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QuickVue Influenza Test for Rapid Detection of Influenza A and B Viruses in a Pediatric Population

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The performance of a lateral-flow immunoassay, the QuickVue Influenza Test, for detection of influenza A and B viruses in comparison with that of cell culture was evaluated by using nasopharyngeal aspirates, in viral transport medium, from children with respiratory tract infections. The sensitivity and specificity were 79.2 and 82.6%, respectively.

Influenza virus infections in children have been associated with increased outpatient visits, admissions, and antibiotic prescriptions (4, 7). Rapid diagnostic methods would therefore be useful to prevent unnecessary antibiotics and admissions and facilitate early antiviral administration. The usual method for diagnosis of influenza virus is cell culture, a method that has good sensitivity (9) but is not very timely.

A new rapid diagnostic kit (QuickVue Influenza Test; Quidel, San Diego, Calif.) using monoclonal antibodies specific for influenza A and B virus antigens is now available for direct detection from nasal swab, wash, and/or aspirate specimens. In our pediatric population, nasopharyngeal aspirates (NPA) are routinely collected for the diagnosis of viral respiratory tract infections and submitted in viral transport medium (VTM) for direct immunofluorescence assay (DFA) and cell culture.

We evaluated the performance of the QuickVue Influenza Test with NPA submitted in VTM and that of the DFA and compared them with that of cell culture.

Methods. NPA submitted in VTM were collected from children with respiratory tract infections seen at the Montreal Children's Hospital, Montreal, Quebec, Canada, in February and March 2001(7 weeks).

Specimens received in the virology laboratory were first tested for the presence of respiratory syncytial virus (RSV; Chemicon, Chemicon International, Temecula, Calif.) and parainfluenza virus (ViraStat; ZymeTx, Oklahoma City, Okla.) by DFA. Slides were prepared for influenza A and B virus testing by DFA (Chemicon) for later reading. Specimens containing <25 cells/well by DFA were considered not interpretable but included as negative in the sensitivity and specificity calculations.

Specimens were inoculated onto human embryonic lung, A549, rhesus monkey kidney, and Madin-Darby canine kidney cells. All cell lines were visually inspected every second day for a viral cytopathic effect for 16 days. Hemadsorption with washed guinea pig erythrocytes was performed on days 3, 7, 12, and 16 of incubation. Viruses isolated from cultures were confirmed by immunofluorescence on cells scraped from the monolayer.

The QuickVue Influenza Test was performed on all specimens as described in the package insert. Briefly, 0.3 ml of NPA in VTM was transferred into a tube, where a test stripe was left in place for 10 min. Any shade of a pink to red test line and the appearance of a blue control line indicated a positive result for either influenza virus.

All assays were run independently and read in a blinded fashion. The VTM was tested on two separate occasions by the QuickVue text and did not show any line.

Results. Three hundred sixteen NPA were received. Sixteen specimens were excluded because of insufficient quantity, leaving 300 specimens for analysis. Fifty-three influenza virus strains were isolated in cell culture. Of those, 48 (90.5%) were influenza B virus strains. One specimen had both RSV and parainfluenza virus.

Thirty-five specimens were only tested for RSV and parainfluenza virus by DFA and were positive for one of the viruses. Table 1 shows the performance of the QuickVue test and DFA compared to that of viral cell culture. There were 85 positive results detected by QuickVue, for a sensitivity of 79.2% (42 of 53) and a specificity of 82.6% (204 of 247), with a positive predictive value (PPV) of 49.4% (42 of 85) and a negative predictive value (NPV) of 94.9% (204 of 215). When reading QuickVue, 41 of 85 positive results were difficult to interpret (very fade pink line) and 36 of those were false-positive results. In accordance with the manufacturer's recommendations, we labeled them as positive. When these dubious results were considered negative, the sensitivity decreased to 69.8% (37 of 53) but the specificity improved to 97.1% (240 of 247), which was comparable to the specificity stated in the package insert for nasal washes: 99% (95% confidence interval [CI], 93 to 99%). The PPV and NPV were 84.1% (37 of 44) and 93.8% (240 of 256), respectively.

One hundred thirty-one specimens were assayed by QuickVue after being thawed once. Table 2 shows the performance of the test comparing specimens that were thawed and those that were assayed fresh.

Of the 265 specimens on which DFA was performed, 43 were positive. The sensitivity and specificity of DFA were

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TABLE 1. Performance of rapid tests for the detection of influenza virus infection in NPA compared with that of viral culture

Test	No. of specimens	% Sensitivity (95% CI)	(%) Specificity (95% CI)	PPV (%)	NPV (%)
Quick Vue	300	79.2 (68.2–90.2)	82.6 (77.9–87.3)	49.4	94.9
Quick Vue (visible line)	300	69.8 (57.4–82.2)	97.1 (95.0–99.2)	84.1	93.8
DFA	265	73.6 (61.7–85.5)	98.1 (96.3–99.9)	90.7	93.7

73.6% (39 of 53) and 98.1% (208 of 212), respectively, with a PPV of 90.7% (39 of 43) and an NPV of 93.7% (208 of 222). Only 11 specimens (3.6%) had noninterpretable results by DFA. Excluding these results did not change the performance of the test.

Immunoassays for rapid detection of influenza virus have been studied in the past. Directigen Flu-A (Becton Dickinson, Cockeysville, Md.), an enzyme immunoassay membrane test, has reported sensitivities ranging from 64.2 to 84.7% and reported specificities ranging from 90 to 100%, respectively (2, 5, 6, 10). ZstatFlu (ZymeTx), a neuraminidase detection assay for both influenza viruses, has a reported sensitivity of 70.1% and a reported specificity of 92.4% for nasal wash specimens from children with respiratory infections (8).

The sensitivity and specificity of QuickVue are similar to those of Directigen and ZstatFlu. The strains that were isolated this year were mainly influenza B viruses. When the sensitivity of QuickVue was calculated for influenza A virus (only five strains), it rose to 80%, compared to 68.8% for influenza B virus. Noyola et al. found a greater sensitivity for ZstatFlu when testing for influenza A virus (76.4%) than when testing for influenza B virus (40.9%) (8).

DFA of NPA had a sensitivity similar to that of QuickVue, with good specificity. Specimens of poor quality (<25 cells/well) that were not interpretable by DFA were also negative by QuickVue, even if the culture was positive. In the literature, the reported sensitivities of DFA range from 59.3 to 84% and the reported specificities range from 87.7 to 100%, which are compatible with our results (1, 3, 8, 10).

The cost of QuickVue was comparable to that of cell culture in our laboratory. However, the former allowed detection of influenza virus only and distinction between types A and B was impossible. QuickVue was rapid and extremely easy to perform, but specimens containing VTM are likely not optimal specimens for the assay. QuickVue would still make a useful test for emergency rooms, where decisions about influenza treatment need to be timely. DFA of the specimen, however, had the lowest cost and allowed us to detect the presence of other respiratory viruses with good sensitivity and high specificity.

TABLE 2. Performance of Quick Vue with thawed and fresh specimens

Specimen type	% Sensitivity	% Specificity	% PPV	% NPV
Thawed[a]	90	86	53	98
Fresh[b]	73	80	47	92

[a] One hundred thirty-one specimens were tested.
[b] One hundred sixty-eight specimens were tested.

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