Diagnosis and management of cases of suspected dermatomycosis in the Netherlands: influence of general practice based potassium hydroxide testing

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SUMMARY

Background. *Microscopy of a potassium hydroxide preparation of skin scrapings or nail clippings, although widely advocated as a test for dermatomycosis, is used in only a small proportion of cases.*

Aim. *This study set out to investigate the effect of potassium hydroxide testing on the subjectively assessed probability that a dermatomycosis was present.*

Method. *The study was undertaken in 1992 in Limburg, a province in the south of the Netherlands. Ten general practitioners and eight trainees completed a questionnaire and performed a potassium hydroxide preparation for each patient presenting with a skin condition that they thought might be caused by dermatomycosis. Skin or nail material was also sent to a microbiology laboratory where another potassium hydroxide preparation as well as a culture were performed, these two tests serving as a gold standard against which to judge the potassium hydroxide preparation by the general practitioners. Data from a total of 164 cases were analysed.*

Results. *The results of the potassium hydroxide test carried out in the practice had a considerable influence on the subjectively assessed probability that a dermatomycosis was present, especially if the outcome was positive. The indication for antifungal treatment was altered as a result of the test in a quarter of all cases, mostly from negative to positive. Use of the practice potassium hydroxide test could increase the proportion of correct therapeutic decisions from 54% to 69%, with 20% of cases being undertreated. Of cases that gave a positive test result in the practice 83% also had a positive laboratory test result, while of cases that gave a negative practice result 43% were positive in the laboratory.*

Conclusion. *The potassium hydroxide test improves the diagnostic process in cases of possible dermatomycosis and may result in a change in management. The test can provide a confirmation of the diagnosis of dermatomycosis but is not useful in the exclusion of this diagnosis.*

Keywords: dermatomycoses; infectious skin diseases; diagnosis; practice based diagnostic tests; management of disease.

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Introduction

MOST cases of dermatomycosis lead to the prescription of an antifungal drug on the basis of clinical signs alone.[1] A favourable outcome from this treatment is then taken as a confirmation of the original diagnosis. In a survey investigating the use of antifungal drugs in a region in the Netherlands, it was found that only seven of the 21 participating general practitioners had carried out any microscopy during the study period.[1] Only 9% of the antifungal drugs had been prescribed after confirmation of the diagnosis by microscopy, and only 1% had been prescribed after confirmation by culture.

It has been demonstrated, however, that dermatomycoses are among the skin disorders most commonly misdiagnosed by general practitioners.[2] Moreover, oral antifungal therapies, especially the newer preparations, place a considerable burden on the health care budget. Since there is no urgency to initiate treatment at the first consultation for this essentially benign condition, confirmation of the clinical diagnosis by a simple test could lead to more efficient and effective prescribing.[3-6] Local hospital microbiology laboratories will perform such testing but the delay involved may be unacceptable to the patient.

This study was undertaken to assess the usefulness of practice based testing, in the form of microscopy of a preparation of skin scrapings or nail clippings using a potassium hydroxide reagent. This test is widely advocated in the literature.[2-7] The impact of such testing on the probability of a diagnosis of dermatomycosis as it was subjectively assessed by the general practitioner, and on the management of cases where this diagnosis was suspected, were examined.

Method

The study was carried out in 16 practices in the south of the Netherlands between May and September 1992. Ten general practitioners and eight general practitioner trainees participated in the study. The general practitioners were in the same postgraduate education group as G S, and all were working in, or in the vicinity of, a medium-sized town. The trainees took part in the same rotation as C de K and worked in eight different practices in a larger area. The study participants differed in their self-assessed skill and experience in carrying out potassium hydroxide tests. Four rated themselves as skilled, 11 as modestly skilled and three as unskilled. Six had much experience, 11 had little, and one had no experience. The estimated number of potassium hydroxide tests made by the participants ranged from zero to 150 per year, with a mean of 23.

The doctors were supplied with a potassium hydroxide test kit and instruction booklet, together with questionnaires to be completed for each patient presenting with a skin condition that they thought might be caused by dermatomycosis. The questionnaire asked for a short description of the condition, an estimation of the probability (as a percentage) that a dermatomycosis was present, and finally whether an antifungal drug was indicated.

The study doctors collected skin scrapings or nail clippings from each patient for practice based testing with potassium hydroxide preparation. The samples were placed on a glass slide, a few drops of 30% potassium hydroxide were added and a cover-

slip was then put on top (potassium hydroxide is used as a clearing solution to digest the keratin material). Depending on the thickness of the sample, after between 10 minutes (for skin scrapings) and a few hours (for nail clippings), the digestion would have proceeded far enough for the slide to be blotted. This was done by applying gentle pressure, thus removing excess solution and air and making the preparation more translucent.[5] After this procedure the slides were ready for microscopy. The study doctors recorded the findings on the questionnaire as positive, equivocal or negative. With the new information provided by the test the doctors made a second assessment of the probability that a dermatomycosis was present and whether an antifungal drug was indicated. Finally they indicated which drug, if any, was prescribed. The questionnaire was then sent or handed to the investigators.

Part of the sample was also sent to the district microbiology laboratory where both microscopy following potassium hydroxide preparation and culture were performed. Together these two tests served as a gold standard against which to compare the general practitioners' performance. The presence of a fungal infection was considered proven if at least one of the tests was positive.

Where appropriate, the statistical significance of the relationships found was tested using Student's *t*-test for independent samples, the Student's *t*-test for paired observations and the chi square test for trend.

Results

As one patient presented with two apparently unrelated skin conditions, 164 questionnaires for 163 patients were received from the 18 doctors. The mean number of questionnaires supplied by each doctor was 9.1 (range 2–31). In 89.0% of the 164 cases a skin condition was present, in the remaining 11.0% the nails were affected.

In 68 cases (41.5%) the practice based potassium hydroxide test results were assessed as positive, 77 (47.0%) were considered negative and 19 (11.6%) equivocal.

The estimated probabilities that a dermatomycosis was present in the different groups before and after the practice potassium hydroxide test are shown in Table 1. The mean probability in the whole group was only slightly changed by the test results. However, in the group with a positive test result, a statistically significant increase in the estimated probability was observed. In the group with a negative test result there was a statistically significant decrease in estimated probability. An equivocal test result did not significantly influence the estimated probability.

The mean estimated probabilities before the test in the groups with a positive and negative potassium hydroxide test result were significantly different (72.2% versus 56.4%; *t*-test for independent samples, $P<0.001$) (Table 1). A significant difference was not found, however, when results of the laboratory tests were used: the mean estimated probability before the test was 66.4% for the 99 cases with a positive result according to the standard and 62.8% for the 61 cases with a negative result.

Table 1. Estimated probability that fungal infection is present before and after the practice potassium hydroxide test.

	Mean estimated probability (%)	
	Before test	After test
Whole group (n = 164)	*64.5*	*66.5*
Test result		
Positive (n = 68)	*72.2*	*96.6****
Equivocal (n = 19)	*69.3*	*65.7*
Negative (n = 77)	*56.4*	*40.7****

n = number of cases in group. *t*-test for paired samples: ***$P<0.001$.

Before the practice potassium hydroxide test, an indication for antifungal treatment was recorded for 109 of 163 cases (66.9%), while an indication for treatment was recorded for 119 cases (73.0%) after the practice potassium hydroxide test (Table 2). After the practice test the proposed management changed for 23.3% of all cases. The indication for treatment changed from negative to positive for five cases following a negative test result. Overall, an indication for antifungal drugs was still thought to exist for 34 of the 76 cases (44.7%) for whom a negative potassium hydroxide test result was recorded.

For the group as a whole the laboratory standard test was positive for 99 of 159 cases (62.3%). Therefore, if the whole group were treated as having a fungal infection, 60 patients (37.7%) would receive unnecessary treatment. Both the initial 'clinical' decision as to whether antifungal treatment was needed, and the outcome of the practice potassium hydroxide test, were compared with the outcome of the standard test (Table 3).

Of the cases where the doctors thought antifungal treatment was indicated before the potassium hydroxide test was performed, 62.3% were positive according to the laboratory standard. In the cases where no indication for antifungal treatment was reported, 62.3% were also positive according to laboratory standard (Table 3). The initial clinical decision regarding treatment agreed with the laboratory test result in 86 of the 159 cases (54.1%); in 40 cases (25.2%) unnecessary treatment would have been prescribed while in the remaining 33 cases (20.8%) patients would not get the necessary treatment.

For cases that gave a positive practice potassium hydroxide test result, the laboratory test was also positive in 83.3% of cases,

Table 2. Changes in proposed management according to the results of the practice potassium hydroxide test.

	% of cases with test result			
Indication for antifungal therapy	Positive (n = 68)	Equivocal (n = 19)	Negative (n = 76)	Total (n = 163)[a]
Changed				
From negative to positive	*26.5*	*5.3*	*6.6*	*14.7*
From positive to negative	*0*	*0*	*18.4*	*8.6*
Unchanged				
Remained positive	*73.5*	*84.2*	*38.2*	*58.3*
Remained negative	*0*	*10.5*	*36.8*	*18.4*

n = number of cases in group. [a]Data missing for one patient.

Table 3. Laboratory test result by indication for antifungal treatment before practice potassium hydroxide (KOH) test and by result of practice test.

	Laboratory test result	
% of patients	Positive	Negative
Indication for treatment before practice KOH test[a]		
Positive (n = 106)	*62.3*	*37.7*
Negative (n = 53)	*62.3*	*37.7*
Practice KOH test result[b]***		
Positive (n = 66)	*83.3*	*16.7*
Equivocal (n = 18)	*61.1*	*38.9*
Negative (n = 75)	*42.7*	*57.3*

n = number of patients in group. [a]Data missing for five patients: 99 had positive laboratory test, 60 negative. [b]Data missing for five patients: 98 had a positive laboratory test, 61 negative. χ^2 test for trend: two-tailed ***$P<0.001$.

for cases with an equivocal result the laboratory test was positive in 61.1% of cases and for those cases with a negative practice test result the laboratory test was positive in 42.7% of cases (Table 3). This trend was statistically highly significant. The results of the practice potassium hydroxide test agreed with the laboratory test result in 109 of the 159 cases (68.7%), assuming all the equivocal practice results are considered as positive. In 18 cases (11.3%) the practice test was positive or equivocal while the laboratory test was negative (possible cases of overtreatment) and in the remaining 32 (20.1%) the practice test was negative and the laboratory test positive (possible cases of undertreatment).

Discussion

This study shows that the participating general practitioners and general practitioner trainees were able to identify, on the basis of clinical signs alone, a group of patients with a high probability of fungal infection (62% of cases had a positive test result recorded in the laboratory). This proportion is considerably higher than those found in most other similar studies performed in different settings.[7-11] In one study the diagnosis could be confirmed in 74% of all 680 cases but these were all cases of suspected tinea pedis or tinea manus.[11] The findings of the present study underline the importance of practice based research for the assessment of characteristics of diagnostic tests which are used in general practice.[12]

Before the practice potassium hydroxide tests were carried out the mean estimated probability that a fungal infection was present was significantly higher in the cases with a positive practice test result than in those with a negative result. However, no such relationship was shown between the estimated probability and the outcome of the standard test. Although an explanation for this difference is beyond the scope of this study, it may be surmised that the outcome of the practice test is more likely to be positive in more clearcut cases of dermatomycosis.

With the aid of the practice potassium hydroxide test, both the diagnostic certainty and the number of 'correct' therapeutic decisions can be increased considerably. The remaining 'incorrect' decisions consist, for the larger part, of possible cases of undertreatment. However, these cases may partly reflect a lack of experience of this test technique among the participating doctors and after training improved results may be obtained.

Comparing the outcome of the practice potassium hydroxide test with the outcome of the laboratory test, it is clear that the practitioner is right to 'trust' a positive result (the percentage of true positives in this series being 83%). On the other hand it is important to interpret a negative practice test result with considerable caution as mycotic infection is present in 43% of these cases. In the case of a negative practice result, antifungal treatment can be started, or other tests (for example, culture) can be performed to exclude the diagnosis with more certainty.

The laboratory test was considered positive if at least one of the two tests carried out was positive. The reason for this is that, given the characteristic appearance of fungal material under the microscope, false positives are unlikely to occur, especially with an experienced investigator. On the other hand false negatives can be quite common, for instance as a result of lack of material or so called 'sampling error'. Therefore, it is doubtful whether the 11 cases found to be false positive when the practice and laboratory tests were compared were indeed falsely positive. It is possible that they were cases where the standard gave a false negative result.

In conclusion, the potassium hydroxide test used in general practice can confirm the presence of a fungal infection and will do so in many cases where such a disorder is present. This confirmation can be useful in motivating the doctor to persevere in those cases which initially fail to respond to treatment or in justifying the start of systemic treatment. The confirmation can also be useful in motivating the patient to undertake the often lengthy treatment of this disorder. On the other hand the test cannot be used to exclude the condition.

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