

## EPIDEMIC GONORRHEAL VULVO-VAGINITIS IN YOUNG GIRLS.\*

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THE occurrence of gonorrheal vulvovaginitis in young girls has obtained only in recent years the recognition to which its serious consequences entitle it. In addition to the numerous instances in which the infection is acquired in the home by sleeping with other members of the household, there are cases in hospitals, asylums, etc., in which the development, mode of infection, and number of cases justify the designation "epidemic vulvovaginitis." There are obvious reasons why this form of gonorrheal infection has not become widely known.†

The earliest record I have been able to find in which the significance of these manifestations was realized is that of Atkinson,<sup>1</sup> who in 1878, in a report of an epidemic among six young girls in a dormitory of a charitable institution in Baltimore, predicted the discovery of an infectious principle common to vulvovaginitis, purulent ophthalmia, and ulcerative stomatitis. There were two or three cases of purulent ophthalmia in the dormitory, and the disease was probably spread by improper practices. The cases averaged two months in duration.

The epidemic described by Fraenkel<sup>2</sup> in 1885, affecting sixty-two girls in the Hamburg hospital and lasting for four years, occurred at a time when there was still considerable discussion concerning the etiologic relation between the gonococcus and vulvovaginitis in children. On account of the few complications, Fraenkel believed that the diplococcus obtained in cover-glass preparations and cultures from these cases was not the gonococcus of Neisser, but a closely related organism. Conjunctivitis appeared in only

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†In reviewing the literature, a number of articles were found dealing with statistics gathered from dispensaries, or with cases admitted to hospitals with a pre-existing discharge; these were not included in the following summary.

four of these cases, and in a few inoculation experiments made by implanting the organism upon the conjunctivæ of three practically moribund girls, a very mild inflammation was produced in one case, and in the others death occurred before results were noted. The epidemic was confined mainly to patients with scarlatina, all of whom were in one building, although cases appeared in other and separate buildings. The mode of transmission was ascribed to the use of common bath-tubs and closets.

In the same year Czeri<sup>3</sup> and Lennander<sup>4</sup> reported epidemics and, in contrast to the view adopted by Fraenkel, declared positively that the organisms in their cases were gonococci. The first of these occurred in Buda-Pesth, and Czeri found the organism by cultures in all of the twenty-six cases involved. This epidemic had its origin in the admission to the hospital of a case of vulvovaginitis. The infection of other children was ascribed to contaminated clothing (bed-linen), lavatories, instruments, bandages, and to mutual contact. A nurse in charge of one of these cases developed a purulent ophthalmia and panophthalmitis, for which removal of the eye was necessary. The cases examined by Lennander numbered eighteen, and the epidemic developed in the children's hospital in Stockholm from the admission of a girl with measles who also had a vaginal discharge.

In the following year an epidemic occurred in the Hebrew Orphans' Home in New York city;<sup>5</sup> thirty-five girls were affected, and eighteen developed purulent ophthalmia. Its spread followed the introduction of four girls with gonorrheal vulvovaginitis.

Following the admission of cases of vulvovaginitis to the children's hospital in Heidelberg, Dusch<sup>6</sup> noted the development of nine other cases, one in 1886 and eight in 1888.

The bacterial nature of the infection was not so definitely determined in the epidemic in the children's hospital of Paris reported by Ollivier,<sup>7</sup> although it undoubtedly belongs to this category. Fifteen became infected following the entrance of two girls with vulvovaginitis.

A similar absence of accurate bacteriological observations obtains in the report by Suchard,<sup>8</sup> in 1888, of two epidemics

occurring in a hospital at Lavey, where hydrotherapy was probably responsible for the transmission. In each epidemic the infection spread among a group of patients newly arrived from Paris and assigned to a common bath. In one instance, out of thirteen using the bath, eleven patients (all girls) were infected, those escaping being a boy, and a woman of thirty; in the other group the vulvovaginitis was discovered in all of the twelve girls using a freshly cemented bath.

The importance of public baths and common lavatory utensils in spreading infection is well shown by the frequent references in the literature to the report by Skutsch<sup>9</sup> of an extensive epidemic of gonorrheal vulvo-vaginitis in Posen in 1891. Two hundred and thirty-six cases developed among girls using the free baths, and many suffered from a complicating purulent ophthalmia. Boys using the same baths escaped the infection.

There are two reports in 1895: one by Fischer<sup>10</sup> from the children's hospital at Altona, in which forty of the fifty-four cases analyzed were instances of infection in the hospital; the other a report by Weill and Barjon,<sup>11</sup> in which careful study of the conditions led to the assumption that the infection was spread by the thermometer used to take the temperatures per rectum. Following appropriate methods of disinfection of this instrument, the epidemic promptly ceased. The cases in this epidemic number twenty, and all appeared during the three months subsequent to the admission of a girl of five years with vulvovaginitis.

A second epidemic in the Hebrew Orphans' Home in New York city, affecting sixty-five girls, occurred in 1896, and is reported by Sheffield.<sup>12</sup> All the cases appeared in the month following the entrance of a patient with gonorrheal vulvovaginitis and ophthalmia. Transmission was attributed to the custom which prevailed of bathing twenty to thirty girls in one large bath simultaneously. From a number of cases growths of the gonococcus were obtained on serum-agar. Of complications, localized peritonitis developed in four cases, synovitis of the ankle in two, and ophthalmia in six.

A careful review of the cases of this form of gonorrheal infection observed in the children's hospital in Zurich between the

years 1874 and 1895 has been made by M<sup>m</sup> Skiba-Zaborowska.<sup>13</sup> For six years (1877–82) the disease was epidemic; during this period fifty-one cases were observed, only nine of which, entering during the first two years, were diseased at the time of entrance. During subsequent years, beginning in 1887, the isolation of all children entering with a vaginal discharge prevented spread of the disease among resident cases.

Less extensive epidemics have been reported by Cnopf<sup>14</sup> from the children's hospital of Nuremberg in 1898, and by Koplik<sup>15</sup> from New York in 1903. The ten cases observed by Cnopf were infected from other infants with ophthalmia, and a similar number noted by Koplik followed directly upon the admission of boys with gonorrheal proctitis. In discussing the modes of transmission, Koplik especially emphasizes the danger of insufficient boiling of bed-linens.

A recent article by Kimball<sup>16</sup> concerns chiefly a series of eight cases of multiple gonorrheal arthritis or bacteriemia (seven males and one female, all under three months) without demonstrable portals of entry; the gonococcus was identified in the arthritic fluid microscopically in all the cases, and by cultures in six. Mention is also made by Kimball of seventy cases of vulvo-vaginitis in the Babies' Hospital of New York, 90 per cent. of which were infected in the hospital. These cases appeared as a series of small epidemics, each following the admission of a child carrying the infection.

In a review of the literature by Dr. I. A. Abt,<sup>17</sup> mention is made of an epidemic in St. Anna's Children's Hospital, Vienna, in which transmission was due to unclean thermometers.

In the nineteen epidemics mentioned in the foregoing there are reported 690 cases of gonorrheal vulvo-vaginitis, the largest epidemic being that described by Skutsch at Posen and involving 236 girls. In twelve epidemics, comprising 498 cases, the age limits range from three months to fourteen years, the average ages being nine years for 235 cases, seven years for 59 cases, and five years for 144 cases. The source of the infection in eight of the epidemics (Lennander, Sheffield, Leszynsky, Dusch, Czeri, Weill and Barjon, Ollivier, Kimball) was traced to the admission

of one or more girls with a pre-existing vaginal discharge; in two (Koplik) the outbreak followed directly upon admission of a boy with rectal discharge. In three (Cnopf, Atkinson) the infection spread from cases of gonorrheal ophthalmia. In the remaining six epidemics the source of infection could not be ascertained. In some of the epidemics the modes of transmission have been positively ascribed to: common baths (Suchard, Skutsch, Sheffield); manipulations by the children (Dusch, Atkinson); thermometers (Weill and Barjon); nurses' hands (Cnopf); baths and closets (Fraenkel). In other epidemics transmission has been attributed to: towels and wash-rags, diapers, bandages and bed-linens, instruments, lavatory fixtures, and the children's hands. Kimball, Koplik, and Ollivier lay especial emphasis on the danger of transmission by the hands of nurses.

The statements of most observers are to the effect that the disease in individual cases is of rather long duration. In 205 cases the average duration was stated to be two months. M<sup>me</sup> Skiba-Zaborowska in her series of 52 cases refers to a duration of "months," many cases resisting all treatment. Fischer also records some cases as uncured after six months. Kimball has called attention to the difficulty with which the vulvo-vaginitis is cured in children over one year, in contrast to the more prompt recovery in younger infants.

The determination of the gonorrheal nature of the discharge was based on microscopic examination in 240 cases (Weill and Barjon, Cnopf, Skiba-Zaborowska, Skutsch, Dusch, Lennander), and on microscopic examination with cultivation on nutrient media in 91 cases (Sheffield, Czeri). As before stated, Fraenkel regarded the organism in his 62 cases as a distinct, though related, organism, because of clinical differences in the diseases. In view of present knowledge, this may be considered as the gonococcus.

The records of the earlier observers indicate that very little attempt has been made to establish the gonorrheal nature of secondary infections of other parts of the body. In seven epidemics, comprising 477 cases, in which such investigations were made, the frequency of the complications mentioned is set forth in the following table:

Ophthalmia	-	-	-	34	Sheffield, Leszynsky, Fraenkel, Kimball, Skiba-Zaborowska
Urethritis	-	-	-	20	Fischer
			Frequent		Skutsch
				1	Skiba-Zaborowska
Infection of glands of Bartholin	-	-	-	13	Fischer
Arthritis	-	-	-	5	Kimball, Sheffield, Skiba-Zaborowska
Peritonitis*	-	-	-	5	4 local (Sheffield); 1 fatal—1878 (Skiba-Zaborowska)
Proctitis	-	-	-	2	Sheffield
Endometritis	-	-	-	1	Sheffield

The variety of complications presented above is easily supplemented from the numerous articles bearing upon the secondary infections by the gonococcus as follows: Cystitis is considered not uncommon by various writers,<sup>18-20</sup> though one<sup>21</sup> takes an opposite stand. Endometritis, salpingitis, oöphoritis, and peritonitis are lamentably frequent occurrences,<sup>22</sup> the three last mentioned generally being associated<sup>21</sup> and often terminating in sterility.<sup>23</sup> It is probable that further study of this variety of infantile vulvovaginitis will reveal cases in which gonorrheal stomatitis occurs as a complication. Kimball suspected that the mouth was the point of primary infection in three of his eight cases of multiple gonorrheal arthritis.

The possibility of some relationship between epidemic vulvovaginitis and pre-existing acute infectious diseases, such as scarlatina, measles, and typhoid fever, has been pointed out by Fraenkel, Dusch, Cnopf, Weill and Barjon, and is explained by Cnopf on the basis of an increased susceptibility of the children.

The hospital epidemic of gonorrheal vulvovaginitis reported here extended over a period of thirteen months, and its study was undertaken at the suggestion of Dr. E. R. Le Count.

This epidemic involved eighteen girls and one boy. During the thirteen months there were three periods, of about two months each, in which no new cases appeared, but, as will be shown, each interval was bridged over by resident cases, so that transmission was never completely interrupted. On July 21, 1902, a boy

\*Twenty-two other cases of peritonitis in young girls are reported in the literature as of gonorrheal nature; in all the primary infection was non-venereal.

(Case I), aged two years, was admitted to a general ward for rectal abscess and anal fistula, which was operated on twice during the succeeding months. Seventeen days after admission edema of the penis, with a urethral discharge, containing diplococci, was noted; eight weeks later (October 5) the discharge had ceased, and the case was considered cured. Three days from this date (October 8) Cases II and III, sisters aged three and six years respectively, were admitted to the same ward for typhoid fever. In the younger of these (Case II) there appeared, two days after entrance, a vaginal discharge containing diplococci refusing Gram's stain; and during the ensuing twenty-one days a similar discharge was noted in five other girls (Cases III–VII): in one, after twelve days; the next, after fifteen days; the elder sister (Case III), after sixteen days; and the two remaining, on the twenty-first day. Three of the patients had typhoid fever, one genu-valgum, one congenital dislocation of the hip, and one tuberculous spondylitis.

The attempts made to prove the gonorrheal character of the infection in these cases included the usual methods of examination of cover-glass preparations. Cultures were also made from two cases upon ordinary media and upon ox-blood serum and agar coated with human blood, which yielded only negative results as regards the gonococcus. These six cases were then removed to a separate ward, and the progress of the epidemic was delayed two months by this procedure. Three weeks before the appearance of any new cases there was admitted to a room adjacent to this isolation ward an infant (Case VIII) under treatment for cleft palate. This propinquity was due to the fact that the child's mother was a patient in the same room. It has been ascertained that the temperature of this infant was taken per rectum by the same nurse who was taking the temperatures of the cases of vulvo-vaginitis. Following the removal of this infant (Case VIII) to a general ward, purulent vaginitis appeared in another infant (Case IX) occupying the same bed.\* These facts led to a more careful examination of Case VIII, in whom gonorrheal vulvovaginitis

\* It was afterward learned that a vaginal discharge was discovered by the mother of another child (Case X) who had left this general ward a few days previously.

had been previously suspected on account of the odor, and the suspicion was confirmed. Eleven and fourteen days later two other infants in the same ward (Cases XI and XII) developed purulent vaginal discharges. In one of these four cases measles appeared, and they were all quarantined; so that at this time there were in the hospital two isolation wards, containing altogether eight cases of vulvovaginitis, two of the first group having been discharged.

Two months later one of these patients, with the vulvovaginitis still persisting, developed scarlatina, and was transferred to the Memorial Institute for Infectious Diseases. There had been admitted to the Memorial Institute a few days before a child (Case XIII) who, during the previous three weeks, had been in the general ward in the hospital. The morning following her transfer she was found to have a vulvovaginitis with a mucopurulent discharge, containing diplococci negative to Gram's stain and non-cultivable on ordinary media. In about two weeks following the entrance of these two sources of infection vulvovaginitis appeared in two other girls (Cases XIV and XV) convalescent from scarlatina; but no other cases developed in the Institute.

Of this third group of cases one was removed by the relatives before the vaginitis was cured, and the other three were transferred to the single ward in the hospital, which at this time contained the remaining cases of vulvovaginitis. These cases were discharged after varying intervals, until there remained but two patients—one a typhoid-fever case, and the other a case of congenital dislocation of the hip. During the month of May the latter patient was frequently dressed in clinics, and on two occasions was conveyed to and from the clinic on the same hospital cart with several other girls, also surgical cases, from the general ward for children. Within one week (June 3) vulvovaginitis was observed in one of these girls (Case XVI); five days later there were two more cases (Cases XVII and XVIII); and four days after this an additional case (Case XIX)—all in the same ward. The four new cases were isolated with a special nurse, and were attended by a physician who saw no other cases in the hospital.



The last of these cases was discharged after ten weeks, and since then no new cases have appeared.

Of the nineteen\* cases included in this epidemic, seven were medical cases—five typhoid, one scarlatina, and one epilepsy. The surgical cases included three each of cleft palate and tuberculosis spondylitis, two cases of congenital dislocation of the hip, and one each of genu valgum, angioma of the face, tuberculosis of the ankle and rib, and anal fistula. All were girls, except the case first mentioned (Case I); their ages ranged from six months to thirteen years. The following table shows the ages of the individual cases:†

6 months	-	-	-	-	-	-	1
8 "	-	-	-	-	-	-	1
2 years	-	-	-	-	-	-	2
3 "	-	-	-	-	-	-	7
4 "	-	-	-	-	-	-	2
6 "	-	-	-	-	-	-	3
9.5 "	-	-	-	-	-	-	1
10 "	-	-	-	-	-	-	1
13 "	-	-	-	-	-	-	1
Total	-	-	-	-	-	-	19

As has been shown by the consideration of other epidemics (Fischer, Skiba-Zaborowska), this form of infection is very resistant to treatment. The eight cases discharged as cured had an average duration of 122 days, the extremes being 39 and 254 days respectively. It is worthy of mention that of these long-standing cases four had typhoid fever; two congenital dislocation of the hip, wearing plaster casts for a considerable time; one case had tuberculous spondylitis, and one anal fistula. Six cases left the hospital uncured, and in two others the cure was questionable at the time of their discharge. One case died of bronchopneumonia following measles, another of tuberculous meningitis, and in the remaining case the infection was not discovered until after the patient had been sent home.

\*This number is equivalent to 6 per cent. of the total number of children under fourteen years in the hospital during this same period, and 12.5 per cent. of the total number of girls.

†The average age of all the patients under fourteen years in the hospital during the epidemic was seven years and two months.

Some of the patients presented symptoms pointing quite definitely to infection of other parts of the body with gonococci. The most interesting case illustrative of this is Case XIV. This patient, aged ten years, was admitted for cleft palate, and, following the development of scarlatina, was removed to the Memorial Institute. During desquamation a vaginal discharge, and pains in the elbows and knees, appeared on the same day. There was slight swelling about the joints, with extreme tenderness. These symptoms were ushered in by a continued fever, which lasted eleven days, averaging  $101.5^{\circ}$  F., with one remission to normal on the second day. The involvement of the joints, diagnosed as multiple gonorrheal arthritis, gradually diminished in severity, and disappeared after eight days. A few days later the temperature rose to  $103^{\circ}$  F., the patient complained of severe abdominal pain, and there was marked tenderness in the hypogastrium, with tympany, constipation, vomiting, and a leucocytosis of 17,000. These acute symptoms were diagnosed as due to gonorrheal peritonitis; they lasted only a few days, but abdominal pain and tenderness, with an occasional slight rise in temperature, remained for approximately four weeks.

Only one case developed a severe and persistent conjunctivitis, and this on microscopic examination showed only streptococci. In three other cases there was a mild conjunctivitis, which was not examined. Two other complications—suppurative otitis media in five cases, and axillary abscess in one—are to be regarded as more closely related to the measles and typhoid fever which were complicated by the vaginitis, than to the gonorrheal infection.

As to the source of the epidemic, it will be remembered that the first case of vulvo-vaginitis (Case II) was discovered two days after her admission, and five days after a boy (Case I) in the same ward had been pronounced cured of gonorrheal urethritis. The indications point toward the former of these as the agent by whom the infection was introduced. Yet the short duration of the period of incubation\* of gonorrhea in young girls renders it possible that the girl (Case II) became infected after entrance by transmission from the boy.

\*Incubation in males ranges from three to seven days; in females, from two to five days, and is especially short in young girls (Keyes, Morrow, Schmidt, and Pedersen).

Careful examination of the conditions surrounding these patients reveals very few possible modes of transmission of the infection from case to case that have not already been considered by other writers. There is little doubt but that the first period of intermission during which no new cases developed, was the result of careful isolation. That this period was limited to two months is explained by the circumstances, already described, under which the temperature of Case VIII was taken. During May, 1903, no new cases were observed. During the latter part of this month, Case VI was twice dressed at the clinic for the congenital dislocation of the hip, with which she was also afflicted. She was conveyed to and from the clinic upon a hospital cart with other girls, and it has seemed probable that transmission was effected either in the clinic or upon the cart. The necessity for complete isolation to prevent spread of the infection was not realized during the earlier months of the epidemic, as has been pointed out, and with the inauguration of radical measures the outbreak was soon brought under complete control.

In this epidemic, as in several found in the literature, there is a relationship to pre-existing infectious diseases. Five cases of typhoid fever and three cases of scarlatina developed the vulvo-vaginitis. Two other cases, one of scarlatina and one of measles, appeared two months and four days, respectively, after the vaginal discharge had been found,

Bacteriologic investigations during the progress of the epidemic yielded the following results: a diplococcus regarded as the gonococcus was found in cover-glass preparations from ten cases; from five other cases the organism failed to grow on ordinary media, although cover-glass preparations demonstrated its presence;\* and finally it was obtained in pure culture and identified as the gonococcus from three cases, the others having been discharged when its cultivation by the writer was undertaken.

The medium employed was a mixture of plain agar condensed to two-thirds its bulk, with either hydrocele, pleuritic, or ascitic fluid, in the proportion of 2 to 1, and solidified, slanting in test-tubes. The transudate was gathered in sterile flasks, distributed

\*For the daily examination of cover-glass preparations from a number of cases, after thorough isolation had been instituted, we are indebted to Dr. T. O. Greig.

in sterile test-tubes, and incubated twenty-four hours at 37°5 C. to determine its sterility. It was then added to agar at 45° C., each tube being prepared separately; the transudates were never subjected to a heat of over 50° C.; thus prepared the tubes were sealed with rubber caps sterilized by a solution of  $\text{HgCl}_2$  (1:1,000), slanted until solid, and incubated at 37°5 C. for two days to again determine sterility. For isolation the slants were used as plates, and a loopful of the secretion was taken directly from the patient, being spread over the medium by means of the water of condensation.

The first cultures made from four patients yielded only mixed colonies, a bacillus and diplococci from two cases, and a bacillus and staphylococci from the other two. The diplococcus resembled the gonococcus in morphology and staining. The bacillus, which took the ordinary stains and Gram's stain, resembled the vaginal bacillus of Döderlein.\* Attempts made on the following day to isolate the diplococci by subcultures proved futile; the same mixed colonies were found, with fewer diplococci.

Attempts were then made to obtain the gonococcus from the case presenting the largest amount of purulent discharge (Case XVI), but again the colonies were mixed, consisting of staphylococci, diplococci, and a few pure colonies of streptococci. In order to obtain a more complete dissemination of the organisms, Petri dishes were substituted for slanted test-tubes, but with no better results. The reaction of the hydrocele-agar was then tested and found to be satisfactory (1 per cent. acid to phenolphthalein). Sample tubes were inoculated with streptococcus and pneumococcus, and both organisms grew luxuriantly.

Meanwhile each patient had been getting a douche with 10 per cent. protargol every four hours four times daily. On July 20, after douching Case XVI with the protargol, she was given a douche of distilled water, and cultures were taken four hours later. These showed no growth after twenty-four hours, but after forty-eight hours numerous pure colonies of diplococci, like the gonococcus in shape and staining reactions, and a few pure colonies

\* This organism had been found previously in four cases by Messrs. A. H. Harms and D. M. Green, in the spring of 1903.

of staphylococci were found. After seventy-two hours subcultures of the diplococcus colonies were made on hydrocele-agar and glycerin agar. Growth on the former was luxuriant and presented the following appearances after twenty-four hours: the colonies were round, raised, moist, about 1 mm. in diameter, opaque, and bearing a striking resemblance to ground glass; the fused growth along the stroke was flat, heavy, with straight edges, faintly translucent, and presented the same ground-glass appearance; the inoculated glycerin-agar slants never showed any growth. This culture was maintained on the mixed medium over three months, the organism in several instances being found alive after twelve days' incubation in one tube, as shown by growth after transplantation.

Attention was now turned to Cases XI and XVIII, Case VI having been discharged in the interval as cured. After several unsuccessful attempts to isolate the organism under varying conditions, the method which succeeded in Case XVI was used; the medicated douche was immediately followed by a douche of distilled water, packing being omitted, and cultures were taken after four hours; twenty-four hours later the slants showed many opaque, white, and some paler pinpoint colonies; after forty-eight hours the paler colonies were found to consist of diplococci with the morphology and staining reactions of the gonococcus; they were then isolated on the other slants, and their nature and purity determined.

It has been thought desirable to describe the technic of cultivation at this length because most of the recent text-books give few details, and the methods recorded by Finger, Ghon and Schlagenhauser,<sup>24</sup> Steinschneider,<sup>25</sup> and others are too cumbersome.

Although the gonococcus has been isolated from only a few cases in this epidemic, the present writer having undertaken its study only during its latter months, it seemed proper to emphasize here the importance of cultivation as an additional step in the diagnosis of gonorrheal infection.

Two other diplococci identical with the gonococcus in morphology and tinctorial reactions, including negative results by Gram's method, have been isolated from male urethras by Stein-

schneider and Galewsky<sup>26</sup> in 4.65 per cent. of 86 cases, and can be differentiated from Neisser's organism only by cultural tests, both growing readily on ordinary media.

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