M25 Lowered Sample Rejection Rate for Rapid Direct Detection of Respiratory Viruses in Children by Use of a Flocked Swab and Nasopharyngeal Sampling

S.E. Richardson, R. Cheung, K. Greenock, J. Nishikawa, Y.C.W. Yau, R. Tellier

Hospital for Sick Children, University of Toronto, Toronto, Canada

Abstract

Background: Prior to the 2002-3 respiratory season, the rejection rate for DFA on polyester nasopharyngeal swabs (NPS) for respiratory virus detection in children in our institution was 11-15% per year. Based on a study showing equivalence of NPS and nasal swabs (NS) for the detection of respiratory viruses in children in an outpatient setting, and following staff education, NS became the recommended specimen type. Soon after institution of NS sampling, DFA rejection rate rose to 22-27% per year, with rates as high as 38% on some wards. High rates of rejection of NS were unaffected by repeated in-service education efforts to improve the yield by addressing technical aspects of obtaining these specimens.
Objective: To study the effect of swab type (polyester vs. flocked) and specimen type (NS vs. NPS) on yield of respiratory viruses by direct fluorescent antibody (DFA) testing and viral isolation.
Methods: A pilot study (n=121) of flocked swabs (Copan) vs. polyester swabs (Puritan) for detection of respiratory viruses from NS of children with suspected viral infection was performed 11/05–01/06 on 3 wards with the highest rate of rejection of specimens for DFA due to insufficient cellular sampling. This was followed by a repeat study (n=146) on the same wards (09/06–02/07), using the same two swab types, but sampling the nasopharynx. Quantitation of cells by swab type (insuff (No cells few cells), 1+, 2+, 3+, 4+), DFA rejection rates, DFA positivity rates and yield of viral isolation was compared between the two groups. Each child was tested with both swab types, one per nare, in each study. All specimens were tested by DFA/culture for influenza A/B, parainfluenza 1,2,3, adenovirus, RSV and human metapneumovirus.
Results: The 2005/6 pilot study of flocked vs. polyester NS showed rejection rates of 32.8% (42/128) and 22.3% (27/121), respectively. The 06/07 study of flocked vs. polyester NPS revealed a dramatically reduced rejection rate of 11.0% (16/146) for flocked swabs vs. 28.1% (41/146) for polyester. For those specimens with adequate cells for analysis, 60% had 3-4+ cells using flocked swabs vs. 43% for polyester swabs. 32 NPS were DFA positive by both flocked and polyester swabs, 3 by flocked only and 2 by polyester only. 5/112 (4.5%) were culture pos/DFA neg, all RSV with ≥2+ cells. 8/144 (5.6%) were culture neg/DFA pos, 5 RSV, one each of influenza A, parainfluenza 1, 3.
Conclusions: In our cohort of children presenting/admitted to hospital, two factors appear to be necessary for optimal sampling of the upper airway for respiratory virus detection: nasopharyngeal sampling rather than nasal, and the use of flocked swabs rather than polyester swabs. Staff education and re-education is also critical but was not as important as swab type or sampling site.

Background

- Non-bacterial pneumonia is the most common cause of pulmonary infections in childhood
- <50% of cases are of unproven etiology using conventional diagnostic techniques. ?Role of suboptimal specimen collection and transport
- Specimen type is important
  - Nasopharyngeal aspirate (NPA)/wash is gold standard
  - Nasopharyngeal swab (NPS) ≤ aspirate
  - Nasal swab (NS) ≤ NPS, greater comfort
- Introduction of NS at SickKids resulted in a rise in the rejection rate of samples from 11% to 27%

Methods

Pilot study Nov 2005- Feb 2006 (Wards 7B, 7C, 7D)
- NASAL flocked (plastic shaft) vs. polyester (wire shaft) both nares (1-1.5 cm) rotated 3-4 times firmly against the mucosa

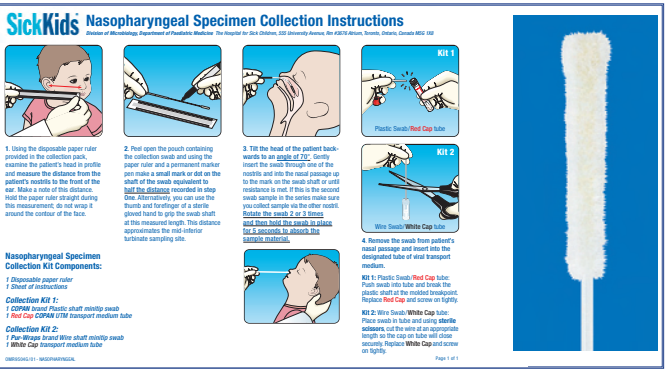
n=346 children with suspected viral RT
- 164 polyester NS
- 182 flocked NS

Study November 2006- April 2007 (Wards 7B, 7C, 7D)
- NASOPHARYNGEAL flocked (plastic shaft) vs. polyester swabs (wire)
  - Measure ½ distance earlobe to tip of nose
  - Mark shaft, insert to this distance
  - Rotate swab 2 or 3 times, hold in place 5 seconds
- n=164 children with suspected viral RTI
  - Flocked swab in one side
  - Polyester swab in the other side
- Transport medium
  - UTM for flocked swab
  - In-house transport medium for polyester swab

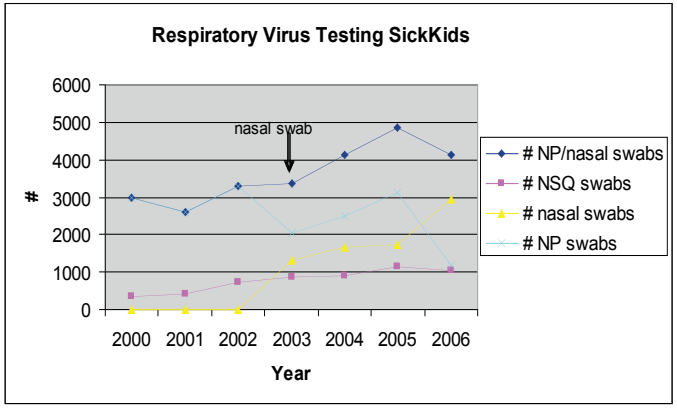
LABORATORY

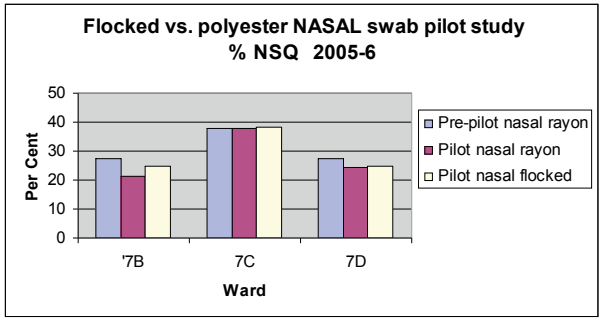
DFA and culture (R-Mix Too shell vial assay) for influenza A and B, parainfluenza 1,2,3, respiratory syncytial virus, human metapneumovirus and adenovirus

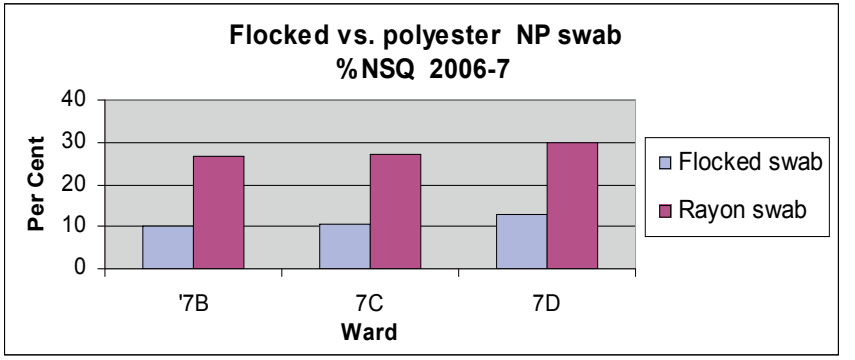
DFA interpretation at 10-20X magnification
NC (no cells): <20 per field ("Inadequate cells")
FC (few cells): 20-50 per field ("Inadequate cells")
1+: 50-100 per field
2+: 100-200 per field
3+: >200 cells/well, ¾ of well filled with cells
4+: well full of cells



Results

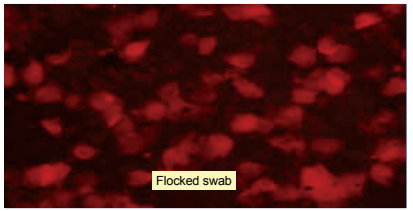




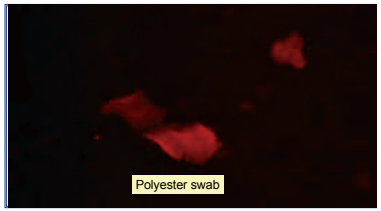


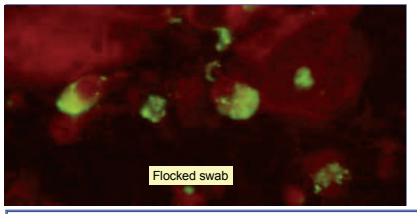
	Flocked NP swabs	Polyester NP swabs	p
NSQ	18/163 (**11%**)	45/163 (**27.6%**)	0.0004
3-4+ cells	99/150 (**66%**)	51/117 (**43.6%**)	<0.05

		Flocked NPS	
		DFA+	DFA-
Polyester NPS	DFA+	32	2
	DFA-	3	164

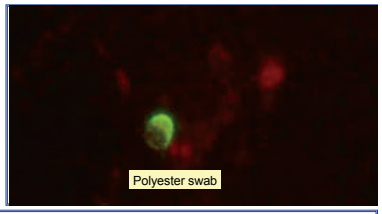


Patient A
Negative DFA





Patient B
RSV positive
DFA



Conclusions

1) Nasal swabs in children, in our institution, have unacceptable rates of rejection due to insufficient cells for DFA, regardless of the type of swab used.
2) Technique makes a difference, underscoring the need for thorough and repeated in-service education and feedback regarding rates of quality of specimen received by patient area.
3) Nasopharyngeal (NPS) polyester (dacron) swab performance is no better than nasal swabs (either flocked or polyester) in children in our hospital.
4) Nasopharyngeal (NPS) flocked swabs capture a significantly higher number of respiratory epithelial cells (p<0.05), and therefore a reduced rejection rate for insufficient cellular sampling (11% vs. 27.6%, p=0.0004), compared to NPS polyester swabs.

Flocked swabs and UTM were generously contributed by Copan Diagnostics Inc.