SELF-COLLECTION IN CYMOL FOR DIAGNOSIS AND SURVEILLANCE OF UPPER RESPIRATORY INFECTIONS IN UNIVERSITY STUDENTS

K. Luinstra[1], S.Carruthers[1], S. Chong[1], A. Petrich[1], J. Mahony[1], and M. Smieja[1]
[1]St. Joseph's Healthcare, Hamilton, ON, Canada

Abstract

Background: CyMol (Copan) is an alternative sample collection system that may be beneficial during a pandemic because of its ability to render a virus non-infectious and stabilize the nucleic acid for molecular testing.

Objective: To evaluate self-collected nasal flocked swabs in CyMol for use in routine diagnosis and surveillance.

Methods: University students (age ≥17) that presented within 48 hours of onset to a Campus Health Center with symptoms of URI (nasal congestion, pharyngitis, fever, cough, headache, and fatigue) were invited to provide a self-collected and a staff-collected nasal flocked mid-turbinate swab from opposite nostrils. Parallel nasal swabs were collected over a 17 week period from January to April 2009 and placed in computer randomized order, into either CyMol or UTM-RT prior to transport to the laboratory. The nasal swab samples were extracted by easyMAG (bioMérieux) and the purified nucleic acid tested in the Luminex x-Tag™ RVP assay. The study was approved by the ethics board, and all subjects provided written, informed consent.

Results: A respiratory virus was detected by RVP in 41 of the 73 students (56.2%) presenting with symptoms of URI. RVP identified 9 influenza A (six H1, three H3), 8 influenza B, 5 entero/rhinovirus, 15 coronaviruses (eight 229E, three NL63 and four OC43), 2 metapneumovirus (MPV), 1 adenovirus and 1 respiratory syncytial virus (RSV). Of the 41 RVP-positive students, 29 had concordant positive results for the same virus in both the CyMol and UTM collection systems, 5 were positive only in CyMol, 7 only in UTM, and 32 were negative with both collection systems. Swabs taken in UTM were positive in 36/41 (87.8%), while those taken in CyMol were positive in 34/41 (82.9%, P=0.56, McNemar test for the paired comparison). For the comparison of the two transport media, raw agreement was 61/73 (83.6%) and *kappa* (agreement beyond chance) was 0.67 (95% CI: 0.50, 0.84). To evaluate self-collected versus staff-collected, two nasal mid-turbinate swabs were taken per student. Of the 41 RVP-positive students, 33 (80.5%) were positive in self-collected swabs and 37 (90.2%) were positive in staff-collected swabs, (P=0.25 for the difference, McNemar test). For the comparison of self- and staff-collected swabs, raw agreement was 61/73 (83.6%) and *kappa* was 0.67 (95% CI: 0.50, 0.84).

Conclusions: In this blinded, randomized comparison of CyMol and UTM, the two collection systems were equivalent for PCR testing. Our study also provided further validation for self-collected nasal swabs as an alternative to staff-collected nasal swabs. Self-collected nasal swabs combined with a highly-sensitive multiplex PCR yielded a respiratory virus diagnosis in over 50% of students. Self-collection in CyMol is an effective approach for diagnosis and surveillance of URI.

Objective

To evaluate self-collected nasal flocked swabs in CyMol for use in routine diagnosis and surveillance of upper respiratory infections.

Methods

Study Population:
- Adults (age ≥17) enrolled as students at McMaster University

Inclusion Criteria:
- Signed Consent form
- Suspected respiratory viral illness for <48 hours with two or more symptoms including : nasal congestion, fever, cough, headache, extreme fatigue, muscle aches, sore throat, stomach symptoms (nausea, vomiting, diarrhea)

Exclusion Criteria
- Known nasal septal perforation, active nosebleed, known or suspected strep throat

Samples
- Participating students were instructed to self-collect a nasal swab (Copan FLOQSwabs™, Copan, Spa Brescia Italy)
- A designated staff member or physician also collected a second nasal swab
- Parallel nasal swabs were collected from opposite nostrils over a 17 week period from January to April 2009
- Swabs were placed in computer randomized order, into either CyMol or UTM-RT prior to transport to the laboratory

Methods

Laboratory Testing
- Nasal swab samples (200 uL) were extracted by easyMAG (bioMérieux) and eluted in 60 uL
- 5 ul of purified nucleic acid was tested in the Luminex x-Tag™ RVP assay

Data Analysis
- Parallel specimens for self and staff-collection were analyzed for the detection of viruses using the McNemar test for paired specimens

Results

Samples: 146 NPS samples were collected from 73 students presenting with URI

RVP Testing:
- 41/73 (56.2%) were positive by RVP for at least one respiratory virus
- 32/73 (43.8%) were negative by RVP with both collection systems
- 29 had concordant positive results for the same virus in both the CyMol and UTM collection systems (Table 1)
- 12 were positive in only one swab (Table 2)

Table 1: Concordant Positives

#	Study Number	RVP	#	Study Number	RVP
1	5049-1C	H1	16	5013-1C	NL63
	5049-2U	H1		5013-2U	NL63
2	5060-1U	Flu A H1	17	5046-1C	NL63
	5060-2C	Flu A H1		5046-2U	NL63
3	5066-1U	H1	18	5017-1U	OC43
	5066-2C	Flu A equiv, H1		5017-2C	OC43
4	5069-1U	Flu A H1	19	5018-1C	OC43
	5069-2C	Flu A H1		5018-2U	OC43
5	5055-1C	Flu A H3	20	5033-1C	OC43
	5055-2U	Flu A H3		5033-2U	OC43
6	5072-1U	Flu A H3	21	5023-1U	229E
	5072-2C	Flu A H3		5023-2C	229E
7	5081-1C	Flu A H3	22	5032-1C	229E
	5081-2U	Flu A H3		5032-2U	229E
8	5020-1U	Flu B	23	5035-1U	229E
	5020-2C	Flu B		5035-2C	229E
9	5042-1C	Flu B	24	5062-1C	229E
	5042-2U	Flu B		5062-2U	229E
10	5058-1C	Flu B	25	5073-1U	229E
	5058-2U	Flu B		5073-2C	229E
11	5082-1U	Flu B	26	5076-1U	229E
	5082-2C	Flu B		5076-2C	229E
12	5045-1C	Entero-Rhino	27	5014-1C	MPV
	5045-2U	Entero-Rhino		5014-2U	MPV
13	5056-1C	Entero-Rhino	28	5034-1U	MPV
	5056-2U	Entero-Rhino		5034-2C	MPV
14	5070-1U	Entero-Rhino	29	5016-1C	RSV
	5070-2C	Entero-Rhino		5016-2U	RSV
15	5083-1U	Entero-Rhino			
	5083-2C	Entero-Rhino			

Table 2: Discordant Positives

#	Study Number	CyMol RVP Result	UTM RVP Result
1	5038-1C	Flu A H1	
	5038-2U		Neg
2	5059-1U		Neg
	5059-2C	Flu A H1	
3	5025-1C	Neg	
	5025-2U		Flu B
4	5039-1C	Neg	
	5039-2U		Flu B
5	5050-1C	Neg	
	5050-2U		Flu B
6	5053-1U		Flu B
	5053-2C	Neg	
7	5057-1C	NL63	
	5057-2U		Neg
8	5019-1U		Neg
	5019-2C	OC43	
9	5040-1U		Neg
	5040-2C	229E	
10	5080-1C	Neg	
	5080-2U		229E
11	5084-1C	Neg	
	5084-2U		Entero-Rhino
12	5021-1U		Adeno
	5021-2C	Neg	

- 5 were only positive in CyMol (C)
- 7 were only positive in UTM (U)

Overall RVP identified 9 influenza A (six H1, three H3), 8 influenza B, 5 entero/rhinovirus, 15 coronaviruses (eight 229E, three NL63 and four OC43), 2 MPV, 1 adenovirus and 1 RSV

Results

Table 3:
Comparison of RVP Positivity Rates in CyMol versus UTM Collection Systems and Self- versus Staff-collected Specimens

	Total	CyMol	UTM	Self-Collected	Staff-Collected
RVP Positive	41/73 (56.2%)	34/41 (82.9%)	36/41 (87.8%)	33/41 (80.5%)	37/41 (90.20%)
RVP Negative	32/73 (43.8%)	38	36	39	35

For comparison of CyMol and UTM media:
- P=0.56 for the difference (McNemar test)
- Raw agreement was 61/73 (83.6%)
- *kappa* was 0.67 (95% CI: 0.50, 0.84)

For the comparison of self-collected versus staff-collected:
- P=0.25 for the difference (McNemar test)
- Raw agreement was 61/73 (83.6%)
- *kappa* was 0.67 (95% CI: 0.50, 0.84)

Conclusions

- In this blinded, randomized comparison of CyMol and UTM, the two collection systems were equivalent for PCR testing
- Our study also provided further validation for self-collected nasal swabs as an alternative to staff-collected nasal swabs
- Self-collected nasal swabs combined with a highly-sensitive multiplex PCR yielded a respiratory virus diagnosis in over 50% of students
- Self-collection in CyMol or UTM is an effective approach for diagnosis and surveillance of URI