AN EVALUATION OF CURRENT TRENDS IN PREGNANCY TESTING

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The detection of pregnancy by means of testing a suspected patient's urine dates from 1928 when Aschheim and Zondek[1] described their well-known test in which the injection of urine from a pregnant woman results in a precocious full ovarian cycle in immature virgin female mice. Although the authors did not know so at the time, this reaction is due to the activity of a gonadotrophic hormone secreted by the developing chorion, a substance now called 'human chorionic gonadotropin' (HCG). All subsequent pregnancy tests, including those most recently developed, have also depended on the detection of this substance in the patient's urine.

In subsequent modifications, other experimental animals (e.g. rabbits,[2] *Xenopus laevis*,[3] and rats[4]) and prepared extracts of the urines were used with a view to increasing the rapidity and accuracy of the test. Each of these modifications had its own circle of advocates and adherents, and each carried (whatever its advantages) all the disabilities of a biological procedure. Here at Cape Town the Xenopus test, using a kaolin-extraction procedure to concentrate the urinary HCG,[5] was judged to be the most efficient when all factors such as reliability, early detection of pregnancy, technical ease, and expense had been taken into account.

In 1934 Selye *et al.*[6,7] reported that animals repeatedly exposed to HCG tend to lose their sensitivity, and this was soon suggested to be due to the evocation of an immunological response,[8] a hypothesis that was subsequently confirmed,[9] and that had its practical application in the recently developed immunological tests for the detection of HCG in urine. During 1960 several papers were published describing complement fixation,[10] a precipitin technique,[11] and an agglutination-inhibition technique[12] as means of demonstrating the presence or absence of urinary HCG in a woman suspected of pregnancy. The last-mentioned test was incorporated in several proprietary testing kits based on the inhibition of haemagglutination of sensitized sheep cells* or the inhibition of agglutination of sensitized latex particles.** Comparisons of the accuracy of the Xenopus test with those of several of these tests have already been published.[13-15]

These agglutination-inhibition tests represent an advance on the biological tests for the following reasons:

1. They achieve a high degree of accuracy and sensitivity, obtainable without taking all the precautions of multiple tests that a biological method entails.
2. They require a far smaller sample of urine and this does not necessarily have to be an early morning specimen.
3. They require less time to set up and also yield a result more quickly.

On the other hand there are several disadvantages:

1. False positive tests tend to occur in a small percentage of cases (2 - 4% according to a survey published this year[13]).
2. Equivocal results occur in a further percentage of cases.
3. The tests still require centrifuging and other technical procedures and are thus outside the province of the average clinician.

The latest development is a simple and rapid slide-agglutination test† based on the inhibition of agglutination of sensitized latex particles by urinary HCG. This test overcomes all the technical difficulties of previous tests and can easily be done by any clinician as a side-room procedure, the only requirements being the kit, *one drop* of the patient's urine and a little practice in reading slide-agglutination reactions. The question is whether this test provides all these advantages without sacrificing accuracy, and to determine this the following survey was carried out in the laboratories of the Department of Physiology, UCT.

METHOD

Each of 167 samples of urine submitted to the Department for routine pregnancy testing was examined by

1. The Xenopus test (as described by Zwarenstein and Duncan[5]);
2. The Prepuerin test (following the manufacturer's instructions); and
3. The Gravindex test (following the manufacturer's instructions).

*e.g. Prepuerin, Burroughs Wellcome & Co., London; UCG-test, Wampole Labs.; Pregnosticon, Organon Inc.; etc.

**Ortho Pregnancy Test, Ortho Pharmaceutical Corporation, Raritan, N.J., USA.

†Gravindex, Ortho Pharmaceutical Corporation, Raritan, N.J., USA.

The specimens were unselected, and no attempt was made to follow the patients up clinically since it was merely desired to ascertain how the results obtained with various tests would agree and whether the Gravindex test could be accepted as a reliable routine test for pregnancy. The results are summarized in Table I:

TABLE I. RESULTS OF PREGNANCY TESTING USING 3 METHODS

No. of cases	*Xenopus*	*Prepuerin*	*Gravindex*
74	+	+	+
83	−	−	−
5	+	+	−
3	−	+	+
1	−	+	−
1	+	−	+
167			

RESULTS

It will be noticed that in 157 cases (85%) there was complete agreement.

In 5 cases (3%) the Gravindex test gave a negative result when the other tests were positive. In 2 of these the patient's period was less than 7 days overdue and the Gravindex test was positive when repeated a week later. As the Xenopus test is known to be unreliable at such an early stage of pregnancy, the discrepancy must be regarded as fortuitous. In 2 more of these cases the frogs laid very few eggs, thus suggesting the possibility that these women were either at a very early stage of pregnancy or secreting a low titre of hormone for some other cause. In the fifth case the Prepuerin test, although accepted as positive, gave a somewhat atypical reaction. These observations might explain why the Gravindex test was negative, particularly as it is commonly recognized in the literature to be a less sensitive indicator of very low titres of HCG than other immunological tests.[16]

In 3 cases (1·2%) the Xenopus test gave a false negative reaction, and in all these cases the Gravindex test proved reliable.

One each of discrepant positive and negative reactions were obtained from the Prepuerin test.

DISCUSSION

These results confirm the conclusions previously published 'that the haemagglutination inhibition method is at least as accurate as the *Xenopus laevis* test'[13,14] and show that the accuracy and sensitivity of the Gravindex test is of the same order. The biological test detected 5 pregnancies that the Gravindex test missed, but the Gravindex test detected 3 positives that the frog test missed. If, however, the same precaution is followed with the Gravindex test as is followed with the Xenopus test (viz. asking for a repeat specimen on all negative cases in 2 weeks time), the accuracy of the two tests is identical. As there is a tendency to neglect some of the necessary precautions in the biological test (e.g. using only 1 frog instead of 4) the Gravindex test may well turn out to be more accurate in general laboratory practice.

With this point established, the many advantages of the Gravindex test become obvious:

1. Only one drop of urine is required instead of a minimum of 4 ounces.
2. It is not necessary to use an early morning specimen of urine since random specimens are equally acceptable.
3. A result is available within 3 minutes—as against 18 hours with the frog and Prepuerin tests.
4. The Gravindex test is considered to be more accurate than the Prepuerin (and most other haemagglutination inhibition tests) because
   (*a*) no equivocal results occur, and
   (*b*) false positive reactions are not found (an observation which is generally supported in the literature[16,17]).

On the basis of this survey the Gravindex test has now been the routine test for pregnancy diagnosis in this department since February 1964.

This test introduces a new dimension into pregnancy testing. It may well be that the testing of urine for HCG will in time become considered a routine side-room or office procedure, and except for problem cases be lifted right out of the sphere of the clinical laboratory with consequent saving of time to the physician and expense to the patient. Certainly this simple test has already proved a great boon to country practitioners.

SUMMARY

An outline of the development of pregnancy testing is given and a comparison of the results of testing 167 random samples of urine with 3 different tests (the Xenopus test, a haemagglutination-inhibition test, and a slide-agglutination test) is made. It is concluded that the slide-agglutination test is as reliable as biological testing and more efficient when all factors are taken into consideration.

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