JOURNAL OF CLINICAL MICROBIOLOGY, Nov. 2002, p. 4337–4339 Vol. 40, No. 11
0095-1137/02/$04.00+0 DOI: 10.1128/JCM.40.11.4337–4339.2002

Nasal Swab versus Nasopharyngeal Aspirate for Isolation of Respiratory Viruses

Terho Heikkinen,[1]* Jane Marttila,[2] Aimo A. Salmi,[2] and Olli Ruuskanen[1]

Department of Pediatrics, Turku University Hospital,[1] and Department of Virology, University of Turku,[2] Turku, Finland

Received 11 February 2002/Returned for modification 23 May 2002/Accepted 31 August 2002

To determine the usefulness of nasal swabs as a simple method for detection of respiratory viruses, we compared nasal swabs and nasopharyngeal aspirates obtained at the same time from the opposite nostrils of 230 children with upper respiratory infection. The sensitivity of nasal swabs was comparable to that of nasopharyngeal aspirates for the detection of all major respiratory viruses except respiratory syncytial virus.

During recent years, the new antiviral agents zanamivir and oseltamivir have been introduced for the treatment of influenza (8, 16), and new compounds against other respiratory viruses, e.g., rhinoviruses and enteroviruses, are forthcoming (7, 14). The full clinical potential of these drugs may be greater than just their effect on the duration of the symptomatic viral infection; for instance, early treatment of influenza with oseltamivir has been shown elsewhere to reduce substantially the development of acute otitis media as a complication in children (17). The optimal use of these new therapeutic options is, however, problematic because all these drugs are virus specific, and respiratory infections caused by different viruses cannot be reliably distinguished from each other on clinical grounds alone (1, 10). Consequently, there is a great need for easy and sensitive methods to verify the specific viral etiology of the infection.

Nasopharyngeal aspirates or nasal wash specimens are generally considered the specimens of choice for the detection of respiratory viruses (3, 5, 12, 13, 15). Obtaining an aspirate is, however, unpleasant, and it requires a suction device, features which make it unfeasible for widespread use in clinical practice. The collection of a nasal swab is easy and painless, and it can be done everywhere without any additional devices. We have previously shown that the sensitivity of a nasal swab is sufficient for diagnosing influenza by a viral antigen detection method (9). In the present study, we sought to determine the usefulness of nasal swabs for detection of a wide range of respiratory viruses by virus culture.

(This work was presented in part as an abstract at the Third International Symposium on Respiratory Viral Infections, St. Lucia, West Indies, 1 to 3 December 2000.)

This study was carried out at the Department of Pediatrics, Turku University Hospital, Turku, Finland, between October 1999 and June 2000. The study protocol was approved by the Committee on Ethics of the Hospital District, and written informed consent was obtained from the parents of the participating children. All children hospitalized with signs and symptoms of an upper respiratory tract infection were eligible for enrollment in the study. After informed consent was obtained, a nasal swab and a nasopharyngeal aspirate specimen were obtained at the same time from the opposite nostrils of the child. The nasal swab was obtained from the right nostril from a depth of 2 to 3 cm by using a sterile cotton swab that was then inserted into a vial containing 2.5 ml of viral transport medium (5% tryptose phosphate broth, 0.5% bovine serum albumin, and antibiotics in phosphate-buffered saline). For the nasopharyngeal aspirate, a disposable catheter connected to a mucus extractor was inserted into the left nostril to a depth of 5 to 7 cm and drawn back while applying gentle suction with an electric suction device. Immediately after suctioning of the secretions, a sterile cotton swab was dipped into the aspirate and placed into a vial containing viral transport medium as described above. Both specimens were obtained without instillation of any solution into the nostrils. The specimens were transported to the laboratory within the same day at room temperature and subjected to virus culture by routine methods. The sensitivities of the two sampling methods were compared by the McNemar test.

A total of 230 children were enrolled in the study. The median age of the children was 10 months (range, 12 days to 15 years), and 150 (65%) of them were boys. The specific viral cause of the respiratory tract infection was determined in 122 (53%) of the 230 children, in whom a total of 124 viruses were detected by either method. The detailed viral findings for the nasopharyngeal aspirate and nasal swab specimens are presented in Table 1. Of the 124 viral isolates, 91 (73%) were detected by both methods, 24 (19%) were detected by nasopharyngeal aspirate only, and 9 (7%) were detected by nasal swab only.

The comparative sensitivities of the nasopharyngeal aspirate and nasal swab specimens for detection of different viruses are shown in Table 2. In children with respiratory syncytial virus (RSV) infection, the rate of detection of this virus in nasopharyngeal aspirates (97%) was significantly higher than that in nasal swabs (76%; $P = 0.001$). No significant differences were observed between the two sampling methods with respect to any other viruses.

* Corresponding author. Mailing address: Department of Pediatrics, Turku University Hospital, Kiinamyllynkatu 4-8, FIN-20520 Turku, Finland. Phone: 358-2-3130000. Fax: 358-2-3131460. E-mail: terho.heikkinen@utu.fi.

TABLE 1. Viral findings for the nasopharyngeal aspirate and nasal swab specimens

Virus	No. of samples in which virus was detected by:			Total no.
	Both methods	Aspirate only	Swab only	
RSV	53	17	2	72
Rhinovirus	9	3	3	15
Influenza virus A or B	11	1	0	12
Parainfluenza virus type 1, 2, or 3	7	1	1	9
Adenovirus	6	1	1	8
Enterovirus	4	1	2	7
Herpes simplex virus	1	0	0	1
Total	91	24	9	124

The results of this study indicate that a simple nasal swab may provide a clinical specimen with adequate sensitivity for detection of various respiratory viruses by virus culture. With the exception of RSV, testing of nasal swabs detected all other viruses at rates comparable to those of nasopharyngeal aspirates. It has to be acknowledged that for most viruses the numbers of positive cultures by either method remained small, but the consistency of the sensitivities of the two methods throughout a range of different viruses could be considered to increase the reliability of the findings.

With respect to RSV, the lower sensitivity of the nasal swabs than of the aspirates could be anticipated (5, 11–13). RSV is known as a relatively labile virus, and the amount of live virus in a small-volume nasal swab specimen may be critically less than that in a sample obtained by aspiration. Further, previous studies have indicated that the overall viral load in the nasopharynx during RSV infection may be substantially lower than that in secretions from the lower airways (4).

Although nasopharyngeal aspirates and nasal washes are generally considered the specimens of choice for detection of respiratory viruses, it is noteworthy that in several cases in the present study the etiologic virus was detected only in the nasal swab specimens. The implication of this finding especially for clinical research on respiratory viruses is that more than one sampling method may be necessary for optimal yield of viruses in nasopharyngeal secretions. For the etiologic diagnosis of respiratory viral infections in general, it should be borne in mind that few data are really available on the optimal sampling methods. The best sites to collect material for viral detection may differ between various viruses. Further, as recommended for enteroviruses, sampling from multiple sites may yield the best results (2). For influenza viruses, the present practice in several European countries includes the collection of both nasal and throat samples that are put in the same vial for transportation to the laboratory (6), but the value of such double sampling has not been clearly established. It should also be emphasized that nasopharyngeal washes were not performed in the present study, and the sensitivity of nasal swabs in comparison with that of nasopharyngeal wash specimens might be different.

TABLE 2. Detection of viruses in nasopharyngeal aspirate and nasal swab specimens compared with total viral findings by either method

Virus	Total *n*	Aspirate positive		Swab positive	
		n	%	*n*	%
RSV	72	70	97	55	76
Rhinovirus	15	12	80	12	80
Influenza virus A or B	12	12	100	11	92
Parainfluenza virus type 1, 2, or 3	9	8	89	8	89
Adenovirus	8	7	88	7	88
Enterovirus	7	5	71	6	86
Herpes simplex virus	1	1	100	1	100
Total	124	115	93	100	81

In everyday clinical practice, the optimal sampling methods must be balanced with the feasibility, costs, and time required to collect the specimens. The results of this study indicate that nasal swabs might prove suitable for obtaining respiratory viral specimens. The collection of a nasal swab is easy and convenient, and it requires no additional devices. Theoretically, together with rapid point-of-care tests, nasal swabs might be utilized to optimize the use of virus-specific drugs for full benefit to the patients, but the sensitivity of nasal swabs with the use of rapid detection tests remains to be demonstrated.

This work was supported by grants from the Academy of Finland and the Jenny and Antti Wihuri Foundation, Finland.

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