

Group A streptococcal antigen detection in schoolchildren

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اكتشاف مستضدات زمرة العقديات A في التلاميذ الأسوياء
هيربيرت نسانزي وكين داوسون وعبد المجيد أمين وندى مصطفى

خلاصة : استهدفت هذه الدراسة تعيين مدى الترابط بين مستضدات زمرة العقديات A المكتشفة في مسحات من الحلق وبين نتائج المزرعة . فأخذت مسحاتان معاً من كل من 1457 طفلاً ، وأجريت مزرعة لكل منهم ، وتم البحث عن المستضدات . وتبين وجود ارتباط وثيق بين اكتشاف المستضد وبين معدلات استفراد العقديات . فصورة إجمالية ، تم استفراد 225 ذرية من زمرة العقديات A ، منهم 53 (57.6%) ذرية من 92 طفلاً كانوا إيجابيين بدرجة عالية للمستضدات ، و 68 (55.7%) ذرية من 122 طفلاً كانوا إيجابيين بدرجة متوسطة ، و 77 (25.4%) ذرية من 303 طفلاً لديهم إيجابية منخفضة للمستضدات . ولم يستفرد إلا 27 (2.9%) ذرية فقط من 940 طفلاً لم تكتشف لديهم أية مستضدات . ونحن نعتقد أن الأطفال الإيجابيين للمستضد والسليبين للمزرعة ، يحملون الجرثام في حلقهم ، ولكنها لا تظهر في المزرعة ربما بسبب قلة أعدادها .

ABSTRACT The objective of the study was to determine the correlation between group A streptococcal antigen detected from throat swabs with the culture results. A total of 1457 children had two swabs taken simultaneously, and culture and antigen detection were performed. There was a good correlation between antigen detection and isolation rates. In all, 225 strains of group A streptococcus were isolated; 53 (57.6%) were from the 92 children with high antigen positivity, 68 (55.7%) were from the 122 children with medium antigen positivity and 77 (25.4%) were from 303 children with low antigen positivity; only 27 (2.9%) were from the 940 children with no antigen detected. We postulate that those who are antigen-positive, culture-negative carry the organisms in their throats, but they may be missed on culture because of the small number carried.

La détection de l'antigène streptococcique de groupe A chez des écoliers

RESUME L'objectif de cette étude était de déterminer la corrélation entre l'antigène streptococcique de groupe A détecté par des prélèvements dans la gorge effectués avec un tampon d'ouate et les résultats de la culture. Deux prélèvements ont été effectués simultanément sur 1457 enfants au total et utilisés pour réaliser une culture et un test de détection de l'antigène. Il y avait une bonne corrélation entre la détection de l'antigène et les taux d'isollements. En tout, 225 souches de streptocoques du groupe A ont été isolées, 53 (57,6%) chez les 92 enfants dont le test de détection de l'antigène révèle une forte positivité, 68 (55,7%) chez les 122 enfants dont le même test révèle une positivité moyenne et 77 (25,4%) chez les 303 enfants dont le test révèle une faible positivité; 27 (2,9%) seulement ont été isolées chez les 940 enfants pour lesquels aucun antigène n'a été détecté. Nous avons posé comme principe que ceux dont le test de détection de l'antigène est positif et les résultats de la culture négatifs sont porteurs des micro-organismes dans leur gorge mais peuvent passer inaperçus à la culture en raison du petit nombre de streptocoques présents.

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Introduction

Group A streptococcal infections are very common in childhood. The recent resurgence of the streptococcus, the significant outbreaks of acute rheumatic fever and the appearance of a streptococcal toxic shock-like syndrome have once again re-focused attention on this important organism [1]. The mechanism of inter-familial spread and the reasons for persistence or otherwise of specific serotypes within the respiratory tract are poorly understood, as are an individual's propensity for group A streptococcal infections [1]. Kaplan has shown that in a suburban elementary school in the United States of America, within a 6-month period, 80% of school students became colonized or infected with the organism [2]. We have also shown that 75% of a school cohort had evidence of streptococcal contact within a one-year period (Nsanze H et al. unpublished data, 1997). Recently, rapid antigen detection of group A streptococcus (GAS) by enzyme immunoassay techniques has become available with the advantage of more sharply defined end-points and increased sensitivity [3].

The purpose of the present study was to determine the value and correlation of the levels of antigen to GAS detected in relation to the culture findings in a population of young healthy schoolchildren. If a close correlation exists, it may be helpful in gaining more information about the spread of the organism and the rates of contact with GAS among schoolchildren in the United Arab Emirates (UAE).

Subjects and methods

A total of 1457 healthy schoolchildren (5–7 years old) had two swabs taken simulta-

neously from their posterior pharynx. The children were drawn from nine different schools in the Al-Ain district of the UAE and the specimens were taken during the cooler months from November to February. The schools were selected at random and the children drawn from the school rolls. All children in the age group who were selected were deemed healthy on the day of the visit by the independent assessment of the school health medical and nursing staff.

One swab was used for culture and the other for antigen detection of group A streptococcus. Culture swabs were directly inoculated on to sheep blood agar and crystal violet (1 mg/ml), blood agar or sulfamethoxazole (23.75 mg/ml)–trimethoprim (1.25 mg/ml) blood agar, but subsequently only on to sheep blood agar. Plates were incubated anaerobically at 37 °C for 24 hours. Suspicious β -haemolytic colonies were purity plated and then identified on bacitracin sensitivity and Lancefield grouped by a strep grouping kit (BBL®). This is a similar technique to that previously described by us [4]. The Test Pack Strep A (Abbott®) immunoassay procedure for direct detection of streptococcus group A antigen was performed. The antigen was eluted from the throat swab by the enzyme extraction fluids provided. The fluid was then placed on the sample window of the reaction card. The fluid moved within 3 to 5 minutes passing through the test window to the control window. The test was ready for reading when the control window showed a reaction colour. The test was read as negative if a red horizontal line appeared, high positive (HP) when a strong and definite plus sign appeared, medium positive (MP) when a strong T sign appeared and low positive when a faint T sign was seen.

Results

Overall, 544 (37.3%) of the children had evidence of streptococcal contact by either culture or antigen detection. The relationship between the level of antigen detection and culture results is shown in Table 1. There was a good correlation between the level of antigen detected and isolation rates. In all, 225 GAS strains were isolated, 53 (57.6%) were from 92 children with high antigen positivity, 68 (55.7%) were from 122 children with medium antigen positivity, 77 (25.4%) were from 303 children with low antigen positivity, while there were only 27 (2.9%) from the 940 children with no antigen detected. Overall 517 (35.5%) swabs gave a positive antigen result of some degree. The HP and MP antigen swabs gave a culture positive rate of GAS in nearly 60% of cases. This was significantly higher than LP antigen swabs ($P < 0.0001$) and negative antigen swabs

($P < 0.0001$) and also the LP culture results were significantly higher than the negative antigen swabs ($P < 0.0001$).

Discussion

Studies from temperate climates suggest that up to 20% of asymptomatic children are carriers of GAS [5]. The carrier state is defined as the subject having a positive culture without illness or immunological response to streptococcal antigens [6]. In our subtropical location, we found that 15.4% of the children grew GAS from their throat swabs. However, a positive antigen test, from high to low positivity was obtained in 35.5%. When we consider culture of GAS from the throat as the accepted indicator of the presence of streptococci, then the negative predictive value of the antigen test was 97.1%, the sensitivity of the test 86.4% and the specificity 72.5%.

Table 1 Correlation between antigen levels and culture results

Antigen result	Culture result	Number of children per school										Total	% positive
HP	Positive	5	9	8	7	1	8	7	2	6	53	57.6	
HP	Negative	6	6	0	1	8	5	3	3	7	39		
MP	Positive	8	14	8	11	1	8	10	2	6	68	55.7	
MP	Negative	9	10	0	3	8	5	9	3	7	54		
LP	Positive	4	16	6	12	6	6	22	1	4	77	25.4	
LP	Negative	47	23	11	34	11	12	50	18	20	226		
Negative	Positive	2	16	0	5	1	0	1	1	1	27	2.9	
Negative	Negative	147	161	75	93	82	76	124	86	69	913		
Total		228	255	108	166	118	120	226	116	120	1457		

HP = high positive, MP = medium positive, LP = low positive for antigen detection

Sensitivity = 86.4% (171/198)

Specificity = 72.5% (913/1259)

Correlation = 80.4% (1171/1457)

Positive predictive value = 33.1% (171/517)

Negative predictive value = 97.1% (913/940)

However, there was a very poor positive predictive value of 33.1%.

Rapid antigen detection tests have now become established in clinical practice and they enable a rapid identification of GAS in the acute clinical situation rather than having to wait 24–48 hours for culture results [7]. The immunoassay method which has been used here is said to have advantages in that the end-points are clearly defined and there is increased sensitivity [8]. However, the same authors quote the sensitivity of the assay, i.e. the ability to detect true positives and exclude the negative culture state, as being very variable and not able to exclude totally the presence of GAS. In our study, the negative predictive value was 97.1% and the sensitivity was 86.4%.

Antigen tests are used as a means of rapid detection in the acute situation of GAS pharyngitis when the organism should be abundant and the antigen plentiful. We have used the antigen detection in a situation in which there was no acute infection but either transient or long-term colonization. In such an epidemiological study it is not practical to obtain paired titres for the assessment of anti-streptococcal O antigen response. We would postulate that there is probably a rise and fall in the population of GAS within individuals' throats. In this situation, the true

marker of the presence of streptococci (the "gold standard") becomes the antigen detection rather than the culture of organisms. Therefore, the very poor positive predictive value of 33.1% could reflect the low colonization levels of the individuals. We have demonstrated in a previous study that certain antigen-positive, culture-negative individuals when subsequently retested became antigen-positive culture-positive (Nsanze H et al. unpublished data 1997). We have also observed that repeated culture of antigen-positive, culture-negative swabs revealed a higher rate of GAS than the antigen-negative group. When there is a small number of organisms we believe that the organisms are more likely to be missed on culture because of the small numbers carried, which may be easily inhibited by normal bacterial flora. Additionally, when there is a small number of organisms they may be missed due to sampling errors or due to the fact that paired swabs have been used.

In states of non-acute infection, antigen detection in normal children has an excellent negative predictive value. We suggest that antigen detection has an important potential role in epidemiological studies and the identification of the carrier state.

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During 1995, 15 000 babies were born every hour. More than 90% of them will survive their first five years to see the dawn of the new century. Half of them will live to celebrate their 75th birthday in 2070. Many will become centenarians who will live throughout the entire 21st century and into the early 22nd.

Source. The World Health Report, 1998. *World Health Organization, Geneva, 1998.*
Chapter 8, page 201