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Rapid Throat-culture as Diagnostic Aid: Ineffective in Decreasing Antibiotic Prescriptions

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An overnight slide-culture for the detection of group A streptococci was introduced in a Finnish health centre. The number of patients from whom a throat culture was obtained increased from 55 % to 70 % with the new method. Despite this increase, the prescribing habits of primary care physicians did not change. Treatment was in most cases (84–90 % of those treated) still initiated before culture results were available, and antibacterial medication was discontinued only occasionally (1–3 %). Physicians usually decided the treatment during the first consultation. These findings contradict earlier studies where prescriptions decreased during rapid culture. Use of throat cultures as diagnostic aid should be reconsidered, especially when more rapid methods now are available.

Key words: primary health care, decision making, streptococcal infections, drug prescriptions, culture media.

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Five to ten per cent of primary care patients in the industrial countries have a sore throat as their major complaint (1, 2), and 50–60 % of Finnish primary care patients consulting for communicable diseases receive a prescription for antibiotics. If the diagnosis is tonsillitis, this figure rises to over 90 % (3).

Sore-throat patients harboring group A beta-hemolytic streptococci (GABHS) should be identified and treated. Others need antibacterials only rarely (4). Both under- and overtreatment of sore throats prevail (5, 6). Bacteriological diagnosis of GABHS has depended on skill or equipment not readily available in primary care, and GABHS identification without bacteriological methods remains inadequate (7, 8, 9). When the samples are sent outside the practice for culturing, the results are usually available only after several days, which is too late to effect treatment decisions.

A slide-culture method for the identification of GABHS was introduced in Scandinavia in 1982 (10). The results are available in 18–24 hours. This method was introduced in a Finnish health centre (11) and in several health stations in Norway (12). The sensitivity and specificity of the method compared well with traditional blood agar culture. During the Finnish study, prescription of antibiotics depending only on clinical assessment decreased by half in the cultured patients, after the physicians were encouraged to wait for the rapid culture results. In the Norwegian health stations, the accuracy of diagnosis improved with the rapid culture method. These studies described only successfully cultured patients. However, many sore throat patients probably are treated on clinical basis even if a rapid culture method is available. Other bacterial infections were not identified, nor were patterns of prescribing before and after the introduction of the slide-culture evaluated.

This study was undertaken when the rapid culture became available in the health centre of Helsinki. The aim was to compare the physicians' decisions to obtain throat cultures and to give medication during two different methods of throat culture, observing all sore-throat patients. It was expected that the rapid method would increase the amount of cultures taken and decrease antibiotic prescriptions. Prescribing would depend more on culture results and less on clinical evaluation.

Table I. *Symptom and sign distribution of patients with sore-throat in general practice (n=1117)*

Symptom or sign	Percentage of patients with symptom	
	First period *n*=605 (%)	Second period *n*=512 (%)
Fever	62	75
Throat symptoms		
Large tonsils	14	8
Exudate	25	19
Erythema	46	41
Lymphadenitis	30	29
Viral symptoms		
Cough	37	42
Coryza	36	36

MATERIAL AND METHODS

Finland provides a communal primary care system free of charge. Each health station has an office laboratory with qualified technicians working office hours. During evening and weekend shifts, personnel on duty performs basic laboratory services, and the physician on duty evaluates culture results.

The slide-cultures used were Streptocult by Orion Diagnostica, Helsinki. This selective-medium blood agar slide is cultured aerobically for streptococci (10). A sterile cotton-tipped applicator was used for obtaining and spreading the specimen. Group A streptococci were identified with 0.4 unit Bacitracin Low disks by Rosco. The laboratory technicians were taught to take and culture the samples and to interpret the results. All participating physicians and the personnel working outside office hours could practise on taking and interpreting the cultures. Any samples judged difficult to interpret could be sent further to a local bacteriological laboratory.

Four health stations with 26 full-time practitioners participated in the study. Data were collected during two observation periods of four weeks each, the first in October–November and the second in March–April. During the first period (base group) throat swabs were sent to a local bacteriological laboratory. Culture results were usually available two to five days after the consultation, but occasional delays could be as much as 10–12 days. During the second period, this practice continued in one station (control group). In the other three stations (slide-culture group), slide-cultures were introduced and used six to ten weeks before the second period started. No effort was made to influence the physicians' diagnostic or treatment decisions.

All patients with sore throat among presenting symptoms were included in the study. The physicians recorded symptoms, investigations, diagnoses and antibacterial medication on a questionnaire during the consultation. The author later compared the data with the patient record, filling in throat culture results and later decisions to begin or discontinue an antibiotic.

The groups were compared using the chi-square test and trends within fever and viral symptom groups evaluated with Kolmogorov-Smirnov test (13). *p*-Values smaller than 0.05 were considered significant. A change was attributed to the culture method when no change occurred between base and control groups and the slide-culture group differed significantly from both.

RESULTS

The material included 1 117 sore-throat patients, of which 62% were female. A fourth of the patients were under 15 years of age, and one per cent were over 65. Compared to the population of the area, women and children are overrepresented in the study, and those over 65 years of age are few. The distribution remained similar within each station and observation period. The symptom prevalences were slightly different in each period (Table I). Patients with other bacterial diagnosis than tonsilli-

Table II. *Effect of culture method, patient variables, symptoms and signs of sore-throat patients in general practice on frequencies of throat cultures and antibiotic medication (n=817)*

		Base period			Slide-culture period	
Patient groups	*n* 512	Cultured (%) 55	Medicated (%) 39	*n* 305	Cultured (%) 68	Medicated (%) 36
Age groups						
0–6 yrs	67	69	45	49	76	37
7–14 yrs	54	61	57	39	77	39
15–24 yrs	138	49	43	84	66	50
25 and over	253	53	35	131	68	28
Tonsillitis diagnosed						
None	311	57	9	209	70	12
Unspecific	109	62	84	55	66	81
Streptococcal	92	41	98	41	73	98
Exudate						
Present	139	47	86	71	72	73
Absent	373	58	24	234	69	25
$p<$		0.05	0.0001		NS	0.0001
Large Tonsils						
Present	73	56	75	28	68	89
Absent	439	55	35	276	71	31
$p<$		NS	0.0001		NS	0.05
Erythema						
Present	232	60	48	134	73	46
Absent	280	51	35	171	67	29
$p<$		0.05	0.01		NS	0.01
Lymphadenitis						
Present	155	55	67	97	71	59
Absent	357	55	29	208	63	26
$p<$		NS	0.001		NS	0.001
Temperature						
<37	191	58	28	70	70	31
37–38	196	53	38	117	65	32
>38	93	54	70	104	74	44
$p<$		NS	0.001		NS	NS
Cough and coryza						
None	281	57	53	164	73	50
Either	109	66	36	63	71	21
Both	122	40	16	78	63	19
$p<$		0.025	0.001		NS	0.001

tis (15% in the first period and 13% in the second period) were exluded. From the base group, 512 patients, from control group 143 and from slide-culture group 305 remained for the final analysis (Tables II to IV). Patient numbers in the tables may be smaller due to missing individual data.

The willingness to obtain a throat culture was greater during the rapid culture: 70% of the patients were cultured with the slide-culture and 55% during conventional methods ($p<0.001$). The decisions to culture and to medicate were assessed in relation to several patient variables (Table II).

During the base and control periods, patients were cultured less during weekends (40%) than from Monday to Thursday (60%) ($p<0.005$). This effect vanished in the slide-culture period, where over 65% of patients were cultured regardless of the day of week.

Table III. *Percentages of patients with sore-throat symptoms in general practice investigated and medicated by culture results and method of culture (n=817)*

	Group		
	Base	Slide-culture	
	(*n*=512)	(*n*=305)	
All patients			
Cultured	55 %	70 %	$p<0.001$
Culture-positive	13 %	11 %	NS
Antibiotic prescription	39 %	36 %	NS
No laboratory investigations	39 %	26 %	$p<0.001$
Patients receiving antibiotics	(*n*=209)	(*n*=110)	
Culture-positive	30 %	25 %	NS
Prescription only after culture results	11 %	16 %	NS
Antibiotic discontinued	1 %	3 %	NS

Table III shows the frequency of investigations and antibiotic prescriptions. There were more culture-positive patients in the base group, but the difference is not significant. The number of other laboratory investigations than throat cultures did not change. Prescribing patterns remained similar over the periods. A quarter of sore-throat patients were diagnosed and treated without any laboratory investigations even when the rapid culture was in use. The treatment decision included antibiotics equally often in those who were cultured and those who were not (Table IV).

Diagnostic and symptom strata were divided to subgroups according to the relative frequencies of medication given and throat cultures taken. This analysis was performed only in base period patients, since the numbers of patients cultured varied very little in the slide-culture period. The results are summarized in fig. 1. Exudate, erythema, large tonsils, lymphadenitis, and fever above 38 all increased medication above mean; and erythema or absence of exudate and fever increased culturing.

DISCUSSION

The age and sex distribution of the patients was similar in both periods and typical of primary care consultations for infectious diseases. The frequency of positive throat cultures and incidence of other bacterial disease were comparable between periods. The number of GABHS positive cultures remained under 20% of all cultures, indicating a non-epidemic situation.

When patients with other bacterial diseases are excluded, the treatment decision theoretically becomes dichotomous: group A streptococci present or absent—treatment needed or unnecessary. An etiologically based line of action would then include: culturing of all sore-throat patients, medication for all GABHS-positive patients and no antibiotics for others. The results, however, illustrate a different kind of clinical thinking.

Decision to culture. When the rapid culture was introduced, 63–77% of sore-throat patients in different patient groups were cultured. The willingness to use the traditional culture differed more widely (40–69%) depending on the age, symptoms and signs of the patient, initial diagnosis, and day of

Table IV. *Antibiotic treatment of patients in general practice with sore-throat symptoms and signs by culture results and method of culture (n=817)*

	Group	
Patient strata	Base	Slide-culture
Not cultured	*n*=230	*n*=91
Antibiotics	97 (42 %)	30 (33 %)
All cultured	*n*=282	*n*=212
Antibiotics	112 (40 %)	80 (37 %)
Culture-negative	*n*=216	*n*=180
Antibiotics	50 (23 %)	53 (29 %)
Culture-positive	*n*=66	*n*=32
Antibiotics	62 (93 %)	27 (84 %)

Differences between cultured and not cultured strata and between groups are insignificant.

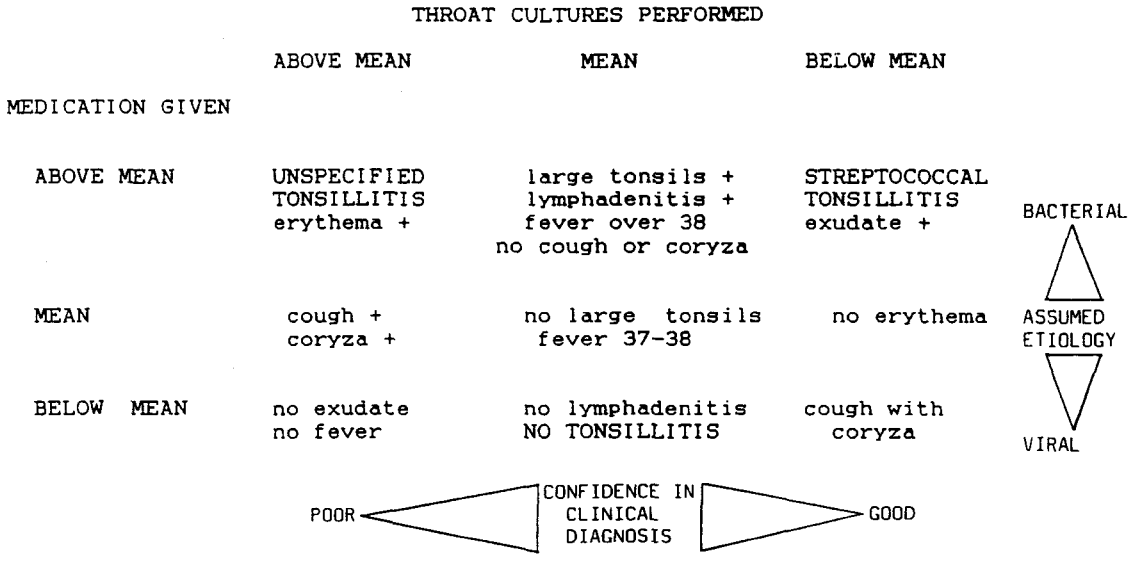

Fig. 1. Effect of presence or absence of symptoms and signs on medication and throat culture decisions.

consultation. The change resulted from increase in groups where initially few cultures were taken, such as the older age groups, patients with exudate or fever, or those with both cough and coryza (Table II). Two pathways of clinical reasoning could explain this outcome. Fear of overlooking an infection, for example in children, may have caused physicians to order a throat culture even when the results were not available very fast. The faster method did not increase the cultures significantly in these groups, since the original levels were already high. The culture was not an attempt to refrain from antibiotics: children received medication more often than adults.

The assumed accuracy of diagnosis without bacteriological methods offers another explanation. If the physicians were reasonably sure of etiology, they decided the treatment without culturing. Certain symptoms and signs were considered typical of either bacterial or viral etiology. If the patient had exudate, he was less likely to be cultured but received medication more likely than those without exudate. Fig. 1 illustrates this thinking, which is logical but insufficient, as repeatedly shown in literature (7, 9).

Decision to medicate. If incidence of GABHS in those not cultured parallels that in the cultured group, over half of all antibiotic prescriptions were written for viral disease during both periods. The rapid culture did not improve this over-prescribing. Treatment was initiated in most cases before the culture results were available, and only a few courses were discontinued when the culture was negative (Table III). All clinical information in general practice is not recorded (14), and new medication probably merited a note in the record more often than discontinuation of an antibiotic. This bias affected both study periods equally.

Howie has demonstrated (15) that the decision on diagnosis does not necessarily precede management decisions. When the therapeutic decision is made, the physician may after that look specifically for signs supporting the chosen line of action. It is possible that some symptoms were recorded only after the prescription decision, and this may distort the results.

Second contact. Several non-bacteriological causes can affect treatment decisions in upper respiratory tract illness (16). Anxiety about increasing workload explains the physicians' reluctance to arrange for a second contact after the culture results are available. This contact is inevitable, if the results are to be put in clinical use.

The strategy for least second contacts is to treat patients with pronounced symptoms immediately, and to disregard possible negative culture results. Positive cases with mild symptoms can be contacted for treatment. This is also the strategy for least

risk, if unnecessary antibiotics are experienced as a smaller risk than an untreated GABHS infection.

Future of throat cultures. Although prescribing did not become more rational, the increase of cultures in the initially seldom-cultured "clearly bacterial" and "clearly viral" patient groups seems promising. The pattern also improved a little during weekends, when results of traditional cultures arrive two extra days slower, and originally few patients were cultured. The speed was perhaps considered an asset here. These changes indicate willingness to use rapid bacteriology in diagnosing sore throats. In this study, only positive culture results were used as a tool for clinical decision-making. A prolonged follow-up is needed to detect possible slower change in prescribing patterns. Physicians need to trust even negative culture results conflicting with clinical symptoms. Effect of physician education should be examined more closely.

All culture methods are slow if treatment decisions are to be reached during one consultation. The new antigen-based slide tests for streptococci give the possibility of etiological diagnosis within an hour or less (17). The techniques have now been simplified to exclude special equipment (18), and these tests may in the future replace culture methods despite their higher costs. When a second contact is needless, the medication patterns may be greatly affected (19). In the light of this study, the new methods need to be evaluated according to their impact on treatment decisions considering all sore-throat patients. If negative test results are not observed, the combined cost of tests and prescriptions may rise very high.

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