SCARLET FEVER AND “FOURTH DISEASE.”

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An epidemic resembling scarlet fever occurred among the 2nd Hampshire Regiment at Naval Hill, Bloemfontein, during the year 1908. As this epidemic presented some unusual symptoms I wish to discuss it briefly in relation to the so-called “fourth disease.”

In the Lancet, July, 1900, Dr. Clement Dukes reported the outbreak of an epidemic in a public school, which he termed provisionally the “fourth disease.” According to Dr. Dukes this disease has these characters: It is infectious; the first symptom may be the rash, the eruption being scarlatiniform in type, and covering the entire body in a few hours. The incubation period is nine to twenty-one days. The fauces are red and swollen, and the conjunctivae pink and suffused. Pre-eruptive vomiting is usually absent. The lymphatic glands are universally enlarged, more especially the posterior cervical, axillary and inguinal. There is usually desquamation which does not bear any relation to the intensity of infection. The kidneys are seldom affected, and in many cases the patient does not really feel ill. The tongue is clean or furred, but does not peel as in scarlet fever. The pulse is not greatly quickened. The temperature ranges from 98° to 104°F. The course of the illness is run in a few days, and an attack does not protect against scarlet fever or rubella.

This paper was subjected to the keenest criticism at the time, and Dr. Dukes had on his side many distinguished observers. Some of his opponents, though not denying the possibility of a “fourth disease,” held that its existence had not been proved, and maintained that some of his cases might have been rubella, and others a mild form of scarlet fever. It is a well recognised fact that scarlet fever in various epidemics exhibits different types.

I do not intend to discuss rubella in relation to this epidemic, though it is well known that rubella occurs in two types—the morbilliform, the usual type, and the scarlatiniform. The cases I propose to describe were seen by five or six medical officers, and all were agreed that the disease was not rubella, and indeed the high temperature range of over 104°F. in some of the cases, together with the free desquamation and presence of complications such as albuminuria, are sufficient evidence that the epidemic was not rubella.
The question then arises, Whether scarlet fever may be so modified by climates or other causes as to present symptoms indistinguishable from Dukes' "fourth disease"?

The ordinary mild type of scarlet fever presents the following features: The incubation is short, usually less than six days, and generally two or three days. Foord Caiger\(^1\) states, "I have never met with an instance in which there was any valid reason to believe that the incubation had been longer than six days." This is a point I desire to lay emphasis on in connection with the cases to be described. The onset is usually sudden; in addition to the ordinary febrile symptoms there are three pre-eruptive symptoms which are more or less characteristic of scarlet fever—i.e., sore throat, headache and vomiting. Out of 1,008 consecutive cases Foord Caiger found that vomiting occurred in no less than 80 per cent. The eruption usually appears on the first or second day of illness, and the pulse increases in frequency and the temperature reaches its maximum height about fourth day, after which defervescence sets in, the eruption fades, and the temperature generally reaches the normal by the end of first week.

As regards the chief symptoms: The face is generally flushed, and the region around the mouth is not invaded but is quite pale, in contrast to the flushed cheek; this circumoral pallor is an aid to diagnosis, more especially from measles. The rash usually appears on first day, and is fully developed by the fourth day; it is of a brick-red colour and consists of a punctate appearance, with, in addition, a general blush of erythema. The temperature rises rapidly with the onset, usually reaching 102° to 104° F. on the fourth day in mild cases, with subsequent gradual decline. A rapid pulse is quite characteristic of scarlet fever, more especially during the first or second day of illness. Desquamation is usually in proportion to the extent and severity of the eruption, large flakes usually peeling from hands and feet. The tongue at first is coated, but usually about the fourth day it becomes stripped of its epithelium and resembles a red strawberry; this symptom is quite characteristic of scarlet fever.

In the epidemic, which was described as scarlet fever, occurring among the 2nd Hampshire Regiment at Naval Hill, the first case reported sick on April 28th, 1908, and the last case on August 13th 1908; altogether 33 cases (including 1 death) occurred among the N.C.O.'s and men, and 3 cases among the children. The peculiar features of this epidemic were: (1) The comparative mildness of

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\(^1\) Allbutt's "System of Medicine," vol. ii., 1902.
the disease, several of the cases having a normal temperature throughout. (2) The absence of pre-eruptive symptoms—i.e., vomiting and headache—in almost all the cases. (3) The unusually low pulse rate observed in all cases. (4) The character and distribution of the eruption. (5) The character of the tongue. (6) The lengthened period of incubation (average fifteen days). (7) The universal enlargement of the posterior cervical and inguinal glands.

As regards the comparative mildness of the disease, I find on analysis of the 36 cases that in 4 cases the temperature remained normal or sub-normal throughout, though the cases were under observation from the first day of illness; in 2 other cases the maximum temperature recorded was 99° F., while in 14 cases it was 100° and in 24 cases 102° F.; in only 12 cases was a temperature of over 102° F. recorded, but in 8 of these the temperature reached 104° F. or over. As regards the duration of the fever, in 17 of the cases the temperature became normal on first or second day of illness, and in 28 cases the temperature fell to normal by end of third day; only 10 of the cases exhibited a temperature for more than three days, and with one exception the temperature in all cases reached normal by end of sixth day. As during the epidemic the regiment was medically inspected once or twice daily, it may be taken for granted that practically all cases were under observation from first day of illness.

As regards absence of pre-eruptive symptoms, i.e., vomiting and headache, a careful record was kept of all cases, and in only three was there a history of vomiting or headache, though in a few other cases headache was complained of after the appearance of the eruption.

I would particularly point out the marked slowness of the pulse in all the cases, even in cases where the temperature reached 104° F. or over. This is in marked contrast to what is usually noted in scarlet fever, where undue rapidity of the pulse-rate is generally noted, and, indeed, is often an aid to diagnosis. In four of the cases the pulse-rate did not at any time exceed 72.

In 18 cases the highest pulse rate recorded was 80 or under, while in 17 of the cases the highest was 90, and in only 2 cases did the pulse-rate exceed a 100.

As regards the appearance of the eruption, in many cases the rash was the first sign of illness, and in only a few cases was the rash delayed to the second or third day. As a rule the eruption appeared first on the sides of the neck and chest, extending to the abdomen and thighs, being particularly well-marked in the groins.
The rash was scarlatiniform, brick red, erythematous, somewhat punctate, but inclining to leave white patches of skin here and there. In many of the cases no rash could be observed on the arms and legs, and no definite rash could be detected on the face, which was flushed, but in these cases there was a marked absence of the circumoral pallor, so frequently observed in scarlet fever. Desquamation was observed in practically all the cases, and generally of a mealy type on the trunk but somewhat flaky on the hands and feet, and in some cases was not completed until the sixth week.

In some cases the tongue presented a normal appearance throughout the disease; in the majority, however, the tongue was coated but did not peel as in scarlet fever, and in only 4 of the cases was the typical strawberry tongue of scarlet fever noted.

In the first 6 cases enlargement of the glands was not looked for, but in the remaining 30 the posterior cervical and inguinal glands were distinctly enlarged, but tenderness was not complained of except in the case of a child, where the posterior cervical glands were distinctly enlarged and painful the day previous to appearance of the eruption.

A point to be particularly noted in connection with this epidemic was the lengthened period of incubation—seven to twenty-eight days—determined in individual cases where previous contact could be proved, as well as from the intervals between the occurrence of cases in the same barrack-rooms. I may mention that during part of the epidemic period the regiment was under canvas, but as each company was kept distinct they may be regarded as occupying their Company barrack-rooms, more especially as during this period the different companies did not mix but carried out their company training separately. I only give particulars of the incubation period observed during the first three months of the epidemic, as towards the end battalion training was carried out, and consequently it was difficult to prove contact. On the occurrence of a case in barracks, the room, kit, and bedding were disinfected in accordance with regulations (Army Medical Service), all blankets being washed in cresol solution. As bearing on this lengthened period of incubation the following points are of interest: On April 7th an additional blanket was issued to each man in the regiment; these blankets (to be afterwards remarked on) were probably infected and the origin of the epidemic; on April 28th the first 2 cases occurred, both from different barrack-rooms, and within a week 5 more cases were noted also from separate barrack-rooms. Six Companies furnished 2 or more cases, and the number
of days interval between the cases was found to be as follows (disinfection being carried out after occurrence of each case):—

A Company. Number of cases, 2. Days interval, 24.
B " " " " 3. " " 5, 4.
D " " " " 5. " " 20, 13, 5, 14.
E " " " " 2. " " 7.
G " " " " 4. " " 10, 3, 11.
H " " " " 5. " " 19, 9, 17, 9.

The average incubation period was twelve days.

During this period six barrack-rooms furnished two or more cases, and the average interval between the occurrence of cases was found to be fifteen days, corresponding very closely with the company outbreaks.

No. 4 Barrack-room. Number of cases, 4. Days interval, 13, 13, 6.
" 10 " " 3. " " 20, 16.
" 12 " " 2. " " 23.
" 13 " " 2. " " 5.
" 16 " " 2. " " 11.
" 23 " " 2. " " 27.

This lengthened period of incubation was also observed in individual cases, where previous contact could be definitely proved; but the following examples will suffice:—

1) Three men occupied same tent from May 9th, 1908. No. 1, Private L., developed scarlet fever on May 17th, 1908, and was isolated in hospital the same day; the two contacts were isolated after disinfection of tent, kits, &c. The isolation was thorough, the men being struck-off duties and not allowed to mix with the regiment. No. 2, Lance-Corporal B., contracted scarlet fever on June 1st, 1908, so that the incubation period in this case must have been sixteen days. No. 3 did not contract the disease.

2) Towards end of epidemic two members of the same family contracted the disease. D. B., aged 3, sickened with scarlet fever on July 21th, 1908; up to this date she occupied the same bed with her elder sister, L. B. The case was isolated, and on August 8th, 1908, L. B., aged 4, developed symptoms of scarlet fever, so that it would appear as if the incubation period in this case must have also been sixteen days.

The following are examples of the cases observed during the epidemic:—

Case 1.—Private J. April 28th: sore throat, red punctate rash on trunk and limbs, none on face; no prodromal headache or vomiting; temperature, morning, 97.6° F., pulse 66; evening, 99° F., pulse 72. April 29th: temperature, 98.8° F., pulse 66; evening, normal; furred tongue. April 30th: temperature normal, rash faded. Subsequent desquamation.

Case 2.—Private N. May 15th: no prodromal vomiting; red punctate rash on chest and abdomen; coated tongue; sore throat; enlarged
posterior cervical glands; temperature, morning, 98.6°F, pulse 72; evening 99°F, pulse 74. May 16th: rash more marked and extending to limbs; temperature, morning, 98.2°F, pulse 74; evening, 98.4°F, pulse 74. May 17th: rash still marked; tongue normal; temperature, morning, 99°F, pulse 72; evening, 99.2°F, pulse 72. May 18th: rash fading; normal temperature. Subsequently desquamated.

Case 3.—Private H. June 15th: tonsillitis; no history of vomiting; enlarged posterior cervical glands and inguinal glands; red punctate rash on chest and abdomen, none on limbs or face; temperature, morning, 100°F, pulse 78; evening, 104.4°F, pulse 104. June 16th: rash extended to limbs and “blotchy” in parts; throat better; temperature, morning, 103°F, pulse 104; evening, 103°F, pulse 104. June 17th: temperature, morning, 98.4°F, pulse 68; evening, 101°F, pulse 84. June 18th: rash fading; temperature, morning, 99°F, pulse 72; evening, 100°F, pulse 80. June 19th: temperature, morning and evening, 99°F, afterwards normal; subsequent general peeling.

Case 4.—Private G. June 11th: sore throat; furred tongue; headache; temperature, morning, 101.8°F, pulse 76; evening, 101.6°F, pulse 76. June 12th: faint red rash noticed this evening on upper part of chest and neck: temperature, morning, 103°F, pulse 78; temperature, evening, 103.4°F, pulse 78. June 13th: red punctate rash well marked on trunk and extremities; throat better; enlarged posterior cervical glands; temperature, morning, 102°F, pulse 76; evening 102.6°F, pulse 78. June 14th: rash fading; tongue peeled—typical strawberry tongue; temperature, morning, 101.6°F, pulse 74; evening, 101.2°F, pulse 74. June 15th: temperature, morning, 99.4°F; evening, 99°F. June 16th: normal temperature with commencing desquamation, which subsequently became general.

Case 5.—Private T. June 16th: sore throat; normal temperature; no vomiting; no rash. June 17th: red punctate rash on trunk and extremities; furred tongue; temperature, morning, 98.6°F, pulse 66; evening, 98.6°F, pulse 63. June 18th: rash well marked; temperature, morning and evening, normal; pulse 68. June 19th: rash fading; tongue clean; normal temperature. Subsequent general desquamation.

Complications: Of the 36 cases, 5 had albuminuria, and 3 developed otorrhœa. As regards the origin of the epidemic, the following particulars are of interest:—

Milk could be excluded, as condensed milk is used in barracks. A few cases were returned as scarlet fever among the civil population in Bloemfontein (two miles distant) previous to the outbreak at Naval Hill, but careful investigation failed to prove any contact with them. It was known that the regiment was free from scarlet fever up to the middle of April, as for various reasons it was under medical observation, and no signs of any infectious disease were
noted. I consider that the epidemic originated by means of infected fomities—i.e., blankets, and that this was the origin will, I think, be apparent on perusal of the following:

1. On April 7th, six Companies were issued an extra blanket per man (these blankets were partially worn and had been returned from outlying stations to ordnance store, but beyond the fact that they had been in store for one or two years, further information could not be obtained). On the same date the remaining Company (C Company) was issued perfectly new blankets from local barrack-store (this was the only Company which received unused blankets). On April 28th, i.e., twenty-one days after the issue of those blankets, two cases of scarlet fever reported sick, both from separate barrack-rooms, and within a week four more cases were detected, also from different barrack-rooms; therefore, the infection was widespread.

2. The incubation period of twenty days also agrees with the lengthened period of incubation observed from cases during the epidemic.

3. Seventeen of the occupied barrack-rooms furnished one or more cases; the remaining five occupied barrack-rooms which did not furnish any cases, were occupied as follows: one room by the band, one room by transport, and the remaining three rooms by C Company; furthermore, all Companies, with the exception of C Company, furnished three or more cases. As regards C Company one case only occurred (the last case of the epidemic), and in this case the diagnosis was doubtful, as beyond a slight erythematous rash the case presented no symptoms and the temperature was normal throughout. Even if the diagnosis was correct in this case, the fact remains that C Company, occupying three barrack-rooms, furnished only one case, and this the last of the epidemic. As regards the band room not furnishing a case, it may be due to the fact that in this barrack-room all blankets and bedding were exchanged on June 5th, this being the only room in which bedding was changed during the period of the epidemic.

4. Only three children among the married families contracted the disease, and this towards the termination of the epidemic, the infection being traced to indirect contact in one case, and in the remaining two cases to direct contact with the first. A point to be noted in connection with this is that the married families were not issued with extra winter blankets.

5. The only other barrack-room in the Hampshire lines is occupied by a detachment of the Royal Engineers. This detachment
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did not receive the extra blanket (winter issue) and did not furnish a case of scarlet fever.

(6) A second thorough disinfection of blankets and bedding was carried out in July, all blankets (about 4,000) being soaked in cresol solution, and from this date only one case occurred; this, I consider, lends additional support to infected blankets being the cause of the outbreak.

Preventive methods: On the suggestion of the Principal Medical Officer, South Africa, I add a few notes on the measures taken to stamp out the epidemic. Owing to the widespread nature of the epidemic, and partly also to the mild type of some of the cases, it was found particularly difficult to stamp out the disease, more especially as it was some time after the epidemic had well started that I was in a position to trace its origin to the issue of infected blankets.

Of twenty-two barrack-rooms occupied by the 2nd Hampshire Regiment, seventeen rooms furnished one or more cases, and taking this into consideration I consider the regiment fortunate in escaping with 33 cases, more especially as regimental training was practically not interfered with.

The origin being widespread, it was found that prompt isolation and disinfection on the occurrence of a case, though undoubtedly preventing the development of cases in the same barrack-rooms, yet were not sufficient, as cases continued to occur in other barrack-rooms, and consequently more active measures had to be carried out. Previous to this outbreak sore throat was somewhat prevalent, and this may have acted as a predisposing factor to the occurrence of scarlet fever or a similar disease.

The first two cases occurred on April 28th, 1908, both from different barrack-rooms. The cases were immediately isolated in hospital, the patients' kits and bedding were passed through the Thresh disinfector; all contacts were isolated and kept under medical observation, and all their bedding, &c., were exposed to the sun daily.

The third case reported sick May 1st, from a different barrack-room. On the occurrence of this case the bedding and kits of the barrack-room were disinfected, and recognising that the disease might be widespread, medical inspection of the regiment was carried out daily, and as a result one case was detected on May 3rd, and two more on the following day; so that on May 4th six cases from five separate barrack-rooms were in hospital diagnosed as scarlet fever, and therefore 150 N.C.O.'s and men
were contacts. For this reason and also owing to the large number of married families occupying quarters near barracks, it was considered advisable to remove all contacts from barracks and place them under canvas, so as to enable the infected rooms and bedding to be thoroughly disinfected. A camp was pitched the same day and the contacts were moved the same afternoon.

Fresh blankets were supplied for use in the camp and all personal kits were disinfected in the Thresh machine. Subsequently the vacated rooms were disinfected, all woodwork and floors were scrubbed with cresol solution, and walls and ceilings were freely sprayed with formalin. For this purpose an American spray was purchased which was found to work admirably. All blankets in infected rooms were soaked in cresol solution and afterwards exposed all day to the sun; bedding and kits were also passed through the Thresh disinfector. The contacts were kept isolated in camp but carried out their military training.

Within a few days three more cases occurred in barracks; as these also came from different barrack-rooms the remaining men of the battalion were ordered into camp, and the following recommendations approved by the Senior Medical Officer were forwarded to the Officer Commanding.

(1) The regiment is to be placed under canvas on a site selected, and sufficient bell tents are to be provided to accommodate three men per tent, so as to give adequate air space and thus lessen the spread of the disease.

(2) Fresh blankets are to be drawn for use in camp. All bedding, &c., in barrack-rooms are to remain therein until disinfected under medical arrangement.

(3) Three separate camps are to be formed so as to enable contacts from infected barrack-rooms, non-contacts and the draft to be more efficiently isolated.

(4) All officers, N.C.O.'s, and men are to be medically inspected daily.

During the period the troops were under canvas all barrack-rooms, bedding, &c., were disinfected in accordance with regulations (Army Medical Service).

Cases continued to occur in camp, but this was due to the disease having been contracted before going under canvas. The proceedings adopted on the occurrence of a case in camp were briefly as follows: The patient was isolated in hospital; the kits and bedding of the patient and the two contacts who occupied the tent were passed through a Thresh disinfector, the tent was struck,
freely sprayed with formalin and exposed all day to the sun. The contacts were isolated and kept under medical observation for fourteen days. This was effectual as only one contact case subsequently developed the disease while in camp.

On May 24th the Officer Commanding was informed that the troops might return to barracks, the last case having occurred on 15th instant; but for military reasons the troops remained under canvas for some days longer.

While troops were isolated under canvas the same measures of disinfection were carried out in vacated barrack-rooms as previously described, special attention being paid to the men's reading-room, all papers and magazines being burned, so that as far as practicable the barracks should have been free from infection when the regiment returned from camp; yet notwithstanding all these precautions, when the barracks were again occupied, cases again began to occur (after an interval of twelve days). This may, I think, be accounted for owing to the insufficient period of quarantine (eight days), as the incubation period in this epidemic was found to be from seven to twenty-eight days; and also, as over 3,000 blankets had to be disinfected, in addition to kits and bedding, it may be possible that some were overlooked.

In July cases again became frequent, and it seemed as if the epidemic would again become widespread. With the permission of the Senior Medical Officer, I again started disinfection of barracks. Three barrack-rooms were disinfected daily, the floors and woodwork being again scrubbed with cresol and the walls with formalin, all kits and bedding were disinfected in accordance with regulations, and all blankets in barracks were washed in cresol under regimental arrangements, and reliable N.C.O.'s were told off to see that none were omitted. These measures were entirely successful as from the date this disinfection was carried out, only one case occurred. During the period of the epidemic, Major Buist, R.A.M.C., Specialist Sanitary Officer, visited Naval Hill in reference to this epidemic and reported that the precautions taken were thorough and comprehensive.

Conclusion.—Though the epidemic resembled scarlet fever in many particulars, and the cases were so diagnosed, yet few, if any, of the cases were typical, and this was observed from the beginning. Taking the epidemic as a whole the cases from a clinical aspect corresponded with the so-called "Fourth Disease." Want of space prevents my detailing the clinical records of more of the cases. The epidemic, owing to its peculiar features, is of sufficient interest to be briefly recorded.