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Bulletin No. 25 September 14, 2007

Interpretation of Rapid Diagnostic Tests for Influenza

Background

Viral isolation in cell culture remains the gold standard for influenza diagnosis and is available through the Alaska State Virology Laboratory. Many health care providers use rapid influenza tests to assist with prompt diagnosis and clinical management. Compared with viral culture, the sensitivity of rapid tests varies from 40–100% (median, 70–75%), and the specificity varies from 52–100% (median, 90–95%). Sensitivity and specificity of the rapid tests are affected by collection technique (e.g., a nasal wash may contain more antigen than a swab), specimen handling, sample quality (e.g., mucous can affect the absorption of the sample), and laboratory technique.

Impact of Disease Prevalence on Rapid Test Accuracy

The negative predictive value of a test is the percentage of truly uninfected patients among patients with negative test results. The positive predictive value is the percentage of truly infected patients among patients with positive test results. The positive predictive value measures the reliability of a positive test result. Positive predictive values depend upon the prevalence of disease in tested persons at the time of specimen collection. Assuming a sensitivity of 100%, Table 1 shows the effect of prevalence on the positive predictive value.

Table 1. Effect of Prevalence on Positive Predictive Value

If influenza prevalence in the tested population is...	And the specificity is...	The predictive value of a positive test is...	The false-positive error rate is...
Very Low (2.5%)	Poor (80%)	Very Poor (12%)	Very High (88%)
Very Low (2.5%)	Good (98%)	Poor (56%)	High (44%)
Moderate (20%)	Poor (80%)	Poor (56%)	High (44%)
Moderate (20%)	Good (98%)	Good (93%)	Low (7%)

In Alaska, some hospitals using rapid tests reported a large number of positive influenza results in the fall of 2006; however, culture-confirmed seasonal influenza did not occur until third week of January. Figure 1 compares positive influenza tests (culture and polymerase chain reaction) from the Alaska State Virology Laboratory with reported results of rapid tests from two hospitals. Hospital A reported numerous positive rapid influenza tests months before influenza was confirmed by the State Public Health Laboratory in January 2007.

Discussion

When influenza activity is low, a positive rapid influenza test has a higher likelihood of being a false-positive. Therefore, in the absence of proven influenza virus circulation, a positive rapid test result provides little information for determining the cause of an individual's symptoms. Conversely, during peak circulation periods, false negative results can occur because a) the sensitivity of rapid assays depends on the quantity of virus obtained during sample collection, and b) the negative predictive value decreases as disease prevalence among tested persons increases. Therefore, during periods of known influenza circulation, a negative rapid influenza result should be interpreted with caution.

If performed on individuals with signs and symptoms consistent with influenza during the influenza season, rapid diagnostic tests can assist in distinguishing respiratory illness due to influenza from illnesses due to other pathogens. Rapid tests can also aid in the prompt diagnosis and management of patients who present with signs and symptoms compatible with influenza during periods of known influenza circulation. Finally, during a respiratory disease outbreak, rapid tests can help to determine if influenza caused the outbreak, as respiratory illness due to influenza and other respiratory pathogens often have a similar clinical presentation.

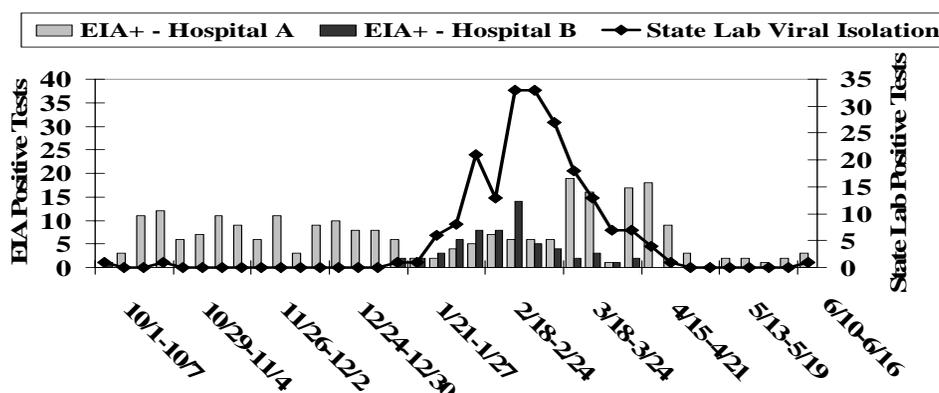
Recommendations

1. Confirm positive rapid test results by culture or PCR during the early season (before confirmation of influenza circulation in the state) and the late season (when influenza has declined to baseline levels).
2. Interpret rapid tests for influenza based upon knowledge of community influenza circulation and infection prevalence in the patient population.
3. Be aware that patients with severe influenza-like illness, especially patients with chronic medical conditions, might have significant bacterial infections instead of, or in addition to influenza.
4. Monitor influenza activity in Alaska by viewing the Alaska Section of Epidemiology Influenza Information website: <http://www.epi.hss.state.ak.us/id/influenza/fluintfo.htm>
5. For more information, refer to CDC's recommended strategies for influenza diagnostic testing at: <http://www.cdc.gov/flu/professionals/diagnosis/rapidclin.htm>

Reference

1. Public Health Advisory, Food and Drug Administration Public Health Advisory Subject: Safe and Appropriate Use of Influenza Drugs, 12 January 2000, <http://www.fda.gov/cder/drug/advisory/influenza.htm>

Figure 1. Positive State Lab Tests and EIA Positive Tests from Two Hospitals by Week during the 2006–07 Influenza Season



(Contributed by Dr. Rosalyn Singleton, ANTHC, CDC and Terry Schmidt, ASVL, DPH.)