with a molecular method with high sensitivity like RT-PCR would be appropriate.

Table 2 shows cases when bedside diagnostic tests are frequently used in children in pediatric infectious disease practice. However, it should be kept in mind that these tests are more valuable in patients with no prior treatment history and that the patient may have been affected by the treatment he/she has received before.

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