

VARIOLA MINOR, A TRUE TYPE OF SMALLPOX WITH
SPECIAL REFERENCE TO A RECENT OUTBREAK.

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INTRODUCTION.

For the past few years considerable attention has been directed towards the outbreaks of smallpox in various parts of England and Wales. These have caused great expense and inconvenience to the communities concerned. The type of disease has been mild, differing in some points from the classical type, and giving rise to a great deal of discussion as to whether we are not encountering a different disease.

Although in vaccination we have a prophylactic remedy capable of stamping out smallpox, the laxity with which our present vaccination laws are framed has caused large numbers of our population to be unprotected, forming an apparently inexhaustible reservoir which affords material for epidemics to recur. These epidemics if left alone increase rapidly, may become seasonal, and may even, in some cases, take on an endemic character.

As an Assistant Medical Officer of Health for Derby, I have been in touch with one of these outbreaks of smallpox, one which has now lasted some four years and which has every appearance of continuing.

In this thesis I propose to describe my experiences /

experiences in connection with the outbreak, my observations being based on nearly two thousand cases of the disease. It shall be my endeavour to prove the important fact that we are dealing with true smallpox. Further, as vaccination and smallpox are so closely connected, I also propose to discuss some of the problems arising with regard to the former.

In conclusion, the material for this thesis is drawn entirely from personal observations, for which I alone am responsible. These are purely clinical in character owing to the lack of any laboratory facilities.

H I S T O R I C A L.

The history of smallpox is full of interest. In the following survey special prominence will be given to the change in virulence of the disease, which at the present time is causing a considerable amount of discussion. It will be convenient to sub-divide into:-

- (a) The Pre-vaccination Period.
- (b) The Post-vaccination Period.

THE PRE-VACCINATION PERIOD.

As is well-known, smallpox or variola in its classical or severe form has been with us for centuries. Epidemics, with high mortality rates, have ravaged different parts of the world from time to time; all classes of persons were affected, royalty being no exception. Preventive treatment was entirely unknown. At the beginning of the 18th century, however, a form of inoculation was practised in the Near East. In the year 1714, the Philosophical Transactions of the Royal Society contain a letter from a doctor in Constantinople describing inoculation against smallpox, and stating that the Circassians had introduced the practice about 40 years previously.¹ He stated that severe cases were rare. Greek women performed inoculation, /

inoculation, using the matter from an early vesicle before the contents had become purulent.

In 1717, we have Lady Mary Wortley-Montague, wife of the British Ambassador in Turkey, declaiming the virtues of this method of inoculation. She used her influence to bring this form of preventive treatment into England. The disease was certainly milder when directly inoculated into the skin than when it occurred naturally, but inoculation never became popular owing to the fact that several deaths were due to it. It also caused transmission of the disease. Considering that aseptic principles, as we know them, were then unknown, it is not surprising that unfortunate accidents occurred.

The great landmark in the history of the disease is Jenner's discovery of vaccination in 1796 which brings us to the Post-vaccination Period.

POST-VACCINATION PERIOD.

In the years that preceded Jenner's discovery and in those which followed, the virulence of the disease was always very marked. Jenner's discovery was of incalculable importance. Here was an absolute preventive against variola. As knowledge of its efficacy in preventing smallpox spread, it was adopted in all countries as the best means of combating/

combating the scourge. Later, it was found that re-vaccination was necessary for continued immunity.

Passing over the various acts relating to vaccination, which first made inoculation illegal, and later made vaccination compulsory, we come to the Act of 1898, which allowed conscientious objection to vaccination. During this time various epidemics occurred, that of 1870-73 being the most severe. In this epidemic smallpox mortality is said to have reached its highest point. In spite of continual object lessons regarding the efficacy of vaccination and re-vaccination, opposition to the measure increased, until we see to-day, as the result of apathy and prejudice, large numbers of the populace unprotected. After the great epidemic of the 'seventies, later epidemics showed a lesser virulence.² From the beginning of the present century the country has been remarkably free from severe visitations, but since the Great War an increase in smallpox has become apparent. The following figures taken from Sir George Newman's report "On the State of the Public Health", 1926, serve to show this.

<u>Year</u>	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926
<u>Cases</u>	<u>7.</u>	<u>63.</u>	<u>311.</u>	<u>280.</u>	<u>336.</u>	<u>973</u>	<u>2,504.</u>	<u>3,797.</u>	<u>5,354.</u>	<u>10,141.</u>

The character of this type of smallpox has been, and is, predominantly mild, with an almost negligible death-rate, /

death-rate, but occasionally severe cases resembling the classical type occur. Concurrently with the mild form of the disease, occasional outbreaks of the classical or severe type have been noted. These latter were due to imported cases, and are characterised by their high virulence and high mortality rate.

When this mild smallpox first appeared, it was thought that the differences which were noticed were sufficient to warrant the disease being considered more akin to the Alastrim type - a type known for years previously as being endemic in Africa and Brazil - than the disease we knew as smallpox. Copeman⁶ (1919) in reporting these cases referred to them as cases of "anomalous varioloid disease". He gave it as his opinion that in all probability under special circumstances, "various stages of varioloid disease may originate between that type to which the name of Alastrim has been given, and that which in this country is ordinarily regarded as typical smallpox."

The occurrence of this mild type of smallpox has produced two opinions. One is that smallpox of the classical type, and the mild smallpox, variously termed "alastrim", "amaas", "para-smallpox" etc. by different observers, are one and the same, and only differ in virulence. Those holding this view have been termed the "Unicists" (Jorge) in contradistinction to/

to the "Dualists" (Jorge) who hold the opposite view that the two types are quite distinct diseases, and have no connection with each other.

This division is very important from the administrative aspect. The former class hold, and quite truly, that the disease being smallpox should be treated and controlled as such, whilst the latter hold that, the two diseases being different, all the administrative requirements necessary for smallpox are useless and superfluous. Among the foremost upholders of the dualist opinion, are Prof. Ricardo Jorge (Lisbon) and Garrow, M.O.H. for Chesterfield. Jorge⁷ holds that the gravity of the disease should be a deciding factor in distinguishing the two. In alastrim, he says, there has been a universal benignity which is quite different from the disease of the classical type, with its invariable high mortality. He is also of opinion that vaccinia cannot serve as the crucial test of identification. With Paul's test he found the reaction inconclusive. In Switzerland the test was found to be positive in many cases. Jorge, however, states this was not conclusive as Baujean said that, according to the German statistics, the test coincided with a clinical diagnosis of smallpox in only 77%. Animal inoculations seemed to be unsatisfactory. He applied the alastrim virus to the shaved and scarified skin of rabbits/

rabbits with negative results. The results of experiments on other animals were "confused and contradictory."

Garrow in several papers, puts his views in no uncertain manner. He prefers the name of "Para-³ smallpox" in dealing with this disease. In 1925, he says that he recognises in Para-smallpox "a definite clinical entity, an acute specific infectious disease, separate and distinct from smallpox - a disease fixed in type, and not tending to assume the virulence and acquire the death-dealing and disfiguring properties of smallpox."

Later, in 1927⁴, he argued that the susceptibility to vaccinia of persons recently recovered from mild smallpox (Para-smallpox) was a point of great importance in determining that mild smallpox and smallpox are not identical diseases.

On the other hand, we have the work of M.H. Gordon (1925)⁵, which, whilst not giving a final verdict, lends support to the Unicist conception. He attacks the problem from the standpoint of the serologist. He quotes Blaxall, who compared the virus from cases of alastrim and variola respectively. Blaxall found that both alastrim and variola viruses were alike in producing a papulo-vesicular lesion on the skin of the monkey, and in failing to do so on the skin of the calf or rabbit. Either of these two variola viruses /

viruses protected the monkey against vaccinia, and conversely vaccinia protected against both of them. By increasing the virulence of both kinds of variola virus for the calf, he succeeded in producing typical lesions of cow-pox. Also, by employing the specific test of allergy, introduced by v. Pirquet, he showed that the viruses of vaccinia, variola, and alastrim, behave alike but are sharply differentiated from that of varicella.

Gordon confirmed Blaxall's work, and further found, on the result of a single observation, that the virus from a case of confluent smallpox was decidedly more virulent than that of alastrim when both were tested on the skin of the same monkey.

Ledingham, quoted by Gordon, says that in his view the three viruses, alastrim, variola, and vaccinia, are all examples of one and the same virus. He considers the difference between them can be explained on the grounds that they are merely instances of variation, analogous with certain features shown by non-toxic and non-virulent varieties of bacteria generally.

Gordon's work up to the present has failed to establish any certain and fixed point of differentiation between the viruses of alastrim and variola, except in regard to virulence for the monkey. He prefers to suspend any final judgment as yet.

It/

It seems therefore that the relationship of alastrim or mild smallpox, or, as we shall term it, variola minor, and the classical type, or variola major, is not fully settled. We note that from the stand-point of the clinician and epidemiologist, we have still a conflict of opinion as to the nature of the present mild type of the disease. The serologist shows the virus of variola minor to be closely similar to, if not identical with, that of variola major, and that the two differ only in their respective virulence to man and animals.

I shall endeavour to show later in the paper that we are dealing with a true smallpox, albeit of a mild variety - i.e. Variola minor.

EPIDEMIOLOGICAL FEATURES OF THE OUTBREAK.

The outbreak of smallpox commenced in April 1924. It continued throughout that year and succeeding years, and is still fitfully proceeding (1928). The statistical account, however, will be taken up to the end of 1927, when a total number of 1850 cases of smallpox were notified.

SEASONAL INCIDENCE.

The disease has been essentially one of the winter and spring months of the year. This is well illustrated in Chart I (appendix) which shows the number of cases at the end of each week during the years 1924-1927.

Leaving out 1924, in which year the epidemic began, and also, perhaps, 1927 which was a well-vaccinated year and consequently would not show such a well marked rise and fall, we are left with the two intervening years, 1925 and 1926. These show very well the seasonal prevalence of the disease. The greater proportion of the cases are seen to be notified during the first and second quarters of each year, with an upward tendency in the fourth and last quarter. The third quarter is characterised by the fewest cases being notified. Reference to Chart II, in which the cases of smallpox notified in England/

England and Wales are plotted in a similar manner, shows a similar seasonal incidence. This seems to be a natural feature of the disease.

This characteristic seasonal incidence may be explained by the fact that in the colder months of the year, the people being more closely aggregated together, the disease would have a greater chance of spreading in such an unprotected population as ours.

Rogers⁸, basing his deductions on his experiences in India in forecasting epidemics, concluded that seasonal prevalence is closely related to the absolute humidity. Low absolute humidity favours, and high checks, the disease.

AGE.

All ages were attacked, from the newly born babe to the nonagenarian. There were no deaths in the 1850 cases. The following table (I) shows the age incidence in the appropriate age-groups, together with the vaccinated state of the cases.

TABLE I./

TABLE I.

Age Group	1924.			1925.			1926.			1927.		
	Total Cases	Un-Vacc.	Vacc.	Total Cases	Un-Vacc.	Vacc.	Total Cases	Un-Vacc.	Vacc.	Total Cases	Un-Vacc.	Vacc.
0 - 5	14	14	-	66	66	-	63	63	-	6	6	-
5 - 10	27	27	-	115	115	-	125	125	-	31	31	-
10-15	71	71	-	154	153	1	175	175	-	14	14	-
15-20	30	30	-	142	142	-	142	142	-	33	33	-
20-25	26	25	1	84	83	1	80	80	-	12	12	-
25-30	8	8	-	40	39	1	29	26	3	8	8	-
30-35	3	3	-	27	26	1	22	21	1	8	8	-
35-40	6	3	3	19	9	10	20	11	9	2	2	-
40-45	6	4	2	16	7	9	19	12	5	1	1	-
45-50	5	-	5	24	10	14	29	15	14	5	1	4
50-55	6	2	4	19	7	12	23	5	18	7	4	3
55-60	7	1	6	14	5	9	13	4	9	3	2	1
60-65	2	-	2	10	2	8	11	1	10	2	-	2
65-70				11	2	9	4	-	4	1	-	1
70-75				4	-	4	3	-	3	1	-	1
75-80				1	1	-						
80-85												
85-90												
90-95										1	-	1
Totals	211	188	23	746	667	79	758	682	76	135	122	13

ALTERED AGE-INCIDENCE.

Taking the age groups 5-10, 10-15, i.e. children of school age, in Table I, there were 712 cases, giving a percentage of 38.4. Adding the cases from the age group 0-5 years, a total of 861 cases is obtained, giving a percentage of 46.4. It will thus be seen that we are gradually returning to the pre-vaccination era when smallpox was essentially a disease of children, and the adult population consisted, in the most part, of survivors from an attack in childhood. Taking the age up to 25 years as being representative of the younger portion of the smallpox cases, we have a total of 1413 cases, equalling 76.3%, or more than three-quarters of the total cases - further evidence that smallpox is becoming a disease of the younger members of the community.

INFLUENCE OF AGE ON THE SEVERITY OF THE DISEASE.

Age apparently had no influence on the severity of the disease, some of the worst cases occurring amongst babies (in one case, a baby, 16 days old, lost an eye) and young adults, and amongst sexagenarians and septuagenarians.

VACCINATED CONDITION OF THE CASES.

Reference to Table I shows that 191 of the cases were vaccinated giving a percentage of 10.3. With one exception none of the cases who were vaccinated within/

within 20 years took the disease. The exception was a schoolgirl of 13 who was vaccinated in infancy. The disease was extremely mild. Ten years would therefore seem to be the limit of immunity, after which re-vaccination would be necessary. In practice I would, however, prefer 7 years as the limit to ensure absolute safety.

SEX.

The sexes were equally affected. In the 1850 cases notified, 929 were males and 921 were females.

SANITARY CONDITIONS.

No connection could be traced between the disease, and housing conditions and sanitary conveniences. Secondary cases of course occurred more frequently in overcrowded dwellings. The disease was no respecter of persons, except in the case of those who were protected by previous vaccination. On the whole, the disease has been confined to the working-class population, who, as a class, are more unprotected than the rest of the community.

DISSEMINATION.

In the whole experience of the outbreak no proof could be found that either clothing or books were infecting agents. Houses, as a matter of routine, were stoved, clothes disinfected, and books destroyed, but/

but secondary cases always recurred with clockwork regularity provided the victims had received a sufficient dose of infection from personal contact with the primary cases, i.e. direct infection.

The cases were found to be most infectious during the final hours of the prodromal period which preceded the rash, and the first few days after the rash had appeared. Spread was by means of "droplet infection". A clear history of intimate contact could nearly always be obtained. Overcrowded bedrooms, and the kitchen in which the family lived together during the greater part of the day, were the chief centres of spread. If a young boy or girl was the primary case, the brother or sister who slept in the same bed was almost invariably the second case. Occasionally all the members of the family would be struck down at the same time, pointing to a common source of infection, but the usual way was for the disease to spread from one unprotected member of the family to another, corresponding to the closeness of contact, this process often occupying several weeks in large families.

INCUBATION PERIOD.

The length of the incubation period is most important if the disease is to be properly controlled.

In a series of cases where the dates could be relied/

relied on, the average duration of the incubation period was 14 - 16 - 17 days, counting from the date of exposure to the first day of the premonitory symptoms. In one case the incubation period was found to be 22 days.

When the disease invaded a ward of the Infirmary, as it did on several occasions, the ward was always quarantined for three weeks.

SEVERITY.

Variola minor has been classed as a mild disease by most authorities, and the present outbreak has been no exception to the general rule, but a proportion of the cases have had the disease in a severe form comparable to what is seen in the classic type of the disease. These cases were characterised by the eruption being semi-confluent on the face, and discrete in the other parts of the body, though not a single square inch of the skin surface escaped. The characteristic odour was noticed on several occasions. Practically all these cases showed a secondary rise in temperature.

In the following arbitrary classification of cases into 3 divisions according to severity, chief reliance is placed on the clinical condition of the patient. The number of spots also affords a good guide. It was found that the prodromal period bore no relation to what was coming; a sharp invasion period/

period often resulted in only a few spots coming out. In a "mild" case the number of spots ranged from 2 to 200 or 300. In a "severe" case the number of spots would range between several thousands, the face being usually semi-confluent. A marked secondary rise in temperature was a feature, and the patient was often acutely ill. Delirium was occasionally present.

The third and final division is the "moderately severe". In this, the number of spots is the chief feature. The cases are usually well covered with the rash, but the patients themselves are apparently well, and have had no secondary rise of temperature.

Taking the above classification, the following were the results in the years under discussion.

TABLE II.

CASES.

Year	Mild	Mod. Severe	Severe	
1924	190	19	2	
1925	690	48	8	
1926	709	36	13	
1927	123	9	3	Grand Total
Total Cases	1712	112	26	1850

The table shows that out of 1850 cases -

1712 cases were classed as "mild" which equals 92.5%

112 " " " "moderately severe" " " 6%

26 " " " as "severe" " " 1.4%

CLINICAL FEATURES OF THE DISEASE.PRODROMAL PERIOD.

In describing the clinical features of the above period, it is well to remember that as an official of the Health Department, I usually came into contact with the case when the rash became visible, i.e. when the prodromal period was over. Fortunately, however, owing to the kindness of various medical practitioners and owing to the fact that we quarantined a fair number of direct contacts who ultimately developed the disease, I was able to see a number of patients in the first stage.

The prodromal period shows a characteristic picture. The commonest symptoms complained of were those of.-

- (a) Headache.
- (b) Backache and pain in the limbs.
- (c) Sweating.
- (d) Fever.
- (e) Vomiting.

Of these the first four were fairly constant symptoms. Vomiting was not so constant, but was often complained of. In about 2% of the cases I found that epistaxis was a peculiar symptom.

Describing the symptoms more fully, it was found that/

that headache was frontal in situation. Very often it was intense, and was the symptom most complained of. Very occasionally, a history of headache alone was given.

Backache was a fairly constant feature, and was often diagnosed as lumbago. Very often the pain radiated to the legs.

Sweating was marked in nearly all the cases. It was often intense, and the garments would often be found wringing wet.

Fever was almost always present and often ushered in by a rigor. It was often high, reaching 104° in several cases. Rarely, no temperature was recorded. The temperature chart showed no characteristic curve, but the temperature would rise fairly rapidly, keep at a moderately high level for one, two, or three days, and then come down by rapid lysis.

The dictum that a sharp prodromal attack would lead to a severe rash stage was very often falsified.

Pain in anomalous situations.

Pain on several occasions was marked over the abdomen. In one case, Case No $\frac{46}{1928}$, this led to a diagnosis of appendicitis. Operation was performed, and the appendix was found healthy. Two days later the rash appeared; a sharp case resulted, with uneventful recovery.

THE INTERVAL BETWEEN THE ONSET, AND COMMENCEMENT OF
THE RASH.

The interval between the onset and the appearance of the rash was apt to vary. To ascertain this more or less exactly 600 consecutive cases were taken and the interval noted. The following table shows the result.

TABLE III.

Interval in Days	No. of Cases.	Percentages.
2	40	6.6%
3	237)	77.3%
4	227)	
5	64	10.6%
6	15	2.5%
7	9	1.5%
8	8	1.3%

From the above it will be seen that over three-quarters of the cases showed the interval to be between 3-4 days. It was usually found that concurrently with the fall in temperature the rash would begin to appear, but very often two or more days would elapse before this happened, the patients in the interval feeling quite well and ready to go to work.

THE RASH.DISTRIBUTION.

In a typical mild case the rash is mostly confined to the face and extremities, with occasional spots on the back and chest, and on the soles and palms. The abdomen is less affected than other parts of the body and is often entirely free from the rash. This accounts for the great majority of cases.

Points of selection when examining doubtful cases are over the region of the spine of the scapulae, and on the forehead.

In the severe cases the whole of the body is covered, including the scalp. ^{rash on the} The face is usually semi-confluent, and, very occasionally, confluent. On the other parts of the body the rash is discrete, with the individual pustules close together - occasionally two or three becoming confluent. The abdomen again is the portion least covered with the rash. It has been noted that the pustules have sometimes affected the hard and soft palate, as well as the conjunctivae.

Rickett's⁹ observation that the pustules tend to congregate where there has been some previous trauma, has been confirmed. A case in point was that of a boy (Case No. 8) who fell from his bicycle during the incubation period and injured his wrist and/

1928

and knee. Several days later when his smallpox rash developed, the pustules were prominently seen over the region of his injuries.

NUMBER.

Cases have occurred in the outbreak where only two or three pustules have developed. In the severe cases, counts up to thousands have been noted.

Between these extremes are the rest of the cases.

Although I cannot give direct evidence, I am of opinion that it is possible to have cases occurring with no spots at all.

DEVELOPMENT OF THE RASH.

STAGE OF MATURATION.

Taking a case of moderate severity as an example, the earliest phase encountered is when the rash is felt under the skin, on the hand being passed over. This can be felt immediately, or soon after, the defervescence of the prodromal period. In the first twenty-four hours a small hard papule appears, about the size of a pin's head, and is surrounded by an areola. This is typically seen on the extremities and occasionally on the chest. On the face, however, the rash is somewhat different. Small reddish papular areas are noticed; these stand out from the rest of the skin, which looks inflamed and presents/

presents a glazed appearance. The papules are hard to the touch. At this stage, if they are examined by means of a hand-lens, they are seen to possess on top a small vesicle with a slightly depressed centre.

The stages from papule to vesicle, and finally to the pustule, are very short, and often merge imperceptibly into each other, so that in about two days from the commencement of the rash small whitish-looking pustules have developed. These enlarge until about the fourth or fifth day, when in the case of the face, they have reached their full development. The face now presents a characteristic appearance. The skin is inflamed and shiny, the glazed appearance being very marked. Studded here and there are the pustules, each with their whitish or sometimes yellowish, contents. Practically all the pustules have reached the same stage of development at the same time, and have that hardness which is so characteristic. Very often the nose may be chiefly affected, and occasionally the ears have numerous pustules. In the most severe cases, when full development has been reached, the intense inflammation present causes marked oedema of the skin of the face and eye-lids. The eyes are hardly visible. The patient at this stage is acutely ill, and is often delirious, and the secondary fever is marked.

Returning/

Returning to the extremities, the pustules attain a larger size, a diameter of a quarter of an inch being fairly common. The areola is still present while the intervening skin presents its normal appearance. The pustules take three or four days longer than those of the face to reach full development. The colour of the contents is usually a dirty white. The shape of these pustules is fairly constant, being usually dome-shaped.

The pustules on the palms and soles develop to their maturity last of all. This step like development of the pustules according to their situation has been very characteristic in the present outbreak. It is thus very common to find that while the pustules on the rest of the body have disappeared, those on the palms and soles are still fully developed. This is probably due to the pustules taking longer to penetrate the thicker skin of these parts.

STAGE OF DESSICATION OF THE RASH.

After having attained maturity, the pustules slowly begin to shrivel up. The contents often escape, and form golden yellow crusts, whilst in other places the pustules dry up without bursting. This process takes about a week, and the same sequence as before takes place according to the situation of the pustules. By the end of ten or twelve days the face/

face is usually completely cleared of crusts, and their place taken by small circular reddish-purple areas, slightly elevated from the surrounding skin. Later, the extremities show a similar condition, except that the dried up crusts, forming a "seed" in the centre, remain longer; the scars also have a star-like appearance due to the broken edges of the epidermis at the periphery. These seeds when dry come away naturally, or can be easily picked out with a penknife. There are then left small round reddish-purple areas, with, occasionally, the silvery scales of the old epidermis still adhering. These latter ultimately disappear, leaving only the purple stains of the rash.

When lesions on the soles and palms occur, they are also very characteristic. They look like small brown seeds embedded in the skin, and often remain for a considerable time.

While this gives a general description of a typical case of moderate severity, the other cases vary within limits. In mild cases with few spots, the various stages described finish much earlier and leave hardly a trace behind, while in severer cases the stages are somewhat prolonged, and the purple stains often remain for several weeks. In some of the most severe cases, permanent pitting has occurred.

THE /

THE QUESTION OF CROPS.

Fresh crops of pustules did not occur in the mild cases, those with which the patient entered hospital being the only ones seen. In the severer cases, a fresh crop of pustules would appear, often accompanied by secondary fever. Later, odd lesions would continue to form, and this would often necessitate the patients' longer detention in hospital.

"SHOTTINESS" OF THE RASH.

While this was a feature of the great majority, I occasionally came across cases where the pustule seemed entirely superficial, and other factors had to be called in before a final diagnosis could be made.

UMBILICATION.

This was noticed in many cases, sometimes being specially marked.

IRRITABILITY OF THE RASH.

In mild cases, the rash seems to cause no discomfort except for an occasional slight itching during the development. In severer cases, the itchiness may be more pronounced.

Pain was never complained of anywhere, except on the soles of the feet. The development of pustules on this part always occasioned great discomfort and pain, and patients had to keep to their beds for no other reason.

THE SECONDARY FEVER.

This is confined to the most severe cases, and comes on a week or so after the commencement of the rash. In infants, apparently, there is often no secondary fever in spite of the severity of the symptoms. During this stage a fresh crop of pustules develops, the patient is acutely ill, and the temperature is high and may remain so for from two to four days. Delirium is frequently present. The face is oedematous, the eyes being half-closed owing to the oedema of the lids. The pulse rate is not high, considering how ill the patient looks. Insomnia is frequent, and has to be treated.

Cases which showed this fever were all confluent to semi-confluent on the face, while the rest of the body had a profuse discrete rash.

The characteristic odour, often found in severe cases of the classical type, was occasionally present.

Recovery was quick, after the fever disappeared.

COMPLICATIONS.(a) Eye Complications.

Only a small number were noted (.5%) to have the above. These all occurred in the severe cases. The conditions noted were chiefly severe conjunctivitis and an occasional corneal ulcer.

A case of keratitis causing partial blindness in one eye in a baby of seventeen days is noted.

(b) Smallpox occurring in Pregnancy.

Six women were pregnant on entering the hospital. Of these two were discharged with no complications occurring, though they had the disease fairly severely. One had a miscarriage at the third month, foetuses of twins being taken away. No complications ensued. I am of opinion that the disease had nothing to do with the miscarriage.

The remaining three were confined in hospital, one case being of twins. The confinement ended naturally in each case. Fuller details of these cases will be given later.

T R E A T M E N T.

In the majority of cases, there was none. Simple isolation alone was necessary.

Every case received frequent baths, which helped to subdue any irritation that was present. Severe cases, and those with a good rash on the face, were served with masks, during the period of full pustular development. These allayed irritation. Insomnia and delirium were appropriately treated. There was thus practically no drug treatment. Occasionally the pustules were painted with iodine. No treatment with Potassium Permanganate, which has recently been advocated in India, has yet been tried.

ALASTRIM OR VARIOLA?*? Alastrim?*

The characteristics of the disease which the Dualists consider essential in determining that alastrim and variola are two separate entities, may be summarised thus -

1. Age Incidence. Mainly attacks adults, and is less severe in children.
2. Mortality. Practically nil.
3. Prodromal Illness. Occasionally absent, but may simulate smallpox.
4. Rash.
 - (a) Crops. Tends to come out in successive crops, and is generally superficial in character.
 - (b) Distribution. Often first on trunk and chest, and then corresponds to smallpox.
 - (c) Vesicles. Not umbilicated. Dull white in colour, and of various shapes.
5. Secondary Fever. Absent.
6. Vaccination. Limited duration of immunity to alastrim conferred by vaccination, and the fact that it is possible to vaccinate patients successfully, shortly after an attack of the disease.

Discussing these characteristics from the view-point of the Unicist, and in the light of the Derby out-break, we find -

1. Age Incidence. The disease does not mainly attack adults. I have shown, from the figures in the present outbreak, that smallpox is becoming a disease of children and of the younger members of the population, as it was before the vaccination era. In severity also, children have suffered equally with adults.

Age incidence, however, cannot be taken as an important factor in distinguishing one disease from another. For example, measles in this country is regarded as a disease of childhood, but when the disease makes its appearance in a race unprotected by previous attacks, adults and children are equally affected, as happened when measles visited the Faroe Islands in 1846, and Fiji in 1875 and 1907.

2. Mortality. The difference in mortality rates between the two types of the disease is of course very marked, but the mortality rate cannot be taken as a crucial test in defining one disease from another. Take the case of scarlet fever. At the present time it is very benign with a very low mortality rate, but formerly the mortality rate was much higher, and yet/

yet nobody would think of putting the present mild type into the category of a new disease.

3. Prodromal Illness. Prodromal symptoms have been very marked in the great majority of the cases, and correspond to the major type of the disease.

4. Rash.

(a) Crops. I do not consider the question of crops is an important point, although it has been noticed in the present outbreak. The rash was not superficial in character, and corresponded to the classical type whenever the disease was severe.

(b) The distribution corresponded exactly to that of the major disease, the rash appearing first on the head and extremities, and being more marked in these parts in severe cases.

(c) With regard to the vesicles, umbilication was of common occurrence. This feature was occasionally repeated in the pustules. These latter varied in colour from a dirty white to golden yellow.

5. Secondary Fever. A varying degree of secondary fever was always present in the severe cases.

6. Vaccination immunises against both "alastrim" and smallpox. In the whole history of the outbreak, no person vaccinated within ten years has contracted the disease, in spite of constant exposure to infection in many cases.

Garrow, /

Garrow^{4.}, from a table showing that in vaccinating persons recently recovered from mild smallpox he obtained 95% successful results, concludes that immunity to vaccinia is of a very evanescent character.

Criticising this table, we find no mention is made of the severity of the disease in the cases concerned, although we know that it does occur in a severe form. Amongst the "successful vaccinated" cases, Garrow includes those showing very modified results. These can hardly be considered successfully vaccinated in the usual acceptance of the term.

I have collected material for a table which is similar to Garrow's, though it does not consist of so many cases as it has been extremely hard to get people to be vaccinated after recovering from the disease, and I consider the results of this table point to a different conclusion.

TABLE IV. /

TABLE IV.

Age and Sex.	Interval Between Smallpox & Vaccination			Result.	Severity of Disease.
	Weeks	Months	Years		
F. 50	3	-	-	-	Very Mild.
F. 12	4	-	-	-	" "
M. 7	4	-	-	-	" "
M. 11	4	-	-	-	" "
F. 20	-	3	-	-	" "
M. 12	-	6	-	-	" "
F. 11	-	8	-	-	" "
M. 26	-	8	-	-	Severe.
F. 11	-	8	-	+	Very Mild.
M. 13	-	10	-	+	" "
F. 13	-	18	-	-	" "
M. 11	-	18	-	-	" "
M. 36	-	-	1½	-	Severe.
M. 48	-	-	2½	+	Mod. Severe.
M. 9	-	-	3	+	Mild.
M. 3	-	-	3	-	Severe.
M. 7	-	-	3	+	Mild.
F. 35	-	-	3	-	Mod. Severe.
F. 5	-	-	3½	+	Mild.
F. 7	-	-	3½	+	"
M. 9	-	-	3½	+	"
M. 16	-	-	3½	+	"
M. 19	-	-	3½	+	"
F. 42	-	-	3½	+	Mod. Severe.
M. 45	-	-	3½	+	" "

NOTE. + = Successful Vaccination.
 † = Modified "
 - = Unsuccessful "

Analysis of the table brings out these interesting points -

1. All cases vaccinated a few weeks after the attack gave negative results, even in the mildest cases, showing complete immunity in the convalescent period.
2. Immunity may last for some months, this depending on the severity of the attack.
3. One case gave a completely positive result after an eight months' interval.
4. Severe cases vaccinated up to an interval of three years gave negative results.
5. Mild cases, vaccinated after an interval of three years, gave modified results.

I regret that this table is not larger, and am aware of the danger of deducing facts from a small series of cases, but as previously stated it was extremely difficult to get volunteers for vaccination in this town.

Looking at the facts shown in this table with due caution, I feel justified in considering that they indicate -

1./

1. That among the mild cases we will continue to get an increasing proportion of successful and modified vaccinations, as the time between the attack and vaccination increases.
2. From those who have had the disease very severely, negative results will, probably, always be obtained, and these persons will therefore be immune for life.

Apparently in the mild cases the immunising response on the part of the individual has not been great, and therefore would be quite capable of giving a modified or successful reaction to vaccination according to the interval that has elapsed. This brings us to the fact that the chief factor at work is the mildness of the disease.

From the foregoing criticism of the dualist conception, it will be seen that some of the differences which the dualist finds between "alastrim" and variola did not exist in the Derby outbreak. The remaining differences, in my opinion, can be completely accounted for by the mildness of the type, and this very mildness is at once the only real difference, and the cause of the superficial differences, between the two varieties.

C O N C L U S I O N S .

1. A recent outbreak in Derby, of Smallpox (variola minor) is described.
 2. The cases have been shown to be predominantly mild, but there has been a small number of severe cases of the classical type.
 3. The epidemiological features of the outbreak are described.
 4. Clinical cases are given illustrating the outbreak. These show that the likeness to the major disease is very marked.
 5. The differences between "alastrim" and variola have been discussed. It has been shown that many were non-existent in the outbreak.
 6. Finally, "alastrim" and variola are one disease. They differ only in severity.
-

REFERENCES.

1. Edwards: Smallpox & Vaccination in Europe. p.24.
2. McVail: Facts about Smallpox and Vaccination (Revised edition).
3. Garrow: Public Health 1925. "Parasmallpox" p.14
4. " Journal of R.S.I. Oct. 1927.
5. Gordon: Studies of the Viruses of Vaccinia and Variola. M.R.C. special report series No.98. 1925. with full bibliography.
6. Monckton Copeman. The Relationship of Smallpox and Alastrim. M. of H. Annual Report of Chief Medical Officer 1919-1920.
7. Jorge, R.: Alastrim and Variola. Special articles Lancet Dec. 20, 1924. p. 1317 and Dec. 27, p.1924, being a Translation from the Bulletin of the Office International d'Hygiene Publique, Paris, October 1924. tome XVI, No.10.
8. Rogers: Smallpox and Climate in England and Wales. Lancet Feb. 25, 1928, p.300.
9. Diagnosis of Smallpox. Ricketts and Byles.
10. Friedmann: An address on the epidemiology of children's infectious diseases. (Lancet, Aug. 4, 1928).

A P P E N D I X.

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CHART I

Outbreak of VARIOLA MINOR DERBY
 showing weekly Notifications 1924-1927.

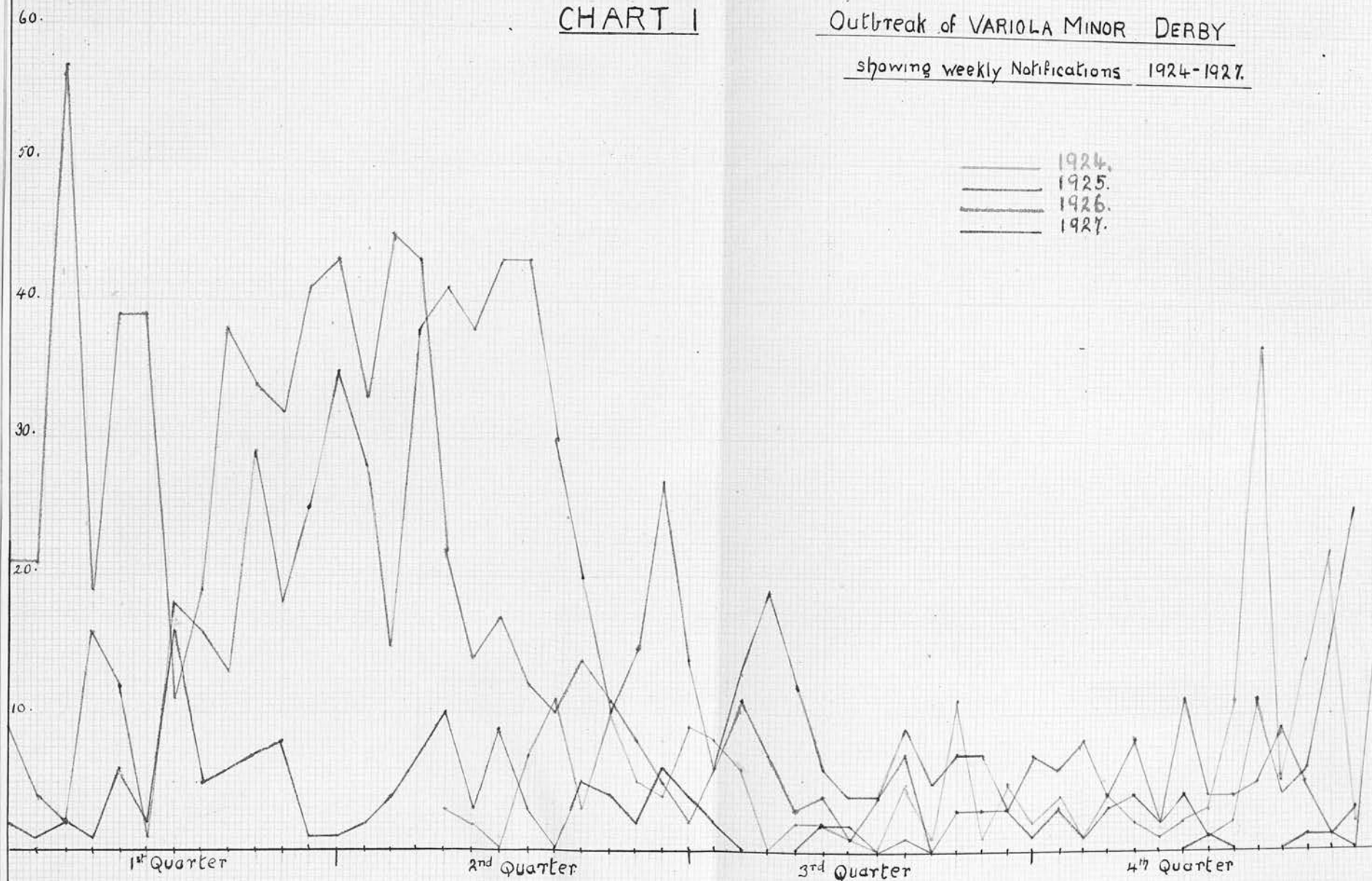


Chart 1 showing the seasonal incidence of the outbreak in Derby 1924-1927.

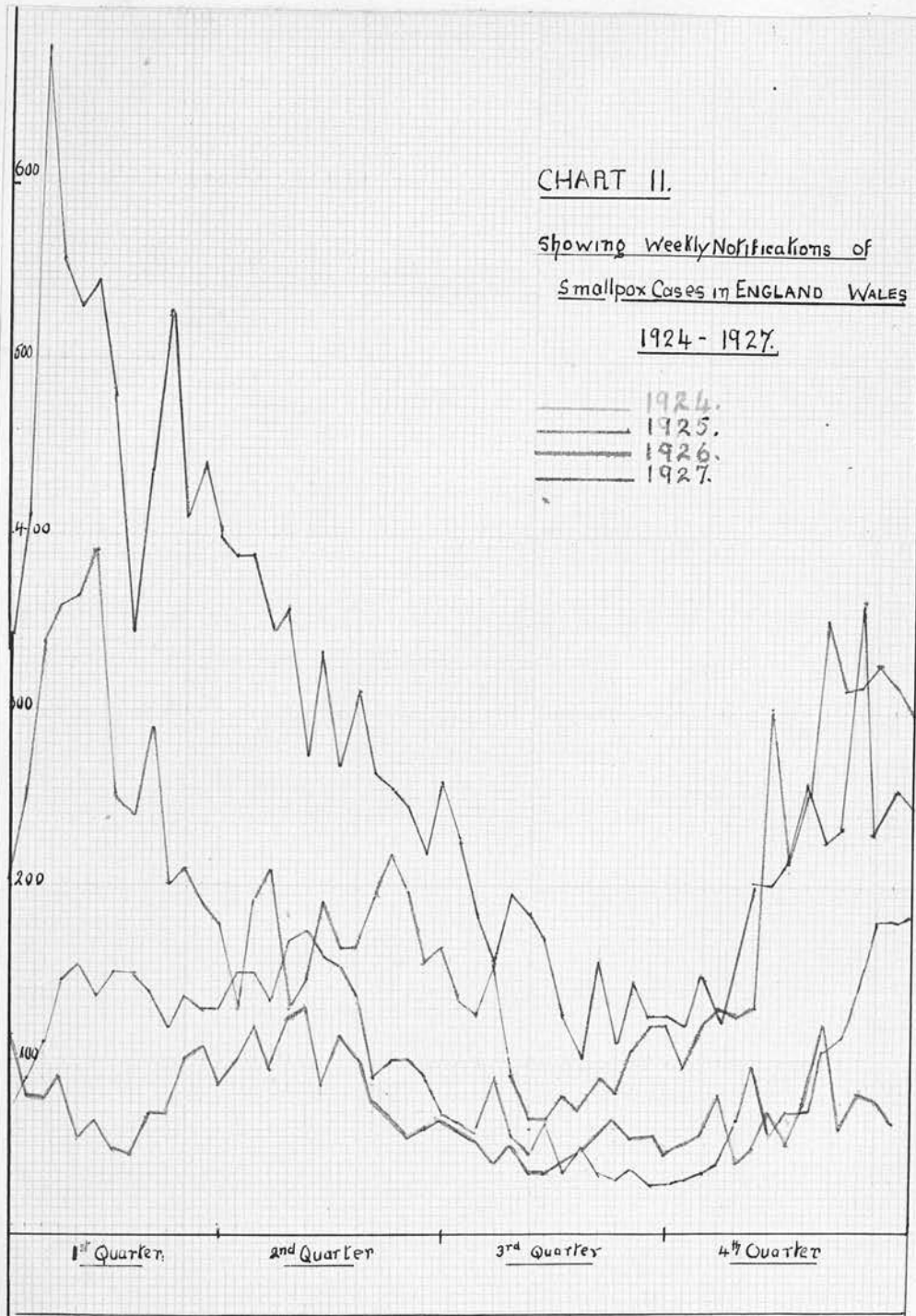


Chart II showing the seasonal incidence in England and Wales 1924-27. The similarity between the two charts is to be noted.

CLINICAL CASES,

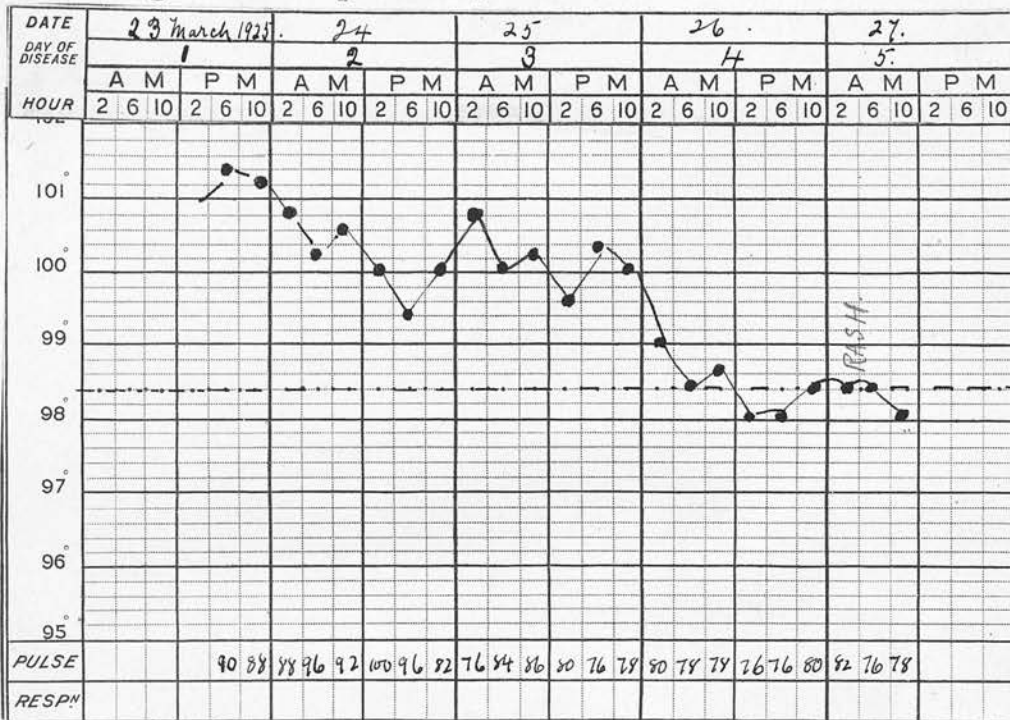
WITH NOTES AND PHOTOGRAPHS ILLUSTRATING SOME

OF THE POINTS REFERRED TO IN THE TEXT.

The following 6 cases occurred in the workhouse infirmary. It will be noted that all the cases were infected about the same time. These show the various phases that are met with in the prodromal period.

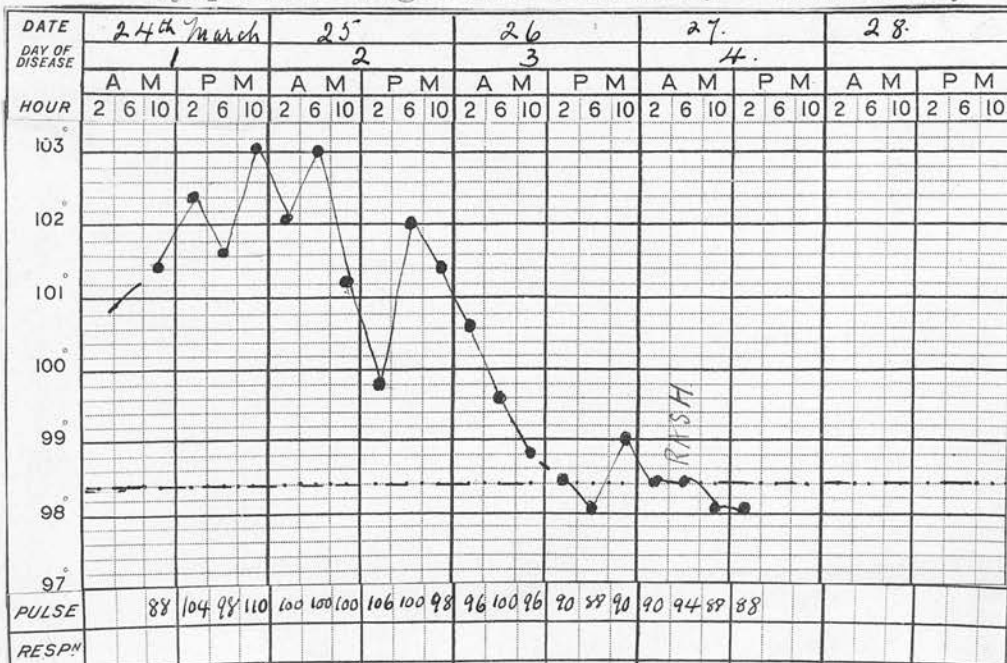
Case 1 ($\frac{185}{1925}$) Male, aet. 66, unvaccinated.

Symptoms. Slight rigor and headache. Fairly good rash present.



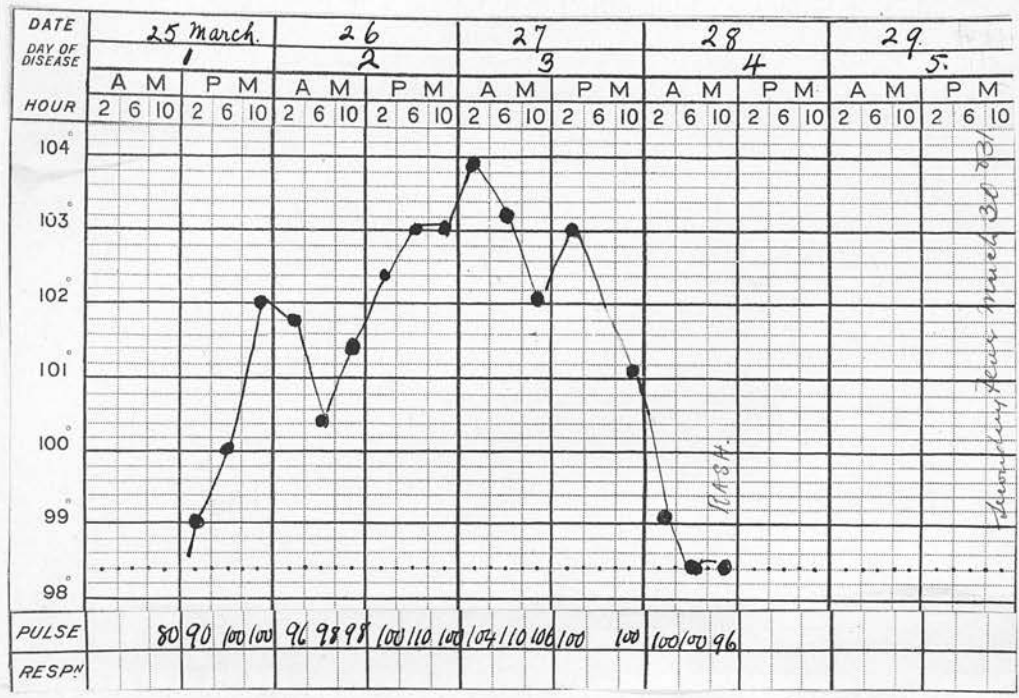
Case II. ($\frac{186}{1925}$) Male, aet. 55. Vaccinated in infancy, 4 insertions.

Symptoms. Rigor and headache. Mild Case.



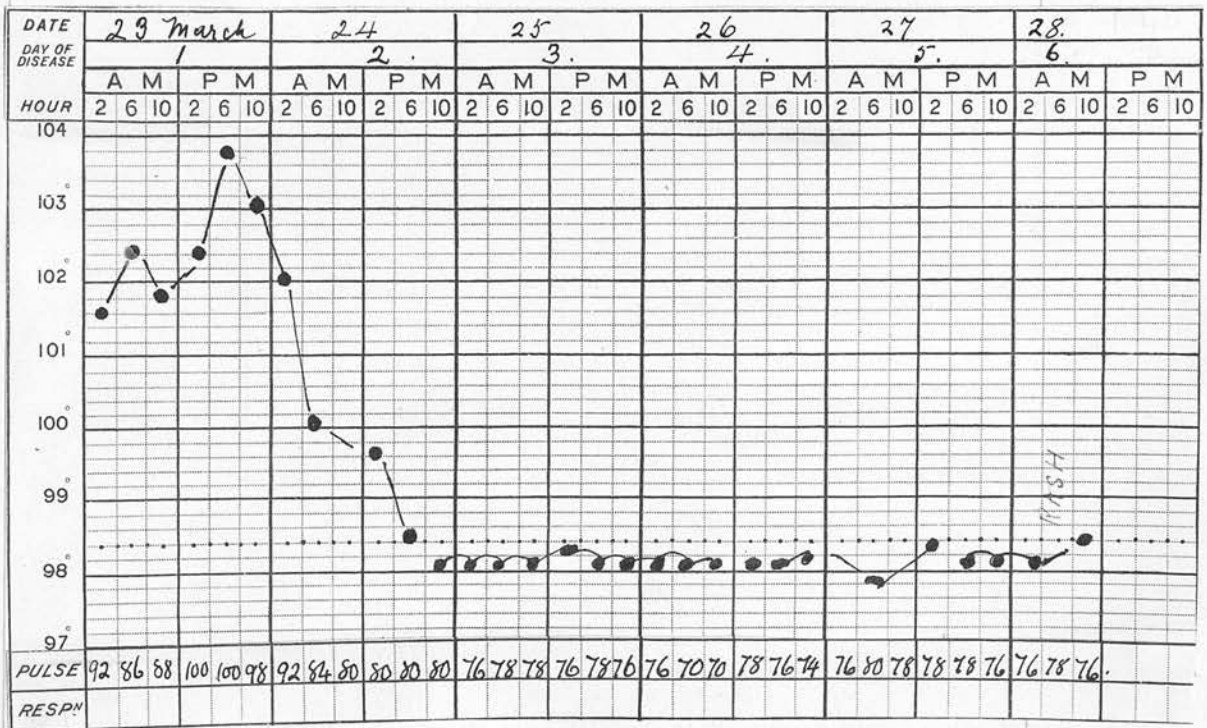
Case III. (¹⁹⁴/₁₉₂₅) Male, aet. 71. Vaccinated in infancy.

Symptoms. Rigor, headache, pains in back. Profuse rash. Secondary Fever on March 30th and 31st. Had acute conjunctivitis as a complication. Severe case.



Case IV. (¹⁹⁵/₁₉₂₅) Male, aet 54. Vaccinated in infancy, two marks.

Symptoms. Slight vomiting, rigor, headache, back-ache, pains in limbs. Very slight rash, mild case.



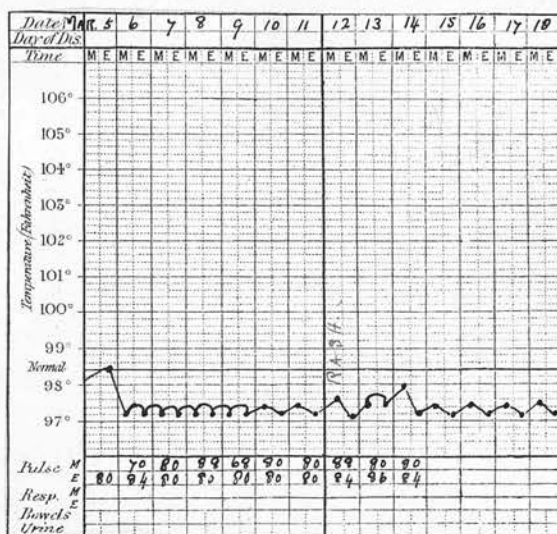
CASE III. ($\frac{53}{1927}$) Male, aet 14 years.

Quarantined as S.P. contact 5.3.27

Smallpox lesions on face, arms and legs 12.3.27.

Symptoms: slight headache; there was no rise of temperature throughout his illness. Fourteen pustules developed.

This is a good example of a very mild case. Many of this type are unrecognised and therefore spread infection.



CASE IV. ($\frac{721}{1926}$) Female, aet 23 years.

This is another example of a very mild case which would have perhaps escaped detection had she not been quarantined.

Notes: Exposure to infection 12th-16th October.

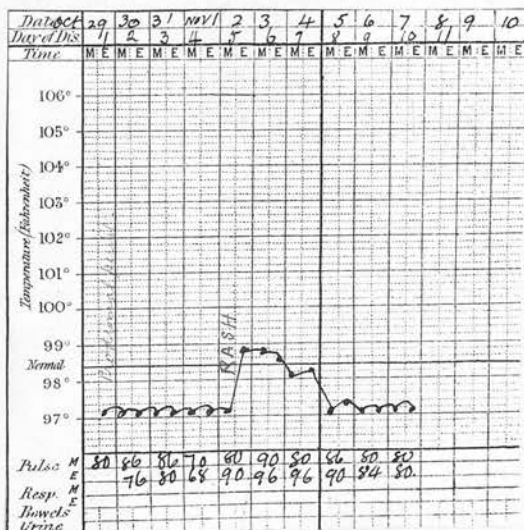
Quarantined 29.10.26.

Slight headache complained of 29.10.26.

No other prodromal symptoms.

Rash developed 2.11.26.

Very mild. Vaccination performed 29.10.26 unsuccessful.



CASE II. ($\frac{66}{1926}$) Male, aet 26. Unvaccinated.
Onset 10.1.26.
Rash 13.1.26.

Complained of rigor, vomiting, severe headache, pains in back and limbs.

Admitted into Hospital on 4th day of disease with a typical smallpox eruption over the whole body.

Rash was highly coloured.

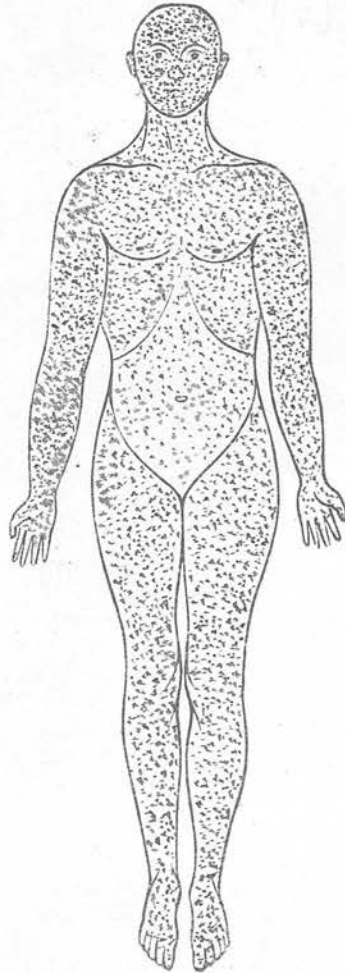
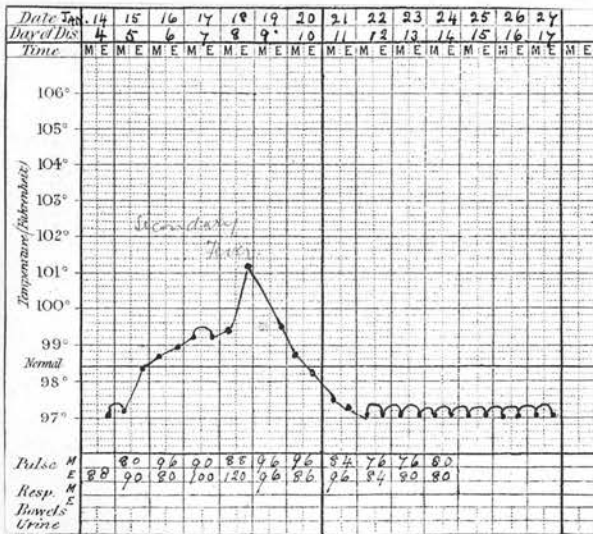
18.1.26. Patient complains of malaise. Throat shows pustules on the hard palate. There is conjunctivitis of both eyes. Rash is semi-confluent. Lesions are surrounded by an inflammatory areola.

19.1.26 Spent a restless night, slight delirium.

20.1.26 Spots still coming out.

21.1.26. Approximately 4000-5000 lesions on body.

23.1.26. Pustules drying up. History uneventful from this point.



CASE V. (⁶⁸²1927) Male, 46 years, unvaccinated.
Onset 8.8.26. Rash 11.8.26.



Photo shows semi-confluent character of the eruption on the face. Note that the chest is more or less free from the rash. Photo taken on 8th day of the disease. Recently unsuccessfully vaccinated - Aug. 1928.

CASE VI. Male, aet 58. Unvaccinated.
Onset 22.12.26. Rash 26.12.26.



Photo shows confluent and semi-confluent nature of the eruption. Photo taken on 9th day of disease. The man was extremely ill. The eruption covered all parts of the body including scalp and abdomen. Note the oedematous appearance of the face.



This case is put in to show the umbilication of the pustules. The woman was pregnant but there was no miscarriage and she left the hospital quite well in every way. When the eruption was at its height she complained of great discomfort and was occasionally delirious. It was noted that pregnant women usually had a sharp attack of the disease.



This photo was taken to show the nature of the eruption on the hand. The rash was full out. It will be noticed that the pustules have all reached the same stage of development. The case was one of moderate severity.



A similar case to the previous one - that of a girl aged 12. She had a severe attack of the disease and was profusely covered with the rash.

Case illustrating the effect of previous trauma on the eruption.



CASE ($\frac{8}{1928}$) previously referred to in the text. This boy fell off his bicycle during the incubation stage of the disease and cut his wrist and knee. It will be noticed that at these places the pustules have developed to a marked degree. .



An example of a mild case which formed a marked feature of the outbreak. Note the characteristic distribution of the eruption. The dark areas round the pustules is due to iodine with which the pustules were painted at the time.



Another example of a moderately severe case. The eruption was beginning to go back. Patient did not feel the effects of the rash. Both this patient and the previous one (p. 61) complained of discomfort on the soles of the feet where the rash had been marked.



Example of the eruption invading the feet. This case, a girl aged 17, was interesting as she developed the disease during the desquamation period of Scarlet Fever.



Photo of hand from a moderately severe case. The illustration shows the characteristic desquamation previously described. The photo was taken 3 weeks after the commencement of the rash. The face and arms were clear except for the staining left by the pustules. The back of the hand shows some of "seeds" still left surrounded by bits of flaky epidermis.



A similar photo of the soles of the feet. It shows the characteristic pustules deeply embedded in the skin and appearing like dark brown seeds. Photo taken more than 3 weeks after the rash came out. Pain on the soles of the feet was marked and the patient had to keep to his bed.

CONTROL OF SMALLPOX OF THE PRESENT DAY.

Variola minor is essentially a mild disease, and this has made its control far more difficult, and not, as some people would have us to believe, any easier.

The chief difficulties that I have encountered in my experience of the outbreak have been -

1. The unrecognised case. As the disease is generally mild, a goodly number of cases escape detection, even by responsible persons who often have had previous knowledge of the disease.
2. Confusion with chicken pox, and other diseases. Cases of mistaken diagnosis continue to occur, chicken pox being the chief offender in this respect. Other diagnoses in connection with the rash stage have been herpes, and one case of bromide rash.

In the prodromal period, a constant diagnosis has been influenza, and the patient ^{has been} allowed to get up and go about after the abatement of the symptoms.

3. The chief source of trouble however, has been the withholding of information, and the constant and deliberate falsehoods, by patients and their families, as to contacts and the movements of the same. This has been a feature of the outbreak.

The /

The tracing of all the contacts is essential if a disease is to be controlled, and never more so than in an outbreak of smallpox, but unless legislation can be brought in to compel persons concerned to give proper information, and to inflict fines for withholding it or giving wrong information, little can be done in this respect.

4. Prejudice against Vaccination. Derby is a stronghold of the anti-vaccinationist, and consequently the vaccination of contacts has been a very slow process. In the first two years of the outbreak the response was very poor, but in April 1926 the Corporation sanctioned the payment of compensation to vaccinated persons in employment.

The question of compensation for vaccination has been regarded by some as being a doubtful policy, and not to be recommended everywhere, but having due regard to the situation as it exists in Derby, I consider it has been of great benefit, and has justified the expenditure incurred.

Payments given in 1926 and 1927 were £493, and £183 respectively.

HOSPITALISATION OF THE CASES.

During the years when the outbreak was at its height the local smallpox hospital became full. Cases had therefore to be sent to the Fever Hospital. There, /

There, over 800 smallpox cases were successfully treated with no cross-infection. (The fever cases, and also the patients in the adjoining sanatorium were all vaccinated as circumstances permitted).

DIAGNOSIS.

As a proper diagnosis is one of the chief aids to control, the following were points borne in mind when diagnosing cases, especially the doubtful ones.

1. Distribution of the rash, as Wanklyn, Cameron, Ricketts and other authorities have so well emphasised. Very occasionally the distribution was atypical, and reliance was placed on other factors, such as.-
 2. The history of a prodromal attack, which was practically always present, but occasionally absent in infants and young children.
 3. The character of the rash, such as the hardness or "body", though this was misleading at times. I consider a very important point in differentiating a case of smallpox closely simulating chicken pox, is, the pustules all reaching the same stage of development at the same time.
- Finally it was not safe to rely on a single symptom but all factors had to be considered, before coming to a final diagnosis.

NOTES ON S.P. CASES CONFINED IN HOSPITAL.

CASE I. Child born 11 days after onset.

Female, aged 39.

Onset of disease 16.2.26. Rash 19.2.26.

Had a well marked pustular eruption when seen.

Rash all over the body. Pregnant.

Confined 27.2.26. Normal in every way. Baby unvaccinated.

(2) History of baby.

Born 27.2.26. 1.5 a.m. Wt. 5 lbs. 6 oz.

29.2.26. Breast feeding. Mother's rash very severe and at full maturation.

3.3.26. Sucking well and giving little trouble.

From 3-7.3.26. Baby not at all fretful.

7.3.26 Two small pustules noted on face.

8.3.26. Pustules on arms.

9.3.28. " on legs, buttocks and groins.

10.3.26. Crop on scalp.

Note.- From birth to first appearance of rash a period of 8 days with apparently no prodromal period. Rash exceedingly mild.

14.3.26. Very definite smallpox but spots very few and mild.

CASE II. Female, aged 32.

Onset 12.1.28. Rash 15.1.28.

Symptoms. Headache, backache, pain in limbs. Pregnant - full time.

Normal confinement took place 22.1.28, i.e. 10 days after onset. Baby successfully vaccinated 8 hours after birth and remained free from smallpox.

Puerperium was uneventful.

CASE III. Female, aged 31.

Onset 29.2.28. Rash 4.3.28.

Symptoms: headache, backache and pain in limbs. Fairly profuse rash.

Normal confinement took place on 11.3.28, i.e. 11 days after the onset.

Birth of twins, both boys.

1st was a Breech presentation and the 2nd was a Vertex presentation. Both infants showed a papular rash comparable to the Smallpox rash but vaccination in each case was successful. The puerperium was uneventful. There was no rise of temperature at any time.

OBSERVATIONS ON VACCINATION.

During the past three years I have performed over two thousand vaccinations with no untoward results. The following observations are of interest as they bear on the problems which confront the Health Official regarding the controversial subject of vaccination.

REACTION.

All successful vaccinations of adults have shown a good amount of local reaction and systemic disturbance, as evidenced by malaise and distaste for food.

A varying degree of temperature was noted. General symptoms would last from two to three days.

Infants showed less local reaction. Systemic disturbance was not noticed by the mothers, who have frequently told me that their babies seemed to suffer no inconvenience at all as the result of being vaccinated. On two occasions infants were vaccinated a few hours after birth, with no abnormal results.

On the other hand, on rare occasions, intense reaction has been observed among adults. The arm becomes enormously swollen, with vaccinated area becoming very inflamed and extremely hard and brawny looking. There is severe systemic disturbance.

The/

The vesicles are surrounded by dark purple bands. A large amount of lymph exudes. The reaction slowly dies down, leaving two large black crusts which slowly form and ultimately drop off. There is no question of sepsis, and I am of the opinion that in these cases of intense reactions we have a sort of anaphylactic phenomenon.

THE NUMBER OF INSERTIONS.

I have always made two insertions. Four, in my opinion, is certainly too many, especially in the case of adults. And here we come perhaps to the chief problem - i.e. the amount of inconvenience caused by vaccination.

It is certainly true to-day that, in many cases, vaccination causes far more inconvenience than an attack of mild smallpox, and many people prefer to take smallpox than submit to vaccination. If by research we could discover a lymph which would cause very little inconvenience and yet be capable of producing a long immunity, a great step towards general vaccination would be obtained.

The recent Royal Commission have given their opinion that one insertion should be sufficient. I would prefer two as the second one acts as a control.

UNSUCCESSFUL VACCINATION OF EXPOSED PERSONS.

On these persons vaccination has been repeatedly performed. Every one was a relation of a case of smallpox, /

smallpox, and had been living in the same house as the case for a varying period, from three days to four weeks, and had therefore presumably been receiving infecting doses of the smallpox virus.

In no case did any of these persons contract smallpox, and they are still to be classed as unsuccessfully vaccinated cases. There is therefore reason to suppose that either -

1. These persons had had recent smallpox although there were no clinical signs, or rash, or remains of a rash, visible, or
2. That these persons have become "salted", or become immunised by subminimal doses of the smallpox virus, a process termed by Friedemann¹⁰ as "latent epidemisation".

Thus, there were..-

Primary Vaccinations.	Secondary Vaccinations.
38	8
<div style="display: flex; justify-content: space-between; width: 100%;"> 23 unsuccessful 15 successful </div>	<div style="display: flex; justify-content: space-between; width: 100%;"> 4 unsuccessful 4 successful </div>

That is, among 36 persons there were only 19 who were successfully vaccinated, giving a percentage of 41.3.

No failures, on the other hand, were recorded amongst 300 primary vaccinations of school-children living in a smallpox invaded area, but who were not known to be direct contacts.