

PROGRESS IN PEDIATRICS

REVIEW OF THE LITERATURE OF THE PAST FIVE YEARS ON GONOCOCCUS VULVOVAGINITIS IN CHILDHOOD *

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This review comprises the most important articles on vulvo-vaginitis in children which have appeared during the past five years, with the exception of a few in foreign magazines to which we did not have access. Articles which consisted merely of a general description of the disease without any original observations were, as a rule, not included. A complete review of the literature from 1883 to 1912, by Generisch,¹ may be found in the Budapest *Medical-Surgical Presse* for 1911 and 1912.

CONTAGIOUSNESS

The extreme contagiousness of gonococcus infection among girls under puberty is universally admitted. As Meister² says, only a primary case is necessary in an institution; a little carelessness will do the rest, and when an epidemic has begun, only the strictest hygiene will prevent its rapid spread.

Hess³ believes that it should not be regarded especially as an institutional disease, however, as it may be found in a considerable proportion of infants who live in crowded tenements in cities. Smith⁴ notes that gonococcus vaginitis is confined largely to hospital practice, which would at once suggest that it is dependent, in part, at least, on poor social conditions. He also calls attention to the frequency with which feeble-minded children act as centers of infection. This fact is an additional argument for their isolation, as such children are usually irresponsible in sexual matters.

Several factors are involved in this peculiar susceptibility of girls to gonococcus infection. Inclán⁵ and Marshall⁶ assert that the vaginal

* Submitted for publication Jan. 30, 1917.

1. Generisch, G.: Pest. Med.-Chir. Presse, Budapest, 1911, **47**, 405; 1912, **48**, 2.

2. Meister, W. B.: Am. Jour. Obst., 1910, **61**, 540.

3. Hess, A. F.: AM. JOUR. DIS. CHILD., 1916, **12**, 466.

4. Smith, R. M.: AM. JOUR. DIS. CHILD., 1913, **6**, 355.

5. Inclán, C.: Crón med.-quir. de la Habana, 1911, **38**, 422.

6. Marshall, C. F.: Brit. Jour. Child. Dis., 1910, **7**, 385.

mucosa of small girls is especially susceptible to gonococcus infection, whereas in women the uterus and adnexa are more vulnerable than the vaginal mucosa. Maier⁷ and Taussig⁸ say that this susceptibility to invasion by the gonococcus is largely contributed to by the fact that the pavement epithelium of the vagina in early life is soft and tender and in reality more closely resembles the columnar than the pavement type.

An additional and important factor, noted by Taussig,⁸ is the condition of the labia in early life. Not only are they devoid of the protective hair, but also are somewhat everted. With the increase in the size of the labia after puberty, and above all, with the development of hair, the vestibulum is shielded. Beyond the age of puberty no cases of vulvovaginitis have come to Taussig's clinic concerning whom there was any suspicion that infection had occurred other than by sexual contact. On the other hand, the great majority of infections under puberty are accidental and nonvenereal. Several authors note the frequency with which gonococcus vaginitis follows measles and scarlet fever. Louis Fischer⁹ states that at times as many as 10 per cent. of the scarlet fever patients at the Willard Parker Hospital have this sequel or complication. Adkins¹⁰ advances the theory that the desquamative changes which follow scarlet fever prepare the ground for infection with the gonococcus.

FREQUENCY AND INCREASE

Jeans¹¹ found that 5.3 per cent. of 262 girls over 1 year of age who applied for treatment of various maladies at the Children's Hospital, St. Louis, over a period of five months, were suffering from gonococcus vaginitis in various stages of the disease. Of 149 physicians replying to the questionnaire of the American Pediatric Society's committee on vaginitis,¹² less than 2 per cent. had observed any decrease in the number of cases seen during recent years, while from 13 to 28 per cent. had noted an increase both in private and hospital practice. Koplik⁹ is authority for the statement that the disease is not as prevalent abroad as in this country, but ventures no explanation.

7. Maier, F. H.: *Therap. Gaz.*, 1910, Series 3, **26**, 540.

8. Taussig, F. J.: *Am. Jour. Med. Sc.*, 1914, **148**, 480.

9. Discussion of Barnett's Paper: *Trans. New York Acad. Med.*, Sec. on *Pediat.*, *Am. Jour. Obst.*, 1913, **68**, 600.

10. Adkins, W. N.: *Atlanta Jour. Rec. Med.*, 1913, **60**, 267.

11. Jeans, P. C.: Quoted by Taussig; see footnote 8.

12. Fife, C. A., Gittings, J. C., and Carpenter, H. C.: *Trans. Am. Pediat. Soc.*, 1915, **27**, 331.

ETIOLOGY

Smith⁴ and Barnett¹³ investigated the source of infection in forty-six and thirty cases, respectively, with the following results:

	Cases
Hospitals or other institutions.....	19
Playmates	4
Other members of the family affected, especially mother or sister	26
Assault	4
Undetermined	23

Spaulding¹⁴ also investigated the source of infection in seventy-five patients treated at the vaginitis clinic at the Children's Hospital in Boston, but apparently includes a number of cases in which the diagnosis was not clearly established by bacteriologic methods.

In the report of the committee on vaginitis of the American Pediatric Society¹² appear the following estimates of physicians as to the probable source of infection in private practice. The figures indicate the number of times each cause was mentioned:

	Cases
Indirect contact with adult members of the household, probably not immoral.....	69
The toilet seat, or toilet articles (in 12 instances, the school toilet was specified).....	53
Nurse or attendant.....	28
Direct transmission	8
Playmates	5
Clothing	5
Diapers or dressings.....	4

In the same report we find the results of the observations of social workers and visiting nurses among dispensary and hospital patients. Infection can be traced to:

	Cases
Other members of family.....	102
Hospital wards	107
Hospital dispensaries	1
Playmates	31
Sleeping arrangements	14
Toilet and bathing facilities.....	10
Public schools	8
Temporary institutions	13
Permanent institutions	1
Day Nurseries	5
Bad habits or character.....	15
Rape	8
Doubtful	93

13. Barnett, N.: Arch. Pediat., 1913, **30**, 650.

14. Spaulding, Edith: AM. JOUR. DIS. CHILD., 1913, **5**, 248.

In Taussig's⁸ report of sixty-six cases, the mother was found to be infected in only two instances. He is inclined to suspect other girls and toilet seats much more frequently than the mother. While admitting that infected towels or clothes may play an etiologic rôle, he points out that the gonococcus quickly loses its virulence when dried, which fact would usually render such articles innocuous. Forty-seven of his sixty-six patients were of school age. This probably influences his conclusions.

Generisch¹ emphasizes the German idea that gonococcus vaginitis in girls owes its origin in some cases to the superstition that a man can be cured of gonorrhea by infecting a virgin.

Mitchell and Quinn¹⁵ report an unusual instance of epididymo-orchitis in a boy of 6 months which caused a small epidemic of vaginitis in four girl patients in the same ward.

BACTERIOLOGY

Louise Pearce¹⁶ states that although it is generally admitted that, both morphologically and by culture, different strains of gonococci seem to be identical, the use of the complement fixation tests shows differences in the power of various strains of gonococci to bind complement when monovalent antigens are used. In her studies she used freshly isolated strains of gonococci with one exception—a gonococcus under cultivation for seven years. Nine were so-called adult strains and six were infant strains. The latter were recovered from patients with vulvovaginitis under 5 years. There were also three strains isolated from cases of ophthalmia. Her conclusions were as follows:

1. Two principal types of gonococci may be recognized by suitable immunologic tests; for example, agglutination and complement fixation. These two types correspond to the adult and infant types of infection with the gonococcus, seen clinically.
2. On the basis of these immunologic reactions the strains of gonococci isolated from three cases of ophthalmia are classed with the adult type.
3. A polyvalent antigen for the serologic diagnosis of a gonococcus infection should represent strains of the infant type of organism in order that both types of infection, infant as well as adult, may be recognized.

In the discussion of her paper Pearce emphasizes the fact that these types are not absolutely clear cut and distinct, but that it is highly probable that gradations between the two types exist; that the gonococcus may be a more or less labile group within itself; and that if a large enough number of strains were tested by their immunologic reactions, certain of these would be found partaking of the characteristics of both types. This experimental evidence seems to corroborate

15. Mitchell, A. G., and Quinn, N.: *Arch. Pediat.*, 1915, **32**, 846.

16. Pearce, Louise: *Jour. Exper. Med.*, 1915, **21**, 289.

the well recognized clinical difference between gonococcal infection as it occurs in infants and in adults.

Meister² insists that failure to find the gonococcus in the vaginal discharge in a suspicious case means no more than failure to find the tubercle bacillus in the sputum of patients with tuberculosis. In cases in which the organism cannot be demonstrated, he recommends the application of a strong solution of silver nitrate to the vaginal mucosa, although the gonococcus should be cultured when possible. Norris¹⁷ also uses a 5 per cent. to 10 per cent. silver solution in such cases, applied the day before the smears are to be made.

R. M. Smith⁴ believes that cultures are required to establish the positive diagnosis of gonococcal vaginitis, although the presence of the typical organism in the smear, he admits, is the usual criterion.

G. G. Smith¹⁸ believes that the examination of smears often gives inconclusive evidence. In many instances the gonococcus is undemonstrable, especially in chronic cases, and even if gram-negative diplococci are seen within the pus cells, their identity is not always certain. Even when there is no discharge and the smears are negative, the so-called negative phase or latent period, the discharge is prone to reappear. Martha Wollstein⁹ also occasionally encounters patients admitted to hospitals during this latent period.

Norris¹⁷ admits the difficulty of demonstrating the gonococcus in the chronic cases, and believes therefore that all suspicious inflammation of the vulvovaginal region during infancy and childhood should be treated as specific (gonococcal). Furthermore, he believes that the gonococcus is readily isolated during the acute stage of the disease.

Spaulding¹⁴ concludes that all cases of vaginitis with a persistent discharge which at any time has been profuse, are due primarily to the gonococcus. She found that in some cases smears were positive for many months after the discharge had stopped, especially in those which had received treatment, whereas in others a positive smear was difficult to obtain even during the acute stage.

Hess³ believes that when bacteria cannot be demonstrated, if numerous pus cells are found in smears taken from the cervix, the infective organism is the gonococcus in the overwhelming majority of cases.

In the report of the American Pediatric Society¹² the summary of the opinion of thirty-seven bacteriologists is of interest. Approximately one third believe that identification is possible by observation of the morphologic and staining characteristics of the organism and by observation of its relation to other structures in the smear prepara-

17. Norris, C. C.: Jour. Am. Med. Assn., 1915, **65**, 327.

18. Smith, G. G.: AM. JOUR. DIS. CHILD., 1913, **5**, 313.

tions; that is, by the fact that the gonococcus is an intracellular, gram-negative biscuit-shaped diplococcus. However, one half are of the opinion that the diagnosis may be safely made when such organisms predominate; when they are found in a profuse discharge from a situation susceptible of infection with the gonococcus; and when pus cells are present in proper position to the bacteria, especially when they show an increase of acidophilic granules. Three fourths of the bacteriologists believe that the percentage of error in this method of examination is very small. About one-third require typical cultural reactions in addition to these morphologic characteristics in order to fix the identity of the organism; one half of these advocates of the cultural method of differentiation demand it, regardless of the clinical history and physical signs, or of the evidence gained from coverslip preparations.

The cultural characteristics most commonly insisted on are: The organism should not grow on ordinary mediums, but readily develop on ascitic, hydrocele or blood agar at body temperature, with the formation in ascitic agar of moist, tiny, transparent, drop-like colonies of gram-negative diplococci of short longevity. These colonies should have thin, irregular, elevated edges and a crumb-like appearance on the center of growth. The culture must ferment dextrose, but no other forms of sugar. The pure culture does not affect ordinary test animals.

The technic of obtaining material for the smears is a matter of great importance. Barnett,¹⁸ for example, found that smears taken from the fornix might be positive, whereas smears taken from near the hymen were negative. Willcox⁹ prefers that smears be taken from the vault of the vagina and cervix, and Martha Wollstein⁹ asserts that only by observing care to secure material from the inside of the vagina can extraneous contamination be avoided.

Van Gieson¹⁹ states that the real value of the detection of the gonococcus is found at the very beginning and in the declining stages of the discharge. The intact leukocytic cell body is a *sine qua non* in diagnosis. Van Gieson finds that the cotton swab ordinarily used in making smears distorts the leukocyte and may injure the mucous membrane. Therefore he advocates the use of a medicine dropper and a 1:5,000 solution of mercuric chlorid in securing specimens for examination. The solution is injected into the vagina and drawn back into the dropper several times. It is then centrifuged and the sediment examined for cells and organisms. By a contrasting table he shows the efficacy of this method as compared with the usual moist or dry swab.

19. Van Gieson, I.: *Med. Rec.*, New York, 1910, **77**, 1001.

Norris¹⁷ and Adkins¹⁰ advocate this method of Van Gieson's. G. G. Smith²⁰ and Spaulding¹⁴ prefer the use of the platinum loop.

Sinclair,²¹ following the method of Rubin and Leopold,²² used the electrically lighted female urethroscope in the diagnosis of gonococcus vaginitis in eighty-three infants. Smears were made through the urethroscope, from the cervix and vaginal mucosa. The platinum loop gave the best results, the moist swab was less satisfactory and the dry swab was much inferior. Van Gieson's irrigation method did not give as reliable results as the use of the urethroscope. Among the eighty-three cases, sixteen were found to be infected or highly suspicious on admission. Of the sixteen cases, 21 per cent. would have escaped detection without the use of the urethroscope, and only 30 per cent. showed any visible signs of discharge. The characteristic tendency of the disease to assume periods of latency is misleading.

Barnett¹³ used a Skene urethral speculum and head mirror, as suggested by Koplik in 1893, in the diagnosis of vulvovaginitis, but later the Kelly electrically lighted endoscope was used. He also prefers the platinum loop for obtaining material for smears from the walls and floors of the vagina.

COMPLEMENT-FIXATION TEST

G. G. Smith,¹⁸ in 1913, described the complement-fixation test as a serum reaction highly specific for gonorrhea. It is similar to the Wassermann reaction in syphilis. In a study of twenty-five cases, Smith found a positive complement fixation in eleven of twelve clinically positive cases, and in four cases in which the clinical evidence was inconclusive. In two of these four cases there had been no discharge for one and two years and smears were negative. The test was negative in three cases in which other evidences of cure were insufficient, but in seven others the clinical findings were corroborative. A year later Smith²⁰ published a further report on sixteen of these cases. Of nine, in whom there had been no recurrences and who gave negative complement-fixation tests in 1913, all but three gave weekly positive or suspicious reactions in 1914. This he explains by the greater sensitiveness of the tests which has developed from further use. Of seven patients who gave positive tests a year before, five were clinically well and two showed some discharge in which the gonococcus could not be demonstrated. Of the five which were apparently cured, two showed a weakly positive complement fixation; one a moderately positive reaction and two were negative. So strong is Smith's belief in the com-

20. Smith, G. G.: *AM. JOUR. DIS. CHILD.*, 1914, **7**, 230.

21. Sinclair, J. F.: *Arch. Pediat.*, 1914, **31**, 29.

22. Rubin, I. C., and Leopold, J. S.: *AM. JOUR. DIS. CHILD.*, 1913, **5**, 58.

plement-fixation test that he interprets an absolutely negative result as proof of the absence of gonococcus infection.

Other authors are less didactic. Norris¹⁷ believes that complement fixation and cutaneous tests are diagnostic if positive and carried out by an expert bacteriologist. Negative tests, however, do not rule out gonorrheal infection. Barney²³ looks on a moderately or strongly positive complement fixation as confirmatory proof in doubtful cases, and R. M. Smith⁴ also considers it as a valuable aid in diagnosis. Kolmer²¹ found only 50 per cent. of positive results in ten of Sinclair's cases, in which the diagnosis had been made with the aid of the urethroscope.

That the apparent vagaries in the results of complement-fixation tests may depend on the degree of involvement can be seen from the following:

Thomas, Ivy and Birdsall,²⁴ using specific and nonspecific antigens, failed to find a positive gonococcus complement fixation in adults when the vagina alone was involved. Williams²⁵ also states that gonococcus infection must reach at least the level of the uterus before a positive reaction occurs. Most of his patients were adults.

Schwartz and McNeill²⁶ also find that in adults the infection must involve the cervix before complement fixation is positive. In ten patients under 5 years of age the complement-fixation test was negative.

McNeill,²⁷ in another communication, reports the result of complement-fixation tests in eight children who had had gonococcus vaginitis from one to three years. Six had no discharge at the time the tests were made. Five gave a four plus positive reaction; two a double plus and only one a one plus. These results, few as they are, nevertheless show that infantile vulvovaginitis may be more than a local infection and that the general infection may be active after all local manifestations have disappeared. In acute cases when the complement-fixation test is negative, antigens may be prepared from pure cultures of the suspected organism and tested against a known antigenococcus serum.

Irons and Nicoll²⁸ obtained a positive complement fixation in seven cases of gonococcus vaginitis and negative results in five cases. In another series of five cases in which the gonococcus was obtained by culture, four showed a positive complement fixation. They investigated

23. Barney, J. D.: *Boston Med. and Surg. Jour.*, 1916, **174**, 740.

24. Thomas, B. A., Ivy, R. H., and Birdsall, J. C.: *Surgery, Gynec. and Obst.*, 1914, **19**, 390.

25. Williams, W. W.: *Interstate Med. Jour.*, 1914, **21**, 1198.

26. Schwartz, H. J., and McNeill, A.: *Am. Jour. Med. Sc.*, 1912, **144**, 815.

27. McNeill, A.: *Arch. Pediat.*, 1913, **30**, 657.

28. Irons, E. E., and Nicoll, H. K.: *Jour. Infect. Dis.*, 1915, **16**, 303.

a third series of seventeen patients who were suffering from scarlatina or diphtheria. All of these showed typical gonococci in smears, and some were also proved by cultural methods. Five of these seventeen cases gave a positive complement fixation, ten were negative and two were weak or doubtful. In one case with a purulent discharge in which no gonococci could be demonstrated, a positive complement fixation was obtained. In two cases in which a colon bacillus and a diphtheroid organism were found, the complement-fixation test was negative. They consider that, as a means of detection of gonococcus vaginitis, the complement-fixation test has a limited value. Positive reaction cannot be expected in early infection, and probably not even in cases of long standing, unless there is deep involvement. A negative reaction, therefore, is inconclusive.

The majority of bacteriologists who replied to the questionnaire of the American Pediatric Society¹² consider that the complement-fixation test is of decided value: when it is performed by a skilled serologist with satisfactory antigen and adequate controls; when the infection involves the deeper structures, and when it has been of duration long enough to cause the production of specific amboceptors.

PATHOLOGY

Sinclair²¹ and Barnett¹⁸ describe the lesions of vulvovaginitis found on a vaginal examination with the urethroscope. In most cases a small amount of dried pus was found on the labia, and pus was seen coming from the vagina, but the external appearance of the hymen might be normal in a pronounced gonorrheal process. The vagina was a dull pink color, with pus in the rugae and, occasionally, hemorrhagic spots. The cervix showed marked changes, being deeply congested, with pus exuding from the cervical canal. Superficial ulceration of the cervix was occasionally observed. In 30 per cent. of Barnett's fifty cases ardor urinae was present.

Hess³ states that postmortem examinations show that in the sub-acute and chronic cases of vaginitis in infants the cervix is most frequently involved, and that the vagina generally shows no signs of inflammation. Cervicitis would therefore seem to be a more correct term than vaginitis. Kenessey²⁹ performed complete necropsies on two children who had gonococcus vaginitis and had died of pneumonia following varicella. In both cases a gram-negative intracellular diplococcus was found in the material within the uterus, and in the second case this organism was isolated in hydrocele agar. From the pathologic findings in these cases he concludes that the gonococcus in childhood

29. Kenessey, A.: *Pest. Med.-Chir. Presse*, Budapest, 1913, **49**, 360.

can invade not only the uterine cavity, but also the tubes and ovaries. Further, that the adnexa can be so severely involved as to cause irreparable damage to their later function.

COMPLICATIONS

Meister² finds that in infants suffering from gonococcus vaginitis complications are usually few and not serious — such as local dermatitis and enlargement of the inguinal glands. In older girls, on the other hand, any of the complications common to gonococcus infection in the adult may occur, including endometritis, salpingitis, peritonitis and, occasionally, endocarditis and pericarditis and arthritis. With this opinion the majority of observers seem to be in accord.

Perrin³⁰ believes that the rudimentary stage of development of the uterus and tubes in little girls explains the rarity of their involvement. Barney,²⁸ noting that the Bartholin and the Skene glands are undeveloped in childhood, as well as the uterus and tubes, ascribes to this fact that blood-borne metastases are rarely seen. Without specifications as to the age of the children, Marshall⁶ and Spaulding¹⁴ believe that gonococcus vaginitis, however contracted, may be followed by the same complications as in adult life.

Danger of infection of the eye seems to be much greater in early life than in adult life. Adkins,¹⁰ who has never encountered a case of gonococcus arthritis, has seen quite a few infections of the eye complicating vaginitis. Van Gieson¹⁹ also considers ophthalmia a serious danger.

Chapin's⁹ experience has been more fortunate. He has rarely seen infection of the eye, and only one instance of tubal involvement. To offset this we have the following:

Marfan and Debre³¹ report in extenso the case of a girl, aged 10½ years, suffering with chronic gonococcal vulvovaginitis, who developed symptoms of pelvic peritonitis and, afterward, endo-pericarditis and pleurisy. The most interesting fact was the recovery from the blood, by culture, of the gonococcus.

Schwerts³² records the case of a child 2½ years old in whom tenosynovitis of both arms, spondylitis and arthritis of the right sternoclavicular articulation and a polymorphous eruption were observed in the course of an acute attack of vulvovaginitis. Recovery ensued without treatment.

30. Perrin, T.: *Allg. med. Centr.-Ztg.*, 1910, **79**, 773.

31. Marfan, A. B., and Debre, R.: *Bull. et mém. Soc. méd. d. hôp. de Paris*, 1910, Series 3, **29**, 712.

32. Schwerts, H.: *Arch. de méd. d'enfants*, 1914, **17**, 355.

Koplik⁹ has known of four instances of fatal gonococcic peritonitis in the course of vaginitis occurring in patients at the Mt. Sinai Hospital, New York City.

Thirty-nine per cent. of the physicians who answered the questionnaire of the American Pediatric Society¹² have seen more or less severe systemic complications such as pus tubes, arthritis, pelvic or general peritonitis, septicemia, endocarditis, ophthalmia, etc., occurring in sixty or more cases.

We may sum up the actual proportion of complications to cases treated in the following reports of physicians who have made a special study of gonococcal vaginitis: Barnett,¹³ 50 cases; Taussig,⁸ 66 cases; Comby and Condat,³³ 18 cases; Sinclair,²¹ 33 cases; Hamburger,³⁴ 21 cases; a total of 188 cases.

Complications	Number of Cases
Arthritis	3
General peritonitis	2
Pelvic peritonitis	2
Tubal infection	6
Ophthalmia	4
Periosteal disease of heel.....	1
Proctitis	3
Intense dermatitis of vulvae and thighs.....	2
Urethritis	1
Inguinal adenitis	1

Number of instances of complications, 25.

Percentage of cases showing complications, 13.3 per cent.

SEQUELAE

Whitehouse³⁵ suggests that some cases of endometritis, salpingitis and dysmenorrhea in the adult may be due to latent, uncured gonorrhea in childhood. Spaulding¹⁴ has been unable to substantiate this, and Koplik⁹ has had under observation several patients who had gonococcic vaginitis during childhood and who afterward married and were able to bear children. In the report of the American Pediatric Society¹² we find that only three of the gynecologists have treated adults who were known to have had gonococcus vaginitis during childhood. One has seen no sequelae, the other two have had to operate, one for pelvic peritonitis, and the other for peritonitis, salpingitis and oöphoritis. Although so few have seen instances in which vaginitis during childhood has manifested itself by sequelae in later life, 30 per cent. of the twenty gynecologists who expressed an opinion, positively state that gonococcus vaginitis of childhood may last after puberty; 40 per cent. more or less qualify their affirmative reply; the remaining 30 per cent. either definitely deny or gravely doubt its persistence.

33. Comby, J., and Mlle. Condat: *Arch. de méd. d'enfants*, 1914, **17**, 419.

34. Hamburger, R.: *Deutsch. med. Wchenschr.*, 1914, **40**, 759.

35. Whitehouse: *Practitioner*, London, 1910, **84**, 485.

TREATMENT

Treatment of gonococcus vaginitis in children involves the use of local remedies and vaccines, and general constitutional measures. Most authors make use of some form of local treatment, some few believing that persistence in a reliable technic will result in cure, although admitting that much time and patience are requisite. Wolff³⁶ opposes local treatment in those past infancy on the score of its demoralizing influence. Rygier³⁷ enlarges on its difficulties and the lack of permanent results.

Adkins¹⁰ believes that the disease runs its course in spite of all one can do to cure it. Certain local measures he finds of temporary benefit. Among these is the injection of suspensions of living lactic acid bacilli.

Whitehouse³⁵ also has treated eight patients with cultures of lactic acid bacilli without the use of other measures. He obtained cessation of discharge and disappearance of gonococci and septic organisms in from fourteen days to three weeks. He does not know whether or not these results are permanent, however.

Taussig⁸ believes in rest and general tonic treatment. He does not believe in irrigations, but prefers instillations of a solution of argyrol, 25 per cent., in the early stages; later a 1 per cent. to 4 per cent. solution of nitrate of silver.

G. G. Smith²⁰ advocates mechanical cleanliness by means of irrigations with potassium permanganate, 1:4,000, and the prolonged use of silver salts, such as argyrol. He continues these treatments for one month after all discharge has disappeared.

Perrin³⁰ has treated over 100 cases during the last ten years with injections of protargol 5, water 8, glycerin, q. s. ad. 50. He claims that all were radically cured within fourteen to twenty days. Most of the cases were chronic and had received a variety of other forms of treatment.

The most elaborate technic is described by Norris¹⁷ as follows: The child is put in the Sims or knee-chest position. The hymen usually must be sacrificed. The vagina is washed with weak potassium permanganate solution and swabbed with 25 per cent. argyrol solution. It is then thoroughly dried with strips of gauze, and the drying completed with an empty atomizer. The child is kept in the Sims position for twenty to thirty minutes to allow air to enter the vagina. Finally the vagina is flooded with a weak solution of silver nitrate, gradually increased in strength, and glycerin added. The above treatment is carried out three times a week. In the interim the mother or nurse uses a weak permanganate or argyrol solution introduced with a soft

36. Wolff, M.: Chicago Med. Recorder, 1913, **35**, 462.

37. Rygier, S.: Deutsch. med. Wchnschr., 1911, **37**, 2334.

rubber ear syringe. By this method Norris cured fourteen patients in an average of twelve weeks, the longest time being eighteen weeks.

Willcox,⁹ after trying all methods of treatment, believes that the disease is controlled but not cured. Fisher⁹ has abandoned treatment other than the use of irrigations of magnesium, alum and water. He also advocates the use of general tonic treatment, namely, change of air, arsenic, cod liver oil and iron.

Rubin and Leopold²² insist on the importance of determining the extent of the deep lesions before beginning treatment. For this purpose the electrically lighted female urethroscope should be employed. When irrigations are resorted to, the douche tip should enter the vagina for at least 1½ inches. Applications by swabs used without the urethroscope are injurious and useless. When strong silver solutions are applied to the cervix and vagina, it is well to keep the child in bed for a few days.

Barnett¹³ also advocates the use of the electrically lighted urethroscope in treatment in order to apply the medicament directly to the cervix. This he considers important, as the involvement of the cervix is not easily amenable to the ordinary douche or irrigation. He prefers Lugol's solution 1:500. With the use of the urethroscope he obtains a cure in a month; whereas at the end of six months only seven of his twenty-six patients undergoing prolonged systematic treatment were cured by ordinary irrigations.

Freeman⁹ states that local treatment should not be limited to one method, as a change often brings good results. He also believes in the use of the endoscope.

Kerley⁹ sounds a timely warning that a large number of cases should be studied before reporting results from any form of treatment, as occasionally a run of mild infections occurs and the physician, in such an event, would become unjustifiably enthusiastic about his method of treatment.

VACCINE TREATMENT

One of the most ardent advocates of the use of vaccines is B. W. Hamilton,³⁸ who treated eighty-four patients with 90 per cent. of cures in an average time of fifty days. These figures he contrasts with 260 patients treated by irrigation alone, in whom there were 60 per cent. of cures in an average time of 300 days (ten months). He used two stock vaccines and one freshly prepared from an eighteen-hour blood agar culture taken from an adult male with urethritis. He describes at length his method of administering vaccines. Apparently, local treatment was not used.

38. Hamilton, B. W.: *Am. Jour. Obst.*, 1910, **61**, 837.

Wolff³⁸ believes that gonococcus vaginitis is one of the diseases in which vaccine treatment has proved itself to be especially advantageous if given in a careful and judicious way. Stock vaccines do not show a constant efficiency and have no scientific basis. Vaccines should be made from fresh cultures, and should include the organisms ordinarily found in conjunction with the gonococcus, namely, staphylococcus, diplococcus (not gonococcus) colon bacillus, pseudodiphtheria bacillus. Wolff treated with vaccine forty patients from 1 to 14 years of age, without local measures other than external cleanliness. Many of the cases were chronic. The number of injections varied from four to ten, with an average of seven, injections being given every five to seven days. After one year only one case is known to have relapsed. He believes autogenous vaccines to be 100 per cent. efficient.

Another strong advocate of vaccine treatment is W. J. Butler,³⁹ who has reported several series of cases treated with monovalent and polyvalent stock vaccines; the former he usually finds more efficacious. His results, without local treatment, show 75 to 85 per cent. of cures in from ten days to two months, in both acute and chronic cases. By cure he means the disappearance of discharge, and "several" negative smears. He finds the vaccine treatment incomparably more efficient than local treatment, and hopes that the latter will be abandoned except in rare instances.

Rygier³⁷ used a stock vaccine made from many strains of gonococci, and believes that vaccine treatment offers greater certainty and rapidity of cure than any other known method.

Comby and Condat³³ treated 18 patients with the vaccine of Nicolle. Marked improvement was noted after the second injection, but no data are given as to the subsequent course. They believe that the results from vaccine compare very favorably with those from local treatment, with the added advantage that local treatment is unnecessary except in unusually stubborn cases.

Spaulding¹⁴ used autogenous vaccines in conjunction with various forms of local treatment. She believes that vaccines are not specific, but an added factor for good.

Whitehouse³⁵ noted disappearance of all symptoms in two cases after the fifth and sixth injections of vaccine, and Adkins¹⁰ reports good results in a series of thirty-two cases.

Strassberg⁴⁰ believes in vaccine in the early stages, before many forms of local treatment have been used. Later he advocates both local and vaccine treatment.

39. Butler, W. J.: *Interstate Med. Jour.*, 1910, **17**, 510.

40. Strassberg, M.: *Wien. klin. Wchnschr.*, 1914, **27**, 889.

Carrau⁴¹ used the vaccine of Nicolle and Blaizot⁴² in fifteen patients, five to twelve years of age, without any local treatment. In only two did the gonococcus disappear, although the discharge diminished markedly in all the others.

Cecil⁴³ used a sensitized vaccine, that is, a vaccine treated with specific homologous serum, with satisfactory results. Some of his patients were adults, however, so that the figures are not available as they apply to children.

Barnett¹³ could find no improvement in the vaginal discharge in patients treated with vaccines, but the complication of arthritis yielded rapidly.

Tieche⁴⁴ notes the danger of "sexual trauma" from the use of local treatment, but concludes that the combination of vaccines and local measures offers the best hope for cure.

Boas and Wulff⁴⁵ treated twenty-six patients, two with vaccine alone, seven with vaccines and local measures, and seventeen received only local treatment. The best results were obtained with the combined treatment. The two patients treated by vaccine alone quite certainly showed no improvement.

The toxicity of gonococcal vaccines is considered an almost insurmountable obstacle by Murphy and Kreuscher,⁴⁶ although Nicolle and Blaizot⁴² claim they have succeeded in entirely overcoming this toxicity and in rendering the vaccines stable.

Marfan and Debre³¹ found Wright's vaccine inefficacious. Hamburger³⁴ has used stock vaccines in the treatment of twenty-one children. He fails to state his definite results, which evidently were unfavorable.

G. G. Smith²⁰ does not believe that results with vaccine are satisfactory in gonococcus infection of the mucous membranes either of the male or female.

Freeman⁹ is inclined to believe that vaccines have done little if any good.

Kerley⁹ used stock vaccines in thirty-six cases without any noteworthy results.

Wollstein⁹ has used both autogenous and stock vaccines, according to the opsonic index. The results were not encouraging.

Of pediatricians who answered the questionnaire of the American Pediatric Society¹² as to the use of vaccines, twenty favored it and

41. Carrau, A.: *Rev. med. d. Uruguay*, Montevideo, 1915, **18**, 79.

42. Nicolle, C., and Blaizot: *Jour. d'urol.*, 1913, **4**, 734.

43. Cecil, R. L.: *Am. Jour. Obst.*, 1915, **72**, 528.

44. Tieche: *Cor.-Bl. f. schweiz. Aerzte*, 1912, **42**, 159.

45. Boas, H., and Wulff, O.: *Hospitalstidende*, 1910, 5 R., p. 801.

46. Murphy, John B., and Kreuscher, P. H.: *Interstate Med. Jour.*, 1914, **21**, 1214.

eleven found no material benefit from it. Approximately two thirds of the bacteriologists throughout the country also favored its use. The majority favored the use of autogenous vaccines, or, in the event that such were not available, some sanctioned the use of polyvalent stock vaccines. About four fifths of the bacteriologists believe that, if vaccines are properly made and administered, they are free from danger. The remaining fifth deny that they are harmless.

OPSONIC INDEX

Hamilton³⁸ could find no relation between the opsonic index and the activity of the vaginal discharge, while using vaccine treatment.

Wolff³⁶ believes that the determination of the opsonic index is not essential if care is taken to regulate the dosage of vaccine by the reaction and the clinical needs of each individual case.

Butler³⁹ originally controlled the administration of vaccine by the determination of the opsonic index, but abandoned it after finding the proper dosage and interval. He advocates small doses, 5 to 50 million at first, repeated at five-day intervals.

The only reference found to the use of serum in the treatment of gonococcus vaginitis was that by Marfan and Debre,³¹ who used anti-meningococcic serum subcutaneously. Unusual and grave anaphylactic symptoms resulted.

DURATION AND LATENCY

The tendency toward chronicity of gonococcus vaginitis in children is one of its most noteworthy and generally admitted characteristics. As Adkins¹⁰ says, a consideration of the well-known chronicity of the disease in adults would give sufficient grounds for a like expectation in children. The tendency toward latent periods followed by recurrences is more marked in children.

Barnett,¹³ in studying fifty cases, found that the duration of the disease, according to the history, varied from one week to several years. One case had existed for six years, with gonococci present in the vaginal pus. The average duration was eight and one-half months. In twenty-six cases, Spaulding¹⁴ found the average duration was twenty months. The disease, she believes, may extend over many years, during which time there may be many recurrences and the periods of latency may be as long as eighteen months.

Rubin and Leopold²² believe that the cause of the chronicity of gonococcus vaginitis in children lies in the anatomic construction which does not permit of free drainage. This is not due to the hymen, but to the fact that each segment of the vagina serves as a valve to dam back the discharge, as the vaginal walls are constantly in close contact.

Then, too, the vaginal portion of the cervix shows the most marked changes, and, at the same time, is in the most disadvantageous position for drainage and treatment.

R. M. Smith⁴ gives the following results in thirty cases: Cured, 8 (no symptoms for from three to twenty-four months); 4 negative complement-fixation tests; under treatment from one and one-half to twenty-one months; did not continue treatment, 14; still under treatment, 8 (from one month to two years).

Barnett¹³ found that the discharge soon ceased with any method of treatment. This, however, did not constitute a cure, as smears may remain positive for months after all visible signs of discharge have ceased.

Kerley⁹ notes that cases clear up spontaneously after an indefinite course, due to the attenuation of the organism. This explains the comparative rarity of a course extending beyond the third or fourth year.

Koplik⁹ also believes that the disease is self-limited.

CURE

R. M. Smith⁴ thinks that the disappearance of all symptoms, after adequate treatment, with persistent negative smears and negative complement fixation, is a fair indication of a cure. The reappearance of a discharge in such patients, when the original source of infection persists and there has been no reform in the habits of the patient, is more likely to be a reinfection than a relapse.

G. G. Smith¹⁸ believes that when other signs point to a cure, the complement-fixation test should be used as a court of last appeal. If a case proves to be a cure, with a negative complement fixation, Smith also believes that a recurrence of discharge containing the gonococcus signifies a reinfection and not a relapse.

Spaulding¹⁴ believes that the most efficient treatment does not insure a permanent cure. She found that twenty-four of twenty-six patients had a recurrence of the discharge after apparent cure, in from three weeks to six years. Apparently she does not consider the possibility of reinfection!

The criteria on which it is believed that a cure can be predicated may be summarized as follows:

Barnett¹³ and Wolff³⁶ base a cure on three negative smears taken at weekly intervals after all treatment has been stopped.

Maier⁷ demands an additional fourth smear after a three-weeks' interval — six weeks in all.

Hamilton³⁸ requires four negative smears at weekly intervals and two additional smears at two-week intervals, eight weeks in all.

Norris¹⁷ bases a cure on three negative bacteriologic and physical examinations made at intervals of two weeks, the last examination being preceded by chemical irritation with a nitrate of silver solution.

PROPHYLAXIS

Smith⁴ believes that we must recognize that we are dealing with a social evil, and that the medical treatment is only a part of what needs to be done in the attempt to eradicate the disease. Parents must be made to recognize the contagiousness of the disease if we are to utilize one of the most important factors in preventing its spread.

Hess³ states that vulvovaginitis is another instance of the healthy but dangerous "carrier," which is emphasized by the difficulty in recognizing the latent cases. By means of a provocative inoculation of gonococcus vaccine he has been able to convert the concealed "carrier" into the "open" case, and in this way to discover many cases which had eluded detection. Furthermore, he believes that the inoculations have some prophylactic value, and that they either confer protection or render subsequent infection of a mild character, so that it assumes a bacteriologic rather than a clinical type.

Spaulding¹⁴ believes that the physician should realize the importance and prevalence of the disease and institute stricter preventive measures, both in hospital and private practice.

Adkins¹⁰ notes that the negro child nurses in the South commonly are infected with the gonococcus, and believes that there should be a law compelling nurses to undergo examination. He advocates the use of silver salts in the vagina immediately after birth, and believes that the vagina is even more liable to infection than the ocular mucosa.

Taussig⁸ also advocates the prophylactic injection of a drop of 2 per cent. solution of silver nitrate into the vestibulum vaginae in all new-born infants, when there is any evidence of gonorrhea in the mother. He advocates making gonococcus infection reportable to the health authorities, the education of mothers, and most important of all, the adoption of the U-shaped toilet seat with the low bowl in all public lavatories, schools, tenements, play-grounds, etc.

Meister² also advocates the use of a 2 per cent. solution of silver nitrate in swabbing the labia and vagina of new-born girls, followed by an irrigation with a saturated solution of boric acid.

It is generally admitted that the routine examination of girls before admission to an institution should include determination of the presence or absence of gonococcal infection.

Willcox⁹ states that at the Bellevue Hospital, New York, girls are kept in the detention ward for three days while smears are taken daily from the cervix and vaginal vault. Absence of pus cells and organisms must be shown before the child is admitted to the wards.

In an editorial in the *Lancet*⁴⁷ attention is called to the variable incubation period in true gonococcus vaginitis, which may be as long as three weeks. There is, therefore, constant danger of the introduction of the contagion into general wards even when a negative smear has been obtained on admission.

Butler³⁹ insists on isolation, especially because one attack does not confer immunity against reinfection. He also insists that the disease is acquired by infection of the genitals. The usual sources he believes to be the common bath tub, common toilet and the hands of the nurse. He does not believe that the laundry plays any part in epidemics.

G. G. Smith²⁰ advocates allowing children to go to school if the mother is warned not to let her child use the toilet.

Sinclair²¹ believes that a campaign of education should be carried out, especially in the home and in all kinds of institutions dealing with the various phases of child welfare, such as day nurseries, asylums, hospitals, public bathhouses, recreation centers, schools, etc. He also advocates the systematic examination of all inmates of institutions, including lay helpers; the establishment of special clinics in hospitals; and that boards of health should be empowered to make gonorrhea a reportable disease. Barnett¹³ also subscribes to most of these precautionary methods.

The opinion of physicians who replied to the questionnaire of the American Pediatric Society¹² as to the importance of various prophylactic measures is shown as follows:

	Points
1. Hospital care.....	88
Under this heading are included, isolation, prolonged treatment till cured, improved technic in handling and in treatment, special instruction to nurses, especially night nurses, etc.	
2. Instruction to the laity.....	52
Under this heading are included printed and verbal instructions as to the nature of the disease, danger of transmission, best means for prophylaxis, etc.	
3. Schools.....	20
Examination and exclusion of positive cases, care as to the toilets, etc	
4. Control by boards of health.....	16
Compulsory report of cases, compulsory treatment, etc.	
5. Physicians.....	15
Instruction as to the importance of early recognition, prolonged treatment, etc.	
6. Institutions and tenements.....	11
Adequate medical supervision, care as to toilets, etc.	
7. Medical-sociologic relief.....	7
Systematic sociologic study, follow-up nursing, etc.	
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47. Editorial: *Lancet*, London, 1910, 2, 1354.