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Disappointing performance of rapid antigen detection tests for group A streptococcus in the Auckland school-based sore throat programme

In 2011 a pilot study at a South Auckland primary school demonstrated the feasibility of school-based sore throat clinics for the purpose of identifying and treating children with group A streptococcus (GAS) pharyngitis and at risk of acute rheumatic fever.[1] Since then, clinics have been introduced into over 200 schools in New Zealand (NZ). In 2013, a total of approximately 170,000 throat swab cultures were performed at Labtests, the Auckland community laboratory.

While throat swab culture is the gold standard, it is relatively costly and turn-around-time can be up to 72 hours. Thus, rapid antigen detection tests (RADTs) are an attractive alternative. Test performance varies in the published literature with sensitivities between 70 and 90%, and specificities greater than 95%.[2] Widespread use of RADTs has been hampered by concern regarding lack of sensitivity compared with culture which is thought to be due to low numbers of organisms picked up on the swab.[3]

Using a flocked (rather than conventional rayon) swab to sample the throat may improve sensitivity as flocked swabs have been developed to enhance the release of organisms into transport media, making greater numbers of organisms available for culture and other testing (e.g. RADT and molecular testing).[4]

We sought to investigate the applicability of a RADT using flocked swabs in the school-based sore throat programme. The RADT kit used (ulti med, Deutschland, Germany) was chosen because it demonstrated equal or superior performance when four kits available in NZ were compared for sensitivity *in vitro*.[5] The study was approved by the Southern Ethics Committee. Kits were provided free of charge by the NZ distributor (Ngaio Diagnostics) and a NZ Heart Foundation Project Grant funded the study.

Study participants were those children at the South Auckland primary school who assented and whose parents/guardians consented to the study, and who, on questioning, self-identified to the public health nurse as having a sore throat. All participants had a dual throat swab collected: either a dual conventional-conventional (C-C) swab or a dual conventional-flocked (C-F) swab. Study participants were randomly swabbed with either a C-C or a C-F swab combination.

Following same-day transportation to Labtests, the conventional swab from each patient was cultured for GAS by standard laboratory methods. The second conventional swab (in C-C arm) or the flocked swab (C-F arm) was tested by RADT by a trained laboratory technician, according to the manufacturer's instructions. RADTs were performed and read in real time (before culture results were available).

The kit's positive and negative controls were tested before each run and there were no quality control failures. In addition, 30 culture swabs were incubated for an additional

48 hours in an enrichment broth to enhance the sensitivity of culture (to exclude the possibility that positive rapid tests and negative cultures were due to lack of culture sensitivity); however, this did not alter the culture results (i.e. no further positive cultures were identified after enrichment).

An interim analysis was performed after 298 consecutive throat swabs were tested. Of the 61 (20.5%) swabs were that were culture positive for GAS, 22 (36%) were RADT positive, and of the 237 swabs that were culture negative for GAS, 200 (84%) were RADT negative. RADT performance for both conventional and flocked swabs is outline in Table 1.

Table 1. RADT performance compared with culture of flocked and conventional swabs for GAS pharyngitis

Conventional swab						
RADT result	Culture positive (n=23)	Culture negative (n=122)	RADT sensitivity (%)	RADT specificity (%)	RADT PPV (%)	RADT NPV (%)
Positive	6	14	26	89	30	86
Negative	17	108				
Flocked swab						
RADT	Culture positive (n=38)	Culture negative (n=115)	RADT sensitivity (%)	RADT specificity (%)	RADT PPV (%)	RADT NPV (%)
Positive	16	23	42	80	41	81
Negative	22	92				

The heavier the culture growth the more likely that the RADT was positive, p=0.002 by Cochran-Armitage trend test.

On the basis of the poor performance of the RADT the study was terminated. We do not have a satisfactory explanation for our findings. The poor PPV (<50%) may have been impacted by the population studied (children well enough to be at school and self-identifying with a sore throat).

In contrast, the published experience focuses on throat swabs collected from patients presenting to the Emergency Department or their primary care doctor with sore throat, often accompanied by fever and cervical adenopathy.[2]

The sensitivity in our study was also worse than expected. While the culture detected GAS in 20.5% of children, in some this may have represented colonisation rather than infection, with coinciding low bacterial burden impeding detection by a non-culture method.[3] Differentiation between infection and colonisation was not possible here as serology was not collected for streptococcal antibody titres.

The sensitivity of RADT on flocked swabs was higher than on conventional swabs (42%) compared (26%); however, this is still too low for utility and the accompanying NPV of 86% for flocked swabs is not high enough such that RADTs could be used to reliably rule out GAS.

We conclude that the test performance of this RADT is insufficiently robust for inclusion in the NZ school-based sore throat clinics.

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