Changing Patterns in Syphilis Serology in Public Health Laboratories

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BLOOD TESTS for syphilis continue to be the most productive tools for detection, for therapy guidance and patient management, and for epidemiologic surveys of population groups. New or modified test procedures are therefore of interest to those concerned with venereal disease control. This paper reviews trends in syphilis serology in public health laboratories during the past 10 years.

When the Public Health Service began its venereal disease control program in this country, public health laboratories used many different test procedures. Test results were not predictably reliable in many instances, since test performance was not well controlled, antigens varied from lot to lot in sensitivity and specificity, and test procedures were modified to suit the convenience of the serologists. The Venereal Disease Research Laboratory, Public Health Service, directed efforts to increase the reliability of tests for syphilis. These efforts include the issuance of the first Manual of Serologic Tests for Syphilis, in 1939, and its periodic revision approximately every 5 years to delete obsolete procedures, present modifications of established tests, and include new test procedures. The importance of performing tests in accordance with prescribed techniques, using standardized reagents and adequate controls, was emphasized and implemented by means of training courses and consultative visits. Research studies were encouraged and supported, resulting in improvement of existing methods and development of new test procedures using cardiolipin-lecithin antigens.

During the past 10 years, a number of tests employing treponemal antigens, which are of particular value in diagnostic problem cases, have been developed (*1–8*). Rapid reagin screening tests for syphilis, which may be performed with plasma or serums, were developed in order to test rapidly and economically large numbers of blood specimens (*9, 10*).

Testing procedures entered by State public health laboratories in the annual Public Health Service Serologic Evaluation Studies reflect the number and diversity of tests used in this country. Reports of these studies have been compiled and issued by the Venereal Disease Research Laboratory.

Table 1 shows a shift from test procedures using lipoidal antigens to those using cardiolipin and treponemal antigens and the elimination of so-called miscellaneous tests. In 1950, 49 participating laboratories submitted 101 lipoidal tests and 51 cardiolipin tests, while in 1961, 52 laboratories performed 115 tests with cardiolipin antigen and only 12 with lipoidal antigen. Of the nontreponemal tests submitted in 1950, 66 percent employed lipoidal antigens; only 9.5 percent used lipoidal antigens in 1961. The SERA study (*11*) conducted by the Public Health Service in 1956–57 substantiated for routine testing ". . . the continued widespread use of a cardiolipin or of a lipoidal antigen test of good sensitivity and good specificity." The VDRL slide test, entered by 52 laboratories in

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the 1961 Serologic Evaluation Study, is the most generally used test at the present time and fulfills these criteria.

Treponemal tests have been performed in State laboratories for only a few years. Tests using a Reiter protein antigen were entered in the Serologic Evaluation Study by 26 laboratories in 1959, by 36 laboratories in 1960, and by 37 laboratories in 1961. This test uses as an antigen a protein extract from the culturable avirulent Reiter treponeme prepared by the method of D'Alessandro and Dardanoni (*4*). The most widely used method is the Kolmer one-fifth volume test with Reiter protein antigen (KRP) (*6*), which can be performed by workers familiar with complement fixation techniques. The antigen is commercially available and is inexpensive.

Table 1. Tests performed by State laboratories [1] in Public Health Service Serologic Evaluation Studies

Tests	Fiscal year 1950	Fiscal year 1961
Lipoidal antigen		
Hinton	7	1
Kahn	28	10
Kline	2	0
Kolmer	30	1
Mazzini	15	0
Eagle	4	0
Miscellaneous	15	0
Total	101	12
Cardiolipin antigen		
Hinton	0	7
Kline (CNL)	10	11
Kline (CSL)	0	1
Kolmer	2	26
Kolmer one-fifth volume	0	5
Mazzini	0	7
VDRL slide	35	52
VDRL tube	4	5
Miscellaneous	0	1
Total	51	115
Treponemal antigen		
Fluorescent treponemal antibody (FTA–200)	0	7
Kolmer one-fifth volume (Reiter protein)	0	37
Total	0	44

[1] Includes District of Columbia, Puerto Rico, and Virgin Islands.

The fluorescent treponemal antibody (FTA) test, using the virulent *Treponema pallidum* as antigen (*8*), was first entered in the Serologic Evaluation Study in 1960 by four laboratories, and in 1961 by seven laboratories; it is being used experimentally in a limited number of public health laboratories. The antigen and fluorescein-labeled antihuman globulin, the reaction indicator, are commercially available at reasonable cost. The relatively simple FTA test uses the indirect fluorescent antibody technique to detect antitreponemal antibodies in human serum. A dark-field fluorescence microscope assembly, used for reading test results, is available in most State public health laboratories.

Only two State laboratories have performed the *Treponema pallidum* immobilization (TPI) test, using living virulent *T. pallidum* as an antigen, because of its complexity and the high cost per test. Since there was a demand for TPI test results on patients considered to be diagnostic problems, a TPI testing service was started in 1955 by the Venereal Disease Research Laboratory (*12*), and specimens from 49 State laboratories were received in fiscal year 1960.

A group of rapid reagin tests for syphilis, designed for screening purposes, have been developed in the past few years. In 1957, the rapid plasma reagin (RPR) test (*9*) was used as a rapid method for screening migrant populations (*13*) and in multiphasic screening surveys (*14*). The test has been modified for use with unheated serum. At present, one of the procedures is being used in five laboratories in the Mexican border district, in at least one jail, one city laboratory, and two State laboratories. The primary advantage of a rapid reagin test is that it can be performed within minutes following the drawing of the blood specimens.

A change in test procedures or adoption of a new procedure by a laboratory should be preceded by the training of workers and by a period of comparative testing. This makes it possible to evaluate the suitability of a test for examining specimens received by a particular laboratory, and gives the laboratory workers experience in the use of the technique. A review of the results of the Serologic Evaluation Studies shows that the performance of new test

Table 2. Analysis of test performance in Public Health Service Serologic Evaluation Studies

Year	Reproducibility on duplicate specimens			Agreement with control laboratory results		
	Total labs	Labs satisfactory	Percent satisfactory	Total labs	Labs satisfactory	Percent satisfactory
VDRL slide test						
1950 [1]	------	------	------	36	26	72.3
1955	46	36	78.3	46	40	87.0
1960	50	49	98.0	50	50	100.0
KRP test						
1959	26	13	50.0	26	14	53.9
1960	35	26	74.4	35	28	80.0

[1] Duplicate specimens not included in 1950 evaluation.

procedures improves from year to year, as laboratories obtain more experience with the techniques.

The improved performance that can be expected in laboratories over a period of time is shown in table 2. In the 1955 Serologic Evaluation Study, 78.3 percent of the laboratories performing the VDRL slide test had satisfactory reproducibility of test results on duplicate serum specimens, and in the 1960 study, 98 percent of the laboratories were satisfactory. A shorter time is available for comparison of test performance of the KRP test because it was first entered in 1959. At that time, 50 percent of the laboratories had satisfactory reproducibility, and in 1960, 74.4 percent were satisfactory. Comparing agreement of test results with a control laboratory, in 1950, 72.3 percent of the laboratories performing the VDRL slide test had satisfactory agreement; in 1955, 87 percent; and in 1960, 100 percent. With the KRP test in the 1959 Serologic Evaluation Study, 53.9 percent had satisfactory agreement, and in 1960, 80 percent were satisfactory.

Since 1951, staff members of the Venereal Disease Research Laboratory have made periodic visits to State and Territorial laboratories to conduct program reviews (*15*). On-the-job training is frequently accomplished during the visits. Program reviews of 26 State laboratories, located in all sections of the country, were selected for comparison on the basis of a 7- to 9-year interval between the first and last reviews, the last being in fiscal years 1959, 1960, or 1961. The laboratories were visited from two to six times during this period.

General improvements were made in the following categories: adequate laboratory facilities, controlled room temperatures for optimal testing conditions, satisfactory test controls, and standardization programs (table 3). A shift from the use of tests employing lipoidal antigens to those using cardiolipin and treponemal antigens is also shown.

Fewer laboratories are preparing antigens because of the ready availability of commercial antigens at reasonable cost.

Of 53 States with public health laboratories, 3 have no premarital or prenatal blood test laws; the other 50 have one or both. State laws requiring the performance of these blood tests in approved laboratories have been the impetus and the foundation for the majority of serology standardization programs conducted by the States. Many States have gradually shifted from the policy of approving laboratories on the basis of application data to basing approval on personnel qualifications, technical performance in a comprehensive evaluation survey, and on observations during laboratory visits of physical facilities, equipment,

Table 3. Comparison of laboratory facilities and serology programs in 26 States during a 7- to 9-year period

Category	Number of laboratories	
	Initial review	Latest review
Adequate laboratory facilities	13	21
Temperature control	3	20
Tests performed:		
Lipoidal	19	5
Cardiolipin	17	25
Treponemal	0	16
Satisfactory test controls	11	21
Antigen preparation	13	6
Intrastate standardization program:		
Performance evaluation	16	17
Training	7	17
Visitation	10	12

and reagents. The number of laboratories conducting evaluation programs is essentially the same, although some have discontinued evaluations and others have instituted this service during this period. There is a decided increase in training programs for technicians in local laboratories. During the last 10 years, staff members of the Venereal Disease Research Laboratory have assisted with planning and conducting 146 workshops in syphilis serology presented by 38 State laboratories. Visits by State laboratory personnel to local laboratories have increased slightly, but more effort in this direction is needed.

Adequate laboratory facilities have enabled State public health laboratories to perform not only routine testing but also to establish broader programs of standardization of syphilis serology throughout the States. In many laboratories, space is available for training technicians in established and new laboratory procedures, and a laboratory is allocated for the preparation, testing, and distribution of evaluation specimens on a routine and continuing basis. Controlled room temperatures have contributed to more uniform and predictably reliable test results. The improvement of test and reagent controls is reflected in better technical performance in several laboratories.

Summary

The syphilis serology standardization program of the Public Health Service, directed by the Venereal Disease Research Laboratory, has been responsible to a great extent for improvements in procedures used in blood tests for syphilis and in the performance of these tests during the past 10 years. State laboratories have shifted from the use of nontreponemal tests employing lipoidal antigens to those with cardiolipin antigens. The VDRL slide test is performed routinely on all blood specimens in most public health and local laboratories. Treponemal tests are used to an increasing extent as confirmatory procedures and on diagnostic problem cases.

Results obtained in the Public Health Service Serology Evaluation Studies over a period of years indicate that difficulties in adopting new test procedures can be resolved with training, experience, and the inclusion of proper controls.

New or expanded laboratory facilities with controlled room temperatures and the adoption of recommendations made in connection with consultative visits to laboratories have contributed to better test performance.

Intrastate standardization programs have emphasized refresher training courses for technologists and intrastate serologic evaluation studies which afford a means of estimating proficiency of test performance of local laboratories.

Blood tests for syphilis performed in State and local laboratories are generally predictably reliable, as a result of the development and adoption of improved testing methods and national and State programs for test performance standardization.

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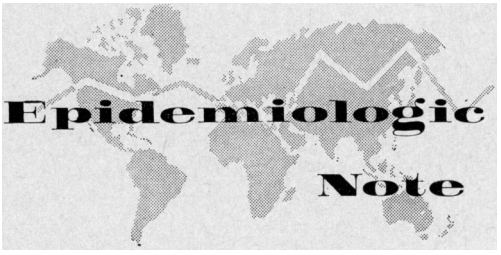

"Opposition" to Fluoridation

When 2,100 citizens in East Hartford, Conn., signed a petition to discontinue fluoridation, which had been introduced in January 1960 after 9 years of effort, a committee was formed by citizens interested in maintaining fluoridation to inquire into the motives of the signers. This committee, aided by a sociologist and demographer from the Connecticut State Department of Health, the State dental director, and the author, discovered that of 91 interviewed, 34 favored fluoridation, 17 were undecided, and only 40 held views coinciding with the petition they signed.

In the group that favored fluoridation, some signed because the petitioner insisted, they "wanted to get rid of him," or they just "wanted to help the petitioner out." Others thought the petition was in favor of fluoridation, and several husbands signed for their wives.

Those who opposed fluoridation were concerned about its physical effects, supposed taste or corrosion of pipes, or felt that it was of no personal benefit. Others thought fluoridation was a plot, and a few gave religious reasons for their opposition. Several women signed at the request of their husbands.

During the 9-year effort to achieve fluoridation 9,500 column-inches of print were devoted to the subject in the two daily newspapers, and one of them printed 132 favorable editorials. Presumably the public was informed.—LEONARD F. MENCZER, D.D.S., M.P.H., *public health dentist, Hartford Health Department, Hartford, Conn.*

Airborne Rabies

Studies in Texas, headed by Dr. Denny G. Constantine, chief of the Southwest Rabies Investigation Station of the Communicable Disease Center, demonstrated that rabies virus can be transmitted through the air in certain bat caves.

A number of animals, including coyotes, dogs, foxes, and cats, were caged and placed in a bat-infested cave. Some of the cages were inside enclosures designed to keep out even the smallest insects, yet some of the coyotes and foxes housed in these cages became ill and died of rabies.

Prior to this experiment, observations had indicated that rabies is transmitted only by the bite of a rabid animal.

Contact Lenses and Eye Hazards

In a recent industrial accident in Indiana, a 50 percent caustic solution blew into the face of an engineer who was wearing contact lenses and safety goggles. His face was immediately bathed, but by the time the contact lenses could be removed, his eyes had received burns that may cause loss of sight. The company now bans the wearing of contact lenses in hazardous areas.

Contact lenses are contraindicated wherever there are chemical eye hazards or where the air contains many foreign particles which could work under the lens and damage the cornea.