

CLINICAL & STATISTICAL OBSERVATIONS

on 150 Cases of Smallpox and
215 cases of Vaccination.

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Clinical and statistical observations of 150 cases of Smallpox and 215 cases of Vaccination.

In submitting this paper I desire to state that it is based on facts actually observed in dealing with a somewhat severe epidemic of smallpox in 1892-93, during which time I was Resident Medical Officer at the Brighthouse & District Hospital, Clifton, Yorks. Great pains were taken to register the fullest obtainable information in regard even to the slightest cases at the actual time of observation. It appeared to me that such a procedure would be likely to render the statistics of greater value and interest.

I propose to deal with the disease first from a clinical and then from a statistical point of view and to conclude with notes of 215 cases of vaccination performed by me on persons who had been exposed to the infection of smallpox directly or indirectly. I have not dwelt upon any points except those which seemed to give evidence upon disputed matters or to strengthen opinions or facts enunciated or observed by others, or such points as appeared to be new and of interest.

Incubation period.

I had excellent opportunities for observing the duration of this in upwards of 40 cases and it never varied, being always 12 days from exposure to infection to the premonitory symptoms which set in on the 12th day and were followed on the 14th day by the eruption.

Premonitory Symptoms.

These may be observed in the last one or two days of the incubation period as a kind of general lassitude and weariness, but I have never observed any decided departure from normal health until the twelfth day after exposure to infection. The onset of the premonitory symptoms is in almost all cases sharply marked but the nature and severity of the symptoms vary a good deal. Three types may be considered:-

1. In the severe cases there is vomiting, violent headache, some sore throat, a temperature up to 102° or 103° even, and great prostration.
2. In other cases though the patient is confined to bed there is only slight headache and slight prostration with a temperature seldom exceeding 101° but there is severe sacral pain

which is with difficulty relieved.

3. In this class of cases the premonitory symptoms resemble those of Measles very closely. There are all the symptoms of a cold in the head catarrh, sneezing, lachrymation and some sore throat. Many of these cases were actually diagnosed as Measles by the Medical attendants.

I find that the more severe the premonitory symptoms the less severe ~~was~~^{is} the actual eruptive stage. There were only a very few exceptions to this general rule in the cases under my care.

Initial Rashes.

The only two types of initial rash which came under my observation were the Scarlatini-form rash and the one resembling measles.

1. The former is not likely to cause any difficulty in diagnosis but rather the reverse: it is much darker or more livid in colour than the rash of Scarlet fever, and its peculiar distribution on the lower part of the abdomen, in the axillae and on the inner sides of the upper arms serves to distinguish it from any other exanthem. If we have in addition to this a history of exposure to infection the diagnosis becomes practically certain.

2. That initial rash which resembles Measles is a more difficult one to diagnose and when, as is often the case, it is combined with the Scarlatini-form rash, the difficulty is increased.

It is however generally seen first on the trunk and limbs and makes its appearance on the face afterwards.

Both of these rashes may appear at the same time as the premonitory symptoms or on the day after these have commenced; they may shew a few scattered papules or vesicles in addition to the rash described but these are usually abortive.

The parts affected by initial rashes are said by most observers to remain free from the typical small-pox eruption, and my experience bears this out: I have never seen more than half a dozen papules on areas so affected and these merely became converted into small partially filled vesicles and then died away.

The initial rashes remain out for about three days and then gradually die away leaving some yellowish brown discolouration of the skin.

I have found the occurrence of initial rashes to be in all cases of favourable prognosis.

General.

Taking the varieties of smallpox to be

- (1) Discrete
- (2) Confluent
- (3) Haemorrhagic
- (4) Modified

we may consider first of all the general characters of the disease, and afterwards, the symptoms, special character of eruption, and the treatment in each variety separately.

The eruption appeared in by far the majority of my cases on the third day of the disease: that is, the patient having been exposed to infection the premonitory symptoms set in on the 12th day after the day of exposure:

this 12th day I have counted as being the first day of the disease, and within from 48 to 60 hours afterwards the typical eruption began to make its appearance.

The following table shews for children adults and old people on what day the eruption appeared.

Children are taken as being those under 12 years of age, adults from 12 to 60 years and old people 60 years of age and upwards.

103 Cases considered.

The eruption appeared)		children	adults	old persons
on the	2nd day in)	2	4	0
"	" 3rd " "	13	50	1
"	" 4th " "	5	27	1
		<u>20</u>	<u>81</u>	<u>2</u>

The table serves to shew:

1. That the appearance of the eruption on the second day of the disease was a rare thing.
2. That the appearance of the eruption on the fourth day occurred in about one third of the cases.
3. The statement often heard that the early appearance of the rash - on the second day - is more common in children than in adults was not borne out by my experience, which however was not large on this point.

It is generally stated that if the appearance of the eruption be retarded the prognosis is favourable. (See Fagge's Principles & Practice of Medicine, 3rd Edition, Vol 1 p. 202).

The general idea that this statement conveys to one is that a favourable prognosis can be based upon the fact of a late appearing eruption. I consider it however both misleading and unreliable.

It appears misleading for the reason that revaccination and recent primary vaccination are of effect in retarding the appearance of the eruption, and therefore are the true primary causes of the general favourable character of these attacks.

It also appears to me unreliable, for, excluding three cases in which vaccination had been recently performed, I found that of the 30 remaining cases :—

17 were mild discrete attacks.

5 were severe discrete attacks,

2 were semi-confluent attacks,

6 were confluent,

and 4 of the cases were fatal.

From a consideration of these figures it would not appear that cases in which the rash was of late appearance were ~~not~~ particularly favourable.

The eruption appeared in almost all cases first on the face or on the wrist and forearms; it then seemed to travel downwards and was often 24 hours later on the feet and legs.

Several peculiar instances of the copious eruption which comes out on surfaces which have been exposed to irritation came under my notice. In one case a mustard plaster had been applied, for some reason, on a part of the upper arm, for about 20 minutes on the day preceding eruption: on this area a crowded eruption appeared and ^{when} the vesicles formed they ran together and produced a large milky-white flat bleb exactly coincident with the part covered by the plaster.

The remainder of the arm shewed scarcely a dozen spots.

In another case where the patient, a stoneminer, was in the habit of wearing a tight leather belt, the eruption followed the line of pressure

almost exactly and the disease if seen in its vesicular stage might have been mistaken for Herpes Zoster most readily.

The mucous lining of the mouth was frequently found to be affected but almost exclusively in confluent cases. In one case in which I made a laryngological examination vesicles were distinctly visible as far down as the chordae vocales which however were clear themselves: in this case the vesicles also extended up into the post-nasal region.

Similarly in confluent cases the nasal passages were always affected and it proved a most trying task to the nurses to remove crusts from the interior of the nose.

In no case were spots found on the conjunctivae, though occasionally one would form on the margin of the eyelid.

During the whole of the first day and indeed often during the second day also, fresh papules would appear in parts already partly covered by rash, but these latter were usually abortive and rarely passed through the stages of vesiculation and pustulation, or if they did they seldom attained the same size as the previous arrivals.

I have observed that in those cases in which the pustules are of a large size and well filled, and in which the pustular stage is prolonged

(that is where drying does not set in quickly) there is more pitting afterwards. Where however the pustular stage is short and drying sets in quickly the amount of pitting is small.

I have verified the observation made by many authorities that the swelling of the face which is present in severe discrete and all confluent cases subsides on the tenth or eleventh day, and the same day usually witnesses commencing puffiness in the hands and feet.

I usually found that in those cases in which the patients' friends had adopted the preliminary treatment of giving copious hot drinks of "saffron tea" on the onset of the premonitory symptoms and had combined with this keeping him in a warm room covered with the bedclothes, and in general trying to "sweat the disease out of him", the eruption was copious and the attack more severe than when no such treatment was carried out. I therefore gave instructions to all the "quarantined" families that in the event of any one of them sickening he should be given a brisk saline purgative, put to bed in a well-ventilated room, sponged with tepid water, given light diet, and plenty of cooling drinks &c.

I believe in many cases this had the effect of lessening the severity of the attack.

I think it is a reasonable plan to pursue, for in smallpox the severity of the disease depends practically on the number of pustules formed — the eruption is the chief item to be considered—and if by a preliminary "sweating" treatment we encourage active congestion of the skin and copious eruption we surely are adding to the danger of the attack.

[I look upon it in a sense as analagous to the appearance of a copious eruption on a part recently exposed to irritation. Possibly the explanation of both phenomena may be that the amount of eruption depends on the vascularity of the part and upon its condition as to recent hyperaemia].

The people in the district themselves had a practice of taking cream of tartar regularly in quite large quantities with a view to "keeping the blood cool" and rendering the attack mild if they should happen to take the disease. I knew many people who took this regularly for nearly two years, and when questioned as to their object in so doing the statement was several times made to me that persons who had taken cream of tartar did not take the disease badly,

It has been stated that a peculiar odour is emitted by the skin during the stage of premonitory symptoms (V. Fagge's Principles & Practice of Medicine, 3rd edit. Vol. 1 p. 199). This odour I have noticed in almost all the cases with which I

had to deal, but it was never observable until the eruption had actually appeared and almost always passed off when the eruption was fully out in its papular form. It is an unmistakable odour and I have frequently diagnosed a case in an upstairs room immediately on opening the front door by the smell alone. Even the ambulance attendants recognised it.

In confluent cases it could be perceived before the papules actually appeared, but only when the skin shewed the peculiar dirty red efflorescence which so commonly precedes this variety of eruption.

The smell too was contained in the exhalations from the skin, and not in the breath which had an unpleasant odour of its own. // The marks left by smallpox may be of the following three kinds, the first two of which are temporary and the last one permanent:-

1. A purpleish red stain which is certainly not depressed but in many cases elevated above the surrounding skin: this may last for 6 or 9 months, but eventually dies away entirely.
2. A reddish brown elevated spot covered with fine white desquamating particles: this follows the type of discrete eruption to be described later in which the spots never become pustular but are covered with a brown horny scab.
3. A depressed pit at first brown and later white in color which lasts for life. This results when

suppuration is prolonged or where there has been a kind of granulating surface formed with firmly adherent and slowly separating crusts: often the cause of the formation of these pits or pocks is that the crusts are picked off or knocked off several times purposely or accidentally.

Smallpox patients, whatever form of the disease they may be suffering from, up to the 10th day of the disease at least, have never in my experience been so affected constitutionally that they could not bear removal for long distances with comparative ease and comfort and with perfect safety. This is a point of considerable importance in dealing with an epidemic.

THE TEMPERATURE IN SMALLPOX.

From a consideration of 71 carefully kept charts I find that the temperature in smallpox can always be classed under one of the following types.

1. No special departure from the normal temperature at any time.

This is always found in recently vaccinated persons. I have had the temperatures taken in these cases for weeks together in many instances in order to make certain that no temporary elevation escaped notice.

2. Primary fever high but falling on the same day or the commencement of the day following the appearance of the eruption and no further rise in temperature noticed.

Such cases usually were of a mild discrete type, but by no means always, for some of my cases in this class were fatal. The primary fever often ran up to 104° but never above this and the average height was 102.6° .

3. Distinct primary fever but no distinct and separate secondary fever observable. In these cases the primary fever continued into an often long-lasting febrile state in which the fever was alternately of a continuous and remittent type with remissions often of $3, 4$ or even 5 degrees.

In many of these cases no proper pustulation took place the vesicles simply becoming milky and opaque and remaining flat. In the fatal cases, which were frequent in patients shewing this type of temperature, the fever from being remittent became intermittent and this change in the type of fever in several cases preceded death by one or two days.

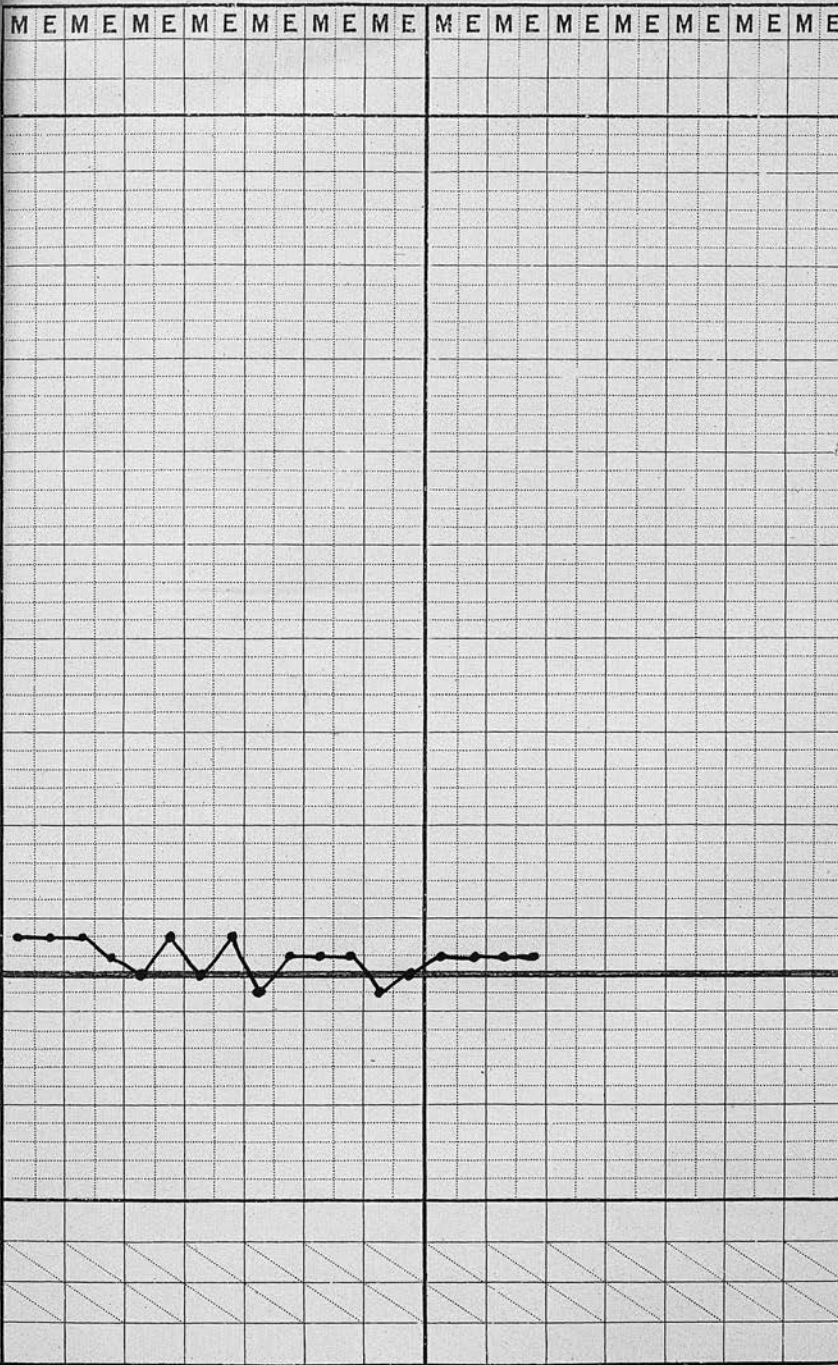
4. Distinct primary and secondary fever separated by an interval of temperatures near to normal.

These cases presented no features worthy of special note. // I was unable to form any idea from the temperature alone as to the prognosis or in fact as to any feature whatever of the attacks with the sole exception of the temperature described as the third type. This I always regarded as of serious import.

I append copies of charts shewing these different types of temperature.

Temperature: Type I.

No. 177.



1. DISCRETE SMALLPOX

Discrete smallpox may vary more than any other variety^t of the disease in severity, and its severity is, generally speaking, proportionate to the quantity of eruption.

There may be from half a dozen up to several thousands of spots.

When these begin to become pustular a rise in temperature takes place and this occurs usually on the 7th or 8th day of the disease and continues for about four days. The amount of daily variation is not great - usually less than two degrees.

When the pustules are not interfered with drying commences in the centre about the 14th or 15th day of the disease and the crusts commence to become detached from the 16th to the 18th day.

Discrete attacks are at times attended with alarming symptoms though I have no fatal case to record. Delirium is often present and is usually violent or maniacal: it is much more frequent in discrete attacks in my experience than in any other variety of the disease.

In one of my cases the patient who had a very mild discrete attack became delirious on the 5th day and developed a "Talking mania". For 14

days he had but 62 hours sleep in all, continuing to talk for the most part at a rapid rate during the whole of the rest of the time. On the 8th day his voice became husky and gradually died away: during the remainder of his remarkable condition it was only possible for him to speak in an indistinct whisper.

The 62 hours' sleep was procured for him by the liberal use of chloral hydrate and potassium bromide combined, but his condition remained unaltered for two days after his discharge from hospital. I sent him home as soon as he could possibly be got clear from infection, judging that the removal into changed and more familiar surroundings would probably put him right.

All the other cases of violent delirium with one single exception were in persons suffering from a discrete attack.

As regards the average duration of stay in hospital the discrete and confluent cases shew scarcely any difference: one discrete case remained in hospital for 65 days and many for six weeks.

There is often no scarring left after discrete cases, but a cherry-colored stain covered with fine scales and with a very delicate fringe of skin all round the circumference.

CONFLUENT SMALLPOX

Before any actual papular rash appears in these cases there is usually a measly blotchy redness of the face which is also usually swollen: on pressure one can as a rule detect some commencing papules.

The papules are always of smaller size than in the discrete variety — the size of small pins' heads.

As papulation and vesiculation progress the facial swelling increases until about the 9th or 10th day, when it usually subsides and the limbs commence to swell.

Vesiculation usually sets in slightly sooner than in discrete cases.

The papules do not become so turgid or so well filled as in discrete cases but remain flattened and sodden and soon become depressed in the centre. Their color scarcely ever attains the bright sulphur yellow of discrete pustules but remains milky white ^{often with} ~~or~~ of a purpleish tinge.

The buccal mucous membrane and the fauces usually shew quite a large number of vesicles and there is a copious discharge of a very viscid saliva or mucus: this is one of the most distressing symptoms of the disease.

Probably the vesicles extend in many cases down into the larynx and are the cause of

the frequent occurrence of laryngitis and oedema glottidis.

Diarrhoea is common, especially in very young children.

The temperature shews no distinct fall between the eruption of papules and the pustular stage but remains up at 103° or 104° often for 10 or 14 days. When actual suppuration does take place, and in my experience true pustulation is rare, hyperpyrexia accompanies it.

From the intense skin irritation and the great area over which vesiculation or partial suppuration is taking place it is but natural to expect some degree of collapse, and indeed this is commonly found two or perhaps three days before death.

Delirium is more frequently of a low typhoid nature and often gives place to complete coma. Convulsions are sometimes met with especially towards the end of a fatal case.

The urine contains albumen very frequently.

Death occurs in almost every fatal case on the 11th, or 12th day: in only one instance did it occur before this - on the 9th day.

The most frequent complications are:-

Diarrhoea)	
Laryngitis)	
Pericarditis)	Frequent
Suppuration of large joints		

<i>Subburation of large joints</i>)	
Bronchitis)	
)	
Pleurisy)	
)	
Convulsions)	Rare
)	
Pneunmonia)	

On recovery setting in, the facial swelling subsides gradually: drying commences in the pustules or vesicles and this drying is attended with frightful itching. The crusts may assume a dark nearly black color, and scarring is usually bad and permanent. It is towards the end of the third week when the temperature regains its normal permanently. Often the hair falls off almost altogether.

3.

HAEMORRHAGIC SMALLPOX.

My experience of this will best be described by notes of cases with which I had to deal.

Case 1 Mrs. H. aged 43, housewife.

A strong healthy woman, the mother of seven children. Her son took smallpox at his workplace, she had been vaccinated in infancy and her arm shewed two small unfoveated scars. She refused resolutely to be revaccinated.

Oct 3rd. On the 12th day after her son's removal to hospital she complained of severe headache and sacral pain.

Temp. 101.4° Vomiting of a severe and persistent type set in.

Oct 4th. Great improvement: temp. 99.4° . All above symptoms had disappeared and she persisted in getting up in spite of all advice.

Oct 5th. Temp in morning 102° in evening 101.6° More headache. Peculiar itchiness of skin especially over sternum and forehead .

No appearance of eruption except one small papule on forehead.

Much sickness and prostration; could take nothing but iced milk or milk and soda. Menstruation commenced to day after only 14 days' interval

and was very profuse.

Removed to Hospital.

Oct 6. Temp morning 102.4^o, evening 102.²

Many petechiae now visible over front of chest and about upper part of arm: also a large number on lower part of abdomen.

Typical eruption also appeared in the shape of papules, the haemorrhagic petechiae being generally between these papules, but in a few cases apparently into them.

Slept fitfully but took scarcely anything in the shape of food.

Towards evening the face began to assume a swollen appearance and the conjunctivae became pink and injected. Metrorrhagia still continued. Bowels moved twice naturally.

Gave following emulsion:-

Rx ol. Terebinth
Mucilaginis aa $\overline{\text{3v}}$
ol. Ment. Pip m $\overline{\text{v}}$
Syr. Simplicis ad $\overline{\text{3viii}}$

Sig. One tablespoonful every 4 hours.

Oct. 7 Medicine not retained after first few doses: therefore diluted to half strength and gave ice to suck before and after.

Temp morning 102.2^o, evening 103. 6^o.

Swelling of face increased and face assumed a dusky red appearance.

Throat much congested and eyes deeply injected. Some vomiting and vomited matters contained blood.

Blood and albumen in Urine.

At night metrorrhagia became so profuse that cold cloths were applied to vulva and following was given hypodermically:-

Rx

Digitalin

Ergotinin Citrate

Strychnin Sulphate $\overline{\text{aa}}$ gr $\frac{1}{100}$

This was repeated in 3 hours but the insertion of the needle caused the patient such exquisite pain that after a third injection it was discontinued, and instead, Digitalis and Ergot were given per oram and a suppository containing 1 grain of Hamamelin per rectum. This almost completely checked the haemorrhage.

Patient much collapsed: took weak beef-tea and milk and water.

Oct 9. Temp morning 100.4° evening 101.2°

Face very puffy and swollen, the eyes being almost completely closed. On the tongue there was a large dark purple patch of discolouration and on the buccal membrane and soft palate a few small purpuric patches.

The petechiae on the body and limbs had by this time become quite faded and had left only yellowish brown stains. Over the left eyelid a ^{fresh} purple patch about the size of a florin now shewed itself.

Dark red blood had effused into the conjunctivae, and curiously enough into the right halves only, the left halves being still only deeply injected and a distinct line of demarcation being present.

On the back of the left hand a purple patch appeared and this remained of the same color until death.

Some vesicles had now formed and on the face and chest were crowded together in small patches: these vesicles were very flabby and many were dark coloured. On ^{microscopic} examination of their contents blood corpuscles were always visible.

Patient could not be prevailed on by anyone to take any nourishment except a little brandy and milk.

Turpentine emulsion still taken.

Oct. 9. Temp. morning 99. 2^o, evening 101. 2^o

No appreciable change.

Vesicles of a milky purpleish colour: oedema of face increased and eyes now completely closed.

Oct 10. Temp . morning 98.6^o, evening 99.8^o.

No apparent alteration. Medicine and brandy and milk taken and retained. Enema given. A few pustules formed; throat very harassing;— deeply congested: local astringents & spraying with very weak perchloride of mercury gave temporary relief.

Oct 11. Temp. morning 98.6^o, evening 100. 6^o.

Low delirium set in at night. Stimulants practically forced into her - champagne and brandy- and caused a slight improvement. Enema - no result. Slight bleeding from nose.

Oct 12. Temp morning 99.4^o, evening 100. 6^o.

Delirious at intervals. Scabbing and drying of pustules. Intolerable itching of face and chest. Hands gloved in Gamgee tissue because patient scratched the skin almost entirely off her forehead. Very restless and complained of pain almost for first time.

Delirium increased at night.

Oct. 13. Temp. morning 100.8^o,

Pulse changed - very slow and soft.

Patient became comatose about 10 a. m. and continued so until death. Throat very troublesome: mucus collected and impeded respiration: had to be cleared away with a padded probe.

Very little brandy and champagne taken.

Gradually sank and died about 4.30 p. m.

Remarks This case is I think peculiar inasmuch as the patient exhibited both the purpuric and typical variolous eruptions, the former appearing with the usual symptoms of haemorrhagic smallpox before the latter. Each eruption went through its various stages independently of the other. It was not a case of haemorrhagic pustular smallpox such as is described by most writers, for in this the typical eruption is only complicated with haemorrhagic symptoms when it attains the commencing pustular stage.

CASE 11. "HAEMORRHAGIC PUSTULAR" SMALLPOX.

Male aged 45 yrs. Previous health good, but habits intemperate.

Admitted April 23rd. with a confluent papular eruption. On April 25th. vesiculation commenced and when the vesicles had formed haemorrhage occurred *into* them and they acquired a pale purple colour.

Pustulation commenced in due course and the spots became dark purple in colour: the scabs when formed were quite black and the man's face appeared, as one of the inmates expressed it, "like a lump of coke."

Haematuria set in on the 9th. day of the disease and lasted for 2 days. Epistaxis commenced on the 5th day and went on intermittently for 3 days.

On the 5th and 6th. days the stools were tarry and on examination were found to contain blood.

That the vesicular fluid contained blood I proved by microscopical examination, and I also removed some scabs, allowed them to stand for about four hours in distilled water to soften them, then pounded them up and examined a few drops of the water:

blood-corpuscles were present in large numbers.

The crusts were very tenacious and although the patient was quite well by the 21st. day most of the scabs adhered firmly until the end of the sixth week, and the patient was not in a fit state to be discharged until he had been 99 days in hospital.

Multiple abscesses followed but that was the only complication he suffered from.

REMARKS I regard this as an ordinary case of haemorrhagic vesicular smallpox - the haemorrhage occurring into the vesicles at the same time as the haemorrhagic diathesis was manifested.

Case 3. I had another case in which all the particulars in regard to age, previous health and habits, vaccination etc. were almost identical.

The eruption pursued too an almost identical course: bleeding from the nose set in on the 7th. day and haematuria on the 8th. day, both continuing until death which occurred on the 10th. day

The temperature differed in the two cases being at first 103.4° and afterwards dropping and remaining subnormal until the tenth day when it rose to 98.8° .

This case I only saw after death.

It was that of a male aged about 50 years employed as a farm labourer.

The evidence shewed that he had been exposed to the infection of a mild case, unrecognised at the time, and on the 12th day following this exposure he had complained of being slightly "out of sorts".

This slight indisposition lasted for three days but the man continued to do his work in the fields until the very hour of his death almost. The night before his death he had slept on some straw in a stable: rising early he did a full day's work and came in about 8 o'clock in the evening to fall dead on his doorstep.

The full possession of the bodily and mental capacities up to the very last in this case make it one worthy of record.

The examination of the body post-mortem revealed the following particulars.

The R. arm shewed some purple discolouration on its upper part: there were numerous petechia² of different sizes on the internal aspect of the elbow

and scattered here and there some slightly raised umbilicated vesicles.

The lower part of the abdomen shewed a uniform livid rash with dark petechia~~e~~ in places, some of them the size of sixpence.

This livid rash had an appearance such as would be presented by a scarlet fever rash turned livid, and it extended down between the thighs and over the scrot~~um~~. On the abdomen there ^{were} ~~was~~ also a fair number of shrunken umbilicated vesicles of different sizes.

.On the legs also a number of the same spots were observable.

The back shewed a similar livid rash or discolouration, almost exactly corresponding to the familiar hypostatic congestion of the post-mortem room.

Both eyes shewed effusion of blood into the conjunctiva~~e~~, completely surrounding the pupils.

The edges of the tongue were purple. There was evidence of bleeding from the nose and some vomited matters which were examined contained blood.

MODIFIED VARIOLA.

This variety of smallpox is not entirely restricted in its occurrence to patients protected by previous smallpox or by vaccination : I have experienced several cases where it occurred in absolutely unprotected patients.

The cases which came under my notice may be classed as of three kinds:-

1. In which the eruption passed through the three stages of papule, vesicle and pustule but the attack was of shorter duration and caused scarcely any constitutional disturbance. The pustules were only of small size and did not fill out so fully: often vesiculation and pustulation would occur just at the apices of the papules and at no other part.
2. In which the pustular stage was not reached. The apex of the papule became vesicular and then the vesicular portion dried and became converted into a dry smooth mahogany-coloured horny and firmly adherent scab. When this fell a slightly elevated pinkish-red spot was left which died away in a few weeks.
3. In which papules appeared, remained out for from four to seven days, and then died away completely.

These three forms may coexist and intermingle to some extent. In none of these cases did I observe any secondary fever - not even when pustulation was well marked.

In one case, that of a child admitted with its mother, and vaccinated on the 3rd. day of the mother's disease there was some sickness and signs of pain in the head on the eleventh day after admission (fourteenth day of mother's disease): this lasted for about 24 hours and then passed off. The vaccination took well (three insertions) and pursued a perfectly normal course. *I cannot give a definite opinion as to whether this was a case of variola without eruption or not.*

COMPLICATIONS & THEIR TREATMENT.

1. The most serious complication was the occurrence of oedematous laryngitis and this was confined to confluent cases. The onset was usually rapid and the obstruction to respiration great. No measures seemed of any special avail to relieve the condition: the application of leeches and the use of a weak perchloride of mercury spray seemed to do most good. In one case I ventured on scarification of the epiglottis which was enormously swollen, but with only very temporary benefit. I certainly do not think tracheotomy advisable though I have not tried it for this condition.

2. Local suppuration in the shape of multiple abscesses is troublesome but nothing more.

3. In one case of confluent smallpox in an unvaccinated adult a succession of complications occurred. A brief description of it may be given.

Nov. 11. On the eighth day of the disease pyaemia was ushered in by the usual symptoms of this condition

Nov. 12 & 13. Pyaemic symptoms continued.

Nov. 14. Right elbow noticed to be oedematous, hot

and painful. Thrombosis suspected.

Nov. 15. Conjunctiva~~2~~ yellow and some tenderness over hepatic region. A very slight aortic systolic murmur. R. elbow more swollen, and L. elbow commencing to swell. Temp. 105°.

Nov. 16. Temp. 104.6°. Urine contains large quantity of bile. All heart sounds impure, and a distinct aortic systolic murmur now present.

Swelling of R. elbow diminished but that of L. elbow increased and very hard.

Pulse at both wrists good. Diagnosed thrombosis. Liver enlarged.

Nov. 17. 9 a. m. L arm much more swollen firm and hard. L. pulse hardly to be perceived. R. pulse extremely feeble. Large patch of purplish discolouration over R. elbow.

Urine still contains bile and conjunctiva~~2~~ still yellow: no discernable change in skin which however was covered with a confluent eruption, the face being crusted over with dark colour~~d~~^e scabs.

5.45 p.m. R. arm shewed firm swelling with large purple blebs, some of which were broken and exposed a shining red raw surface beneath. No

pulse to be felt in the R. arm even in the brachial artery. Breathing very rapid and irregular.

Delirium. L. arm - swelling diminished and pulse normal.

Patient gradually became comatose and died.

Remarks In the first place I think the complication was pyaemia which caused the jaundice.

There was later some endocarditis developed.

At first in both arms there was then thrombosis which was followed in the R. arm by embolism and moist gangrene.

4. The curious case of "talking mania" has already been mentioned.

5. Diarrhoea in confluent cases in children was very common, but did not appear to produce the degree of debility one generally associates with such a condition under other circumstances.

I made a practice of not checking it unless it appeared to be exerting an injurious effect.

6. Retention of urine was observed in a good number of confluent cases, and was more common in males than in females. It usually caused trouble about the 8th. or 9th. day and never lasted more than 36 or 48 hours.

7. The eyes frequently gave trouble owing to the formation of pustules upon the margin of the lids. This condition was treated by frequent spraying with very weak perchloride of mercury solution, then washing with tepid water and afterwards smearing a little Ung. Hydrarg. Oxid. Flav. over the edges of the lids.

8. A mild and superficial form of conjunctivitis was common in confluent cases and sometimes seen in discrete attacks.

9. Combined with this in three severely confluent cases was Iritis which however readily yielded to ordinary treatment. In none of my cases did any ill-effects to the eyes result.

10. In one case purulent inflammation of the knee-joint ensued- that is a suppurative arthritis - but free ^{incision} ~~imission~~ and drainage were followed by a rapid recovery with a joint not quite rigid but limited in movement only.

11. In one case abortion resulted at the time of the secondary fever, which however was not by any means severe the highest point attained being 102.4° . The patient made an excellent recovery.

DIAGNOSIS

The only disease which I found to cause confusion in diagnosis were measles, chickenpox, acne, erysipelas, and herpes.

In one single case a transient eczematous (papular) eruption of the scalp in an infant, associated with constipation, was mistaken for smallpox, and in another case the disease was confused with Lichen Scrofulosus. But the only two diseases which really caused trouble were acne and chickenpox, the latter much more than the former.

Chickenpox too was most frequently confused with smallpox and vice versa during the last few months of the epidemic when it assumed a very mild type. I relied upon the following characters for its distinction, in addition to those more generally known.

1. Chickenpox exhibits spots in the papular, vesicular and crusting stages at the same time on the same part of the body. Smallpox, the eruption of which comes out for the most part all at once, does not shew these different stages of eruption on the same part of the body.

2. There is in most cases of chickenpox no umbilication: when it does occur it is only in the large spots - the centre sinking in or drying up. Even then the peripheral parts of the vesicle can be emptied all at once by pricking, when the vesicle collapses entirely.

3. The scab of chickenpox is always of a paler yellow colour than that of smallpox and is more easily detached.

4. Chickenpox is a disease of childhood.

5. No spots are to be found on the palms of the hands or soles of the feet in chickenpox as in smallpox.

ACNE VULGARIS is distinguished from smallpox by:-

1. The absence of premonitory symptoms.
2. The presence of papules and pustules and sometimes also scars at one time on the same part of the body.
3. The presence of comedones.
4. The general absence of areola and vesicles.
5. It is a disease of adolescence and should not confuse the diagnosis except at this period of life.

6. The face and shoulders alone are usually affected in acne whereas smallpox may be found in any situation.

PROGNOSIS

1. The main element in prognosis, to which all other conditions are emphatically subservient, is the condition as to vaccination .

This will be more fully discoursed ^{upon} later.

2. The previous habits of the patient especially in regard to alcohol are of the same significance here as in other acute diseases.

3. The character of the eruption is perhaps next in importance to vaccination.

Pure haemorrhagic cases are always fatal; haemorrhagic pustular cases are except in extremely rare instances also fatal; and cases ^{by} where the eruption is nearly confluent even in the papular and quite confluent in the vesicular stage are more fatal than those in which the confluence is only observed in the pustular stage.

4. I am inclined to lay special stress upon a

change in colour of the vesicles from a milky white to a livid or pale purple colour as a most unfavourable sign. This colour becomes darker as the pustular and scabbing stages are reached.

But in some cases, especially in old people, it is a common thing to find scattered blebs filled with a dark purple fluid: these are generally found on the lower limbs and in a few cases have probably been caused by the patient getting out of bed in a state of delirium. The cases in which I observed them all ended favourably.

5. Subsidence of the facial swelling if it take place gradually and is followed by puffiness of the hands and feet is usually a not unfavourable sign.

But should this swelling of the face or extremities disappear suddenly it is almost invariably unfavourable.

6. The onset of convulsions I have observed in a few cases to be preliminary to a fatal termination. Convalescence is usually rapid and the health and strength are not impaired. In fact the patients were usually better after an attack of smallpox than they had been for some time before.

In one case, a patient whose death from ~~Phthisis~~ ^{Phthisis} was being daily awaited by her relatives, contracted smallpox and was removed with great difficulty to the Hospital: after a mild discrete attack lasting for 15 days she was able to walk the greater part of the way home - two and a half miles away.

T R E A T M E N T. I formed the opinion from a consideration of the cases with which I had to deal that there were three main things to be done in the treatment of smallpox:-

- (1) Attend to the eruption.
- (2) Combat the pyrexia.
- (3) Treat the delirium, depression, sleeplessness &c as well as the complications on ordinary lines.

Perhaps however, before discussing these lines of treatment it should be said that the Hospital Wards should be freely ventilated. Overcrowding or the close aggregation of bad cases especially in the pustular stage retards recovery, and, I believe, renders the patients more liable to suffer from boils and abscesses afterwards. Diarrhoea too is more common in such overcrowded wards. I do not attach much importance to the somewhat fanciful treatment of patients in rooms with red blinds &c &c, but I think that in smallpox as in most exanthemata, where the eyes seem to

share in the hyperaemia common to the skin, care should be taken that patients are not exposed to strong light.

A moderate temperature should be maintained in the wards - about 50° or 52° F; itching of the skin is probably lessened by this procedure, and also restlessness and delirium.

1. Turning now to the treatment of the eruption itself, I was advised by the Medical Superintendent of a neighbouring Smallpox Hospital to try the effect of Antimony: he gave it as his opinion from purely empirical observation that it had the effect of hastening pustulation and scabbing. For this purpose I gave Vinum Antimoniale in doses of from 5 to 30 minims both by itself and combined with Tinct. Cinchonae Co. in a number of cases, and also Antimon. Tart. in $\frac{1}{16}$ grain doses in another series of cases. Careful observations were made and records kept but I was forced to the conclusion that the treatment probably had not the stated effect. My friend urged that he could often obtain the formation of crusts by the 7th day. But in children not taking medicine of any kind it is not at all uncommon to find crusts formed even on the 6th day, though in adults it is usually the 9th day at the earliest.

It must be remembered, too, that accidental rupture of a vesicle or pustule, such as

frequently results from lying on them, is followed by oozing of fluid from these spots which dries up to form crusts.

A plan of treatment, which I believe has been recommended before in a different manner, is to open the pustules when they are so to speak ripe, empty them as far as possible of their contents by dabbing them with antiseptic wool and afterwards applying one of the antiseptic ointments or one of the dusting powders to be mentioned shortly.

I believe this method of treatment has saved scarring to some extent by preventing the infiltration of puscells into the cutis vera and consequent destructive inflammation of this.

Looked at in another way too it would appear but a rational mode of treatment. Imagine these numerous small abscesses, for such they are, combined ^{into} ~~with~~ one large abscess - the treatment would be obvious and would be to incise and relieve tension. Why should it not be done to each small abscess or pustule individually? It is a method which is adopted too, in dealing with acne pustules, with great benefit.

But the results obtained on actual practice of the treatment render all argument from

analogy unnecessary. I have records of numerous cases in which a high maturation fever was reduced in a few hours within safe limits and remained low permanently.

These are brief particulars of some of them.

Case 1. Unvaccinated: Confluent Attack: Temp 9 p. m. on 8th day 105° ; large number of pustules opened and dressed: temp 11.30 p. m. same day 100° : rose to 101° next morning; 100.8° next evening, and 101.6 morning after. Afterwards it sank gradually.

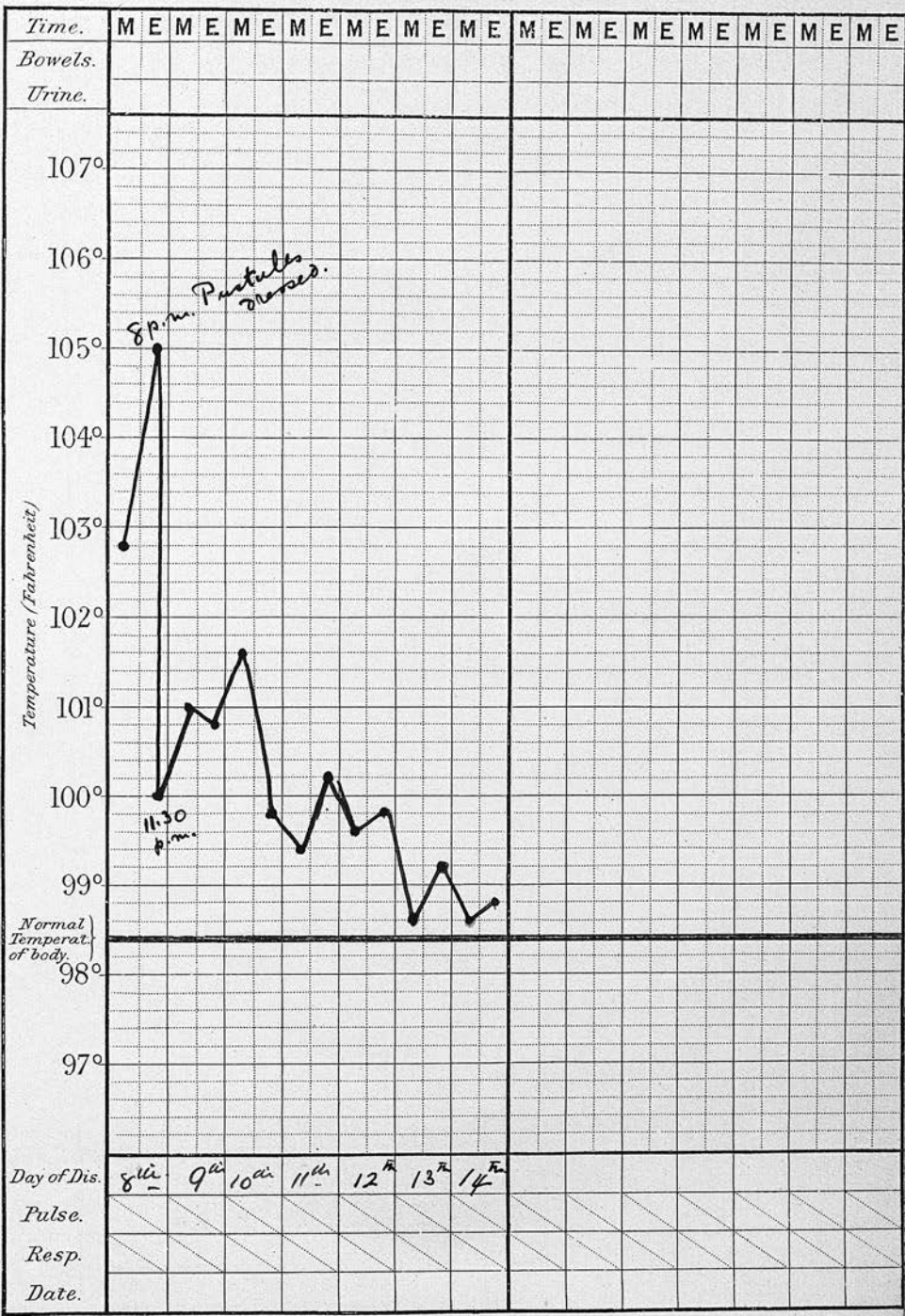
Case 2. Unvaccinated: semi-confluent attack. On 9th day temp. 104.6° pustules pricked and dressed; temp fell to 98.4 in 2 hours, It rose to 103° next morning, but without any further opening of pustules it rapidly sank and remained very little above normal.

Case 3. Unvaccinated: copious discrete eruption. Temp. 7th day when pustules - filled 105.2° : after dressing a large number of pustules the temperature fell to 101° in about four hours; next morning it was 99° , next evening 99.2° and it remained good.

These are fair examples of the results obtained in a large number of cases. Of course no medicine was given and no other measures except

Case I.

DISEASE.



Notes of Case.

Name {

Age

Diet

Case Book N^o

Date of admission.

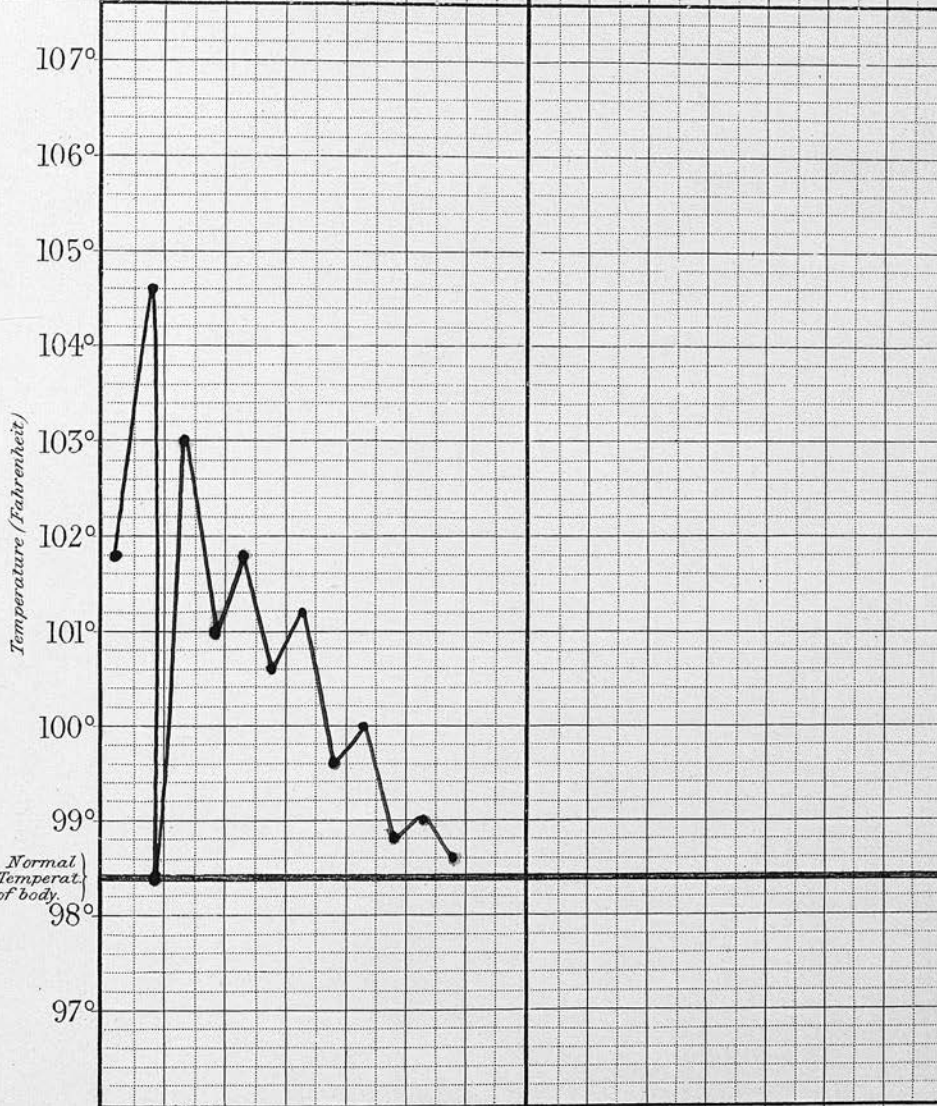
Result

Case II

DISEASE.

Time.	M	E	M	E	M	E	M	E	M	E	M	E	M	E	M	E	M	E	M	E
Bowels.																				
Urine.																				

Notes of Case.



Day of Dis.	9	10	11	12	13	14													
Pulse.																			
Resp.																			
Date.																			

Date of admission.

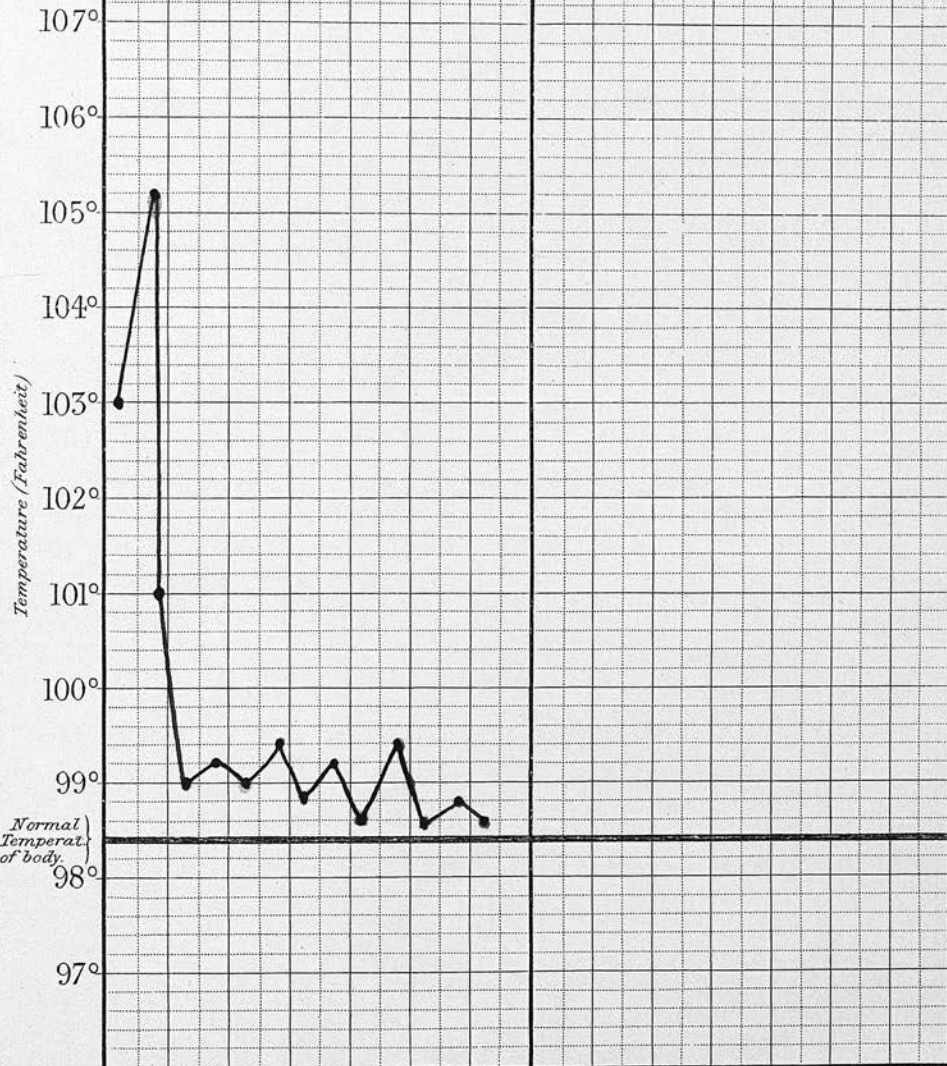
Case III

DISEASE.

Time.	M	E	M	E	M	E	M	E	M	E	M	E	M	E	M	E	M	E	M	E
Bowels.																				
Urine.																				

Notes of Case.

me {
e
t
se Book N^o



Date of admission.

Day of Dis.	Pulse.	Resp.	Date.

those stated were adopted so that the results are not likely to have been vitiated.

I found that after the pustules had been thus opened and their contents expressed, the good result was ensured by the use either of a dusting powder or of an antiseptic ointment, or of both, the powder being used for the first three or four days until the crusts began to be detached and then the ointment.

After a trial of various dusting powders such as calomel either alone or with starch, zinc oxide either alone or with equal parts of starch, Fuller's earth, zinc carbonate, Boracic Acid with starch and chalk, and other combinations I gave them all up and came back to one I had used previously Calcium Phosphate. . This is light, white, neutral and bland, all of which qualities are essential for the comfort of the patient. It was applied daily or at times twice daily to any broken pustule which was oozing as well as to those which were artificially opened.

The antiseptic ointments were of use in allaying the sometimes terrible irritation and itching of the drying pustules, and the first two mentioned which contain camphor proved of the greatest utility.

1. R.

Paraff. Dur partes $\frac{xvi}{i}$

Paraff. Moll. " 140

Iodoformi " 7

Camphorae " 14

Misce: fiat *unguentum*. (Smear on).

2. R.

Ung. Zinci $3\dot{i}$

Camphorae gr. $\overline{X X X}$

Misce: fiat *unguentum*. (Smear on).

3. R.

Acid. Carbol. $3\dot{i}$

Glycerini. $3\dot{i}\beta$

Sp. Vin. Rect $3\dot{i}\gamma$

Aquam ad $3\dot{v}\dot{i}$

Misce: fiat Lotio.

(To be dabbed on frequently)

4. R

Resorcini $3\dot{i}$

Lanolini $3\dot{i}$

Adipis Benzoat. $3\dot{i}\gamma$

Misce; fiat *unguentum*. (smear on)

5. R

Glyc. Acid Carbol.

Glycerini \overline{aa} partes equales.

Misce: fiat Lotio.

(To be dabbed on)

6. R Aq. Calcis

Ol. Lini \overline{aa} partes equales.

Misce bene: fiat emulsio.

(To be smeared on)

7. R.

Iodoformi gr $\overline{X X X}$

Ol. Eucalypt. $\overline{3\text{℥}}$

Glycerini $\overline{3\text{ij}}$

Misce bene: fiat emulsio: (smear on)

The advantages of treatment by the pricking of pustules and the use of dusting powders, antiseptic ointments &c are:-

(1) That the shedding of the scabs is hastened: the average length of the time from the actual commencement of eruption to the falling of the scabs being here 12 days, whereas in cases where the skin is not treated it is from 18 to 21 days or longer.

(2) The pyrexia is lessened.

(3) Itching is relieved.

(4) The occurrence of boils and abscesses afterwards is very rare

(5) In some cases it has appeared to prevent scarring.

INTERNAL MEDICATION

The following remarks have special reference, except where otherwise mentioned, to confluent cases.

In discrete cases medicine was scarcely ever given internally except when the eruption was copious. Then as in confluent cases quinine usually in combination with iron, or potassium chlorate in combination with cinchona and hydrochloric acid, as follows:-

R Potass. Chlorat gr 180
Tinct. Cinchon. Co
Acid. Hydrochlor. Dil. aa $\overline{3\text{ij}}$
Aq. ad $\overline{3\text{vi}}$

Misce: fiat, mistura.

Sig. One Tablespoonful every 3 or 4 hours.

The following mixture was found of great benefit in cases in which pyrexia and restlessness were present together:-

R. Salol gr. 180
Tinct. Chloroformi et Morphinae $\overline{3\text{ij}}$
Mucilag Acaciae $\overline{3\text{ij}}$
Aq. ad $\overline{3\text{viii}}$

Misce: fiat mistura.

Sig. One tablespoonful every 2 hours.

Along with these I used always to give a mild laxative if there was the least cause to suspect sluggish action of the bowels.

In those cases (mostly confluent) where the pustules did not fill out properly or did not acquire a healthy yellow colour, but remained flat and contained a thin watery fluid, the pulse and general strength remaining feeble, I placed reliance on the exhibition of large doses of cinchona and acids with stimulants and a generous strengthening diet. In some of these cases too the use of iron and strychnine alternately with cinchona and acids had a markedly beneficial result.

To combat the pyrexia I found antifebrin, given in 8 grain doses every 4 hours, generally with a little weak brandy and water given ten minutes afterwards, a most valuable drug. It does not appear to produce the same degree of depression, even when given without any subsequent stimulant, as antipyrin, and it has a steady continuous action when given as above which is most valuable in dealing with prolonged high temperatures.

Phenacetin, in my opinion runs it close as a safe antipyretic: the effects of an 8 grain dose last from 4 to 6 hours and no ill results have been observed by me.

In a few cases in which hyperpyrexia

occured I used the hydrobromate of quinine in grain doses hypodermically with excellent temporary result but in only one of the cases did ultimate recovery take place.

The use of Turpentine and Ergot in haemorrhagic cases has been alluded to.

As a hypnotic the most valuable combination I have ever used, and to which I would pin my faith unhesitatingly in all kinds of cases of Variola, was a draught of opium and ether as follows:-

Rx Tinct Opii
Ether aa m x v *to 3℥*
Aq. Camphorae ad *3℥*
Misce: fiat haustus.

Repeat in one hour if necessary.

Next in value I would place Hyoscine given hypodermically in doses of $\frac{1}{150}$ to $\frac{1}{100}$ grain,

Hyoscyamine given similarly in doses of $\frac{1}{100}$ to $\frac{1}{50}$ grain, or perhaps better still a combination of these two.

Next again in value I think would come a combination of 10 grains each of chloral hydrate and potassium bromide, but where the throat was affected I always hesitated to use this on account of the irritation it caused.

In all cases where it was not absolutely contra-indicated a brisk saline purgative was given on the earliest onset of delirium and I feel confident it was of effect in lessening it.

Hypodermic administration of drugs in cases of severe smallpox is a matter of difficulty because of the state of the skin. It was positively difficult in some confluent cases to find a place in which the needle could be inserted without piercing a pustule or vesicle, and if one plunged the point bravely through a pustule one usually found next morning that a tender raised and angry looking swelling was formed which caused great discomfort to the patient for 2 or 3 days.

I always gave sedatives with great caution in those cases in which there was much salivation for obvious reasons.

Constant watching was found necessary in cases of delirium and in a few cases a male attendant had to be employed. Indeed had this not been carried out carefully we should probably have lost several of our cases by violent death.

To relieve the sometimes intense thirst warm drinks were usually found best, but in other cases nothing gave relief but sucking ice, and in a few other cases, curiously enough, the sucking of very small pieces of Troch. Morphinae et Ipecacuanhae.

PART 2.

STATISTICAL

STATISTICS OF 150 CASES OF SMALLPOX.

These cases classified according to their state as regards vaccination were as follows:-

36 cases never vaccinated,
101 cases once vaccinated,
9 cases revaccinated,
and 4 cases doubtful.

I propose to consider with reference to each class -

1. The total mortality and the mortality at various age - periods
2. The nature of attack in each class as a whole and at various age - periods.

1. In the unvaccinated class there were 36 cases with 11 deaths: the mortality was thus 30.55 per cent. In the once-vaccinated class there were 101 cases with 5 deaths: the mortality was thus 4.95 per cent.

In the revaccinated class there were 9 cases with no deaths.

In the "doubtful" class there were 4 cases with 2 deaths.

Thus the mortality in the unvaccinated class was slightly more than six times as great as in the once-vaccinated class.

Taking now the mortality at different age-periods in the never-vaccinated and the once-vaccinated classes, and excluding 3 cases under 3 months of age and never-vaccinated for the sake of absolute fairness, we find, as the following Tables will shew:-

1. That the cases in once-vaccinated persons under 20 years of age were very few.
2. That no death occurred under the age of 30 years.
3. That in the never-vaccinated class the largest number of attacks were at ages under 10 years and that 7 out of a total ^{of} 9 deaths occurred _{in} within the first ten years of life.
4. That the case-mortality in the once-vaccinated never reached 16 per cent, at any age, whilst in the unvaccinated the lowest case-mortality was just over 16 per cent.

Had the rate of mortality been the same in the once-vaccinated as in the unvaccinated the deaths amongst vaccinated persons would have been 27 instead of 5.

It must be borne in mind too that the vaccinated class includes a number of cases - nearly one sixth - in which the vaccination marks were decidedly poor.

ONCE VACCINATED CASES

Ages in Years	Total Attacks	Total Deaths
0 - 1	2	0
1 - 5	2	0
5 - 10	2	0
10 - 15	3	0
15 - 20	6	0
20 - 30	31	0
30 - 40	36	2 (5.55)
over 40	19	3 (15.7)
<i>All Ages</i>	<i>101</i>	<i>5 (4.95)</i>

UNVACCINATED CASES

Ages in Years	Total Attacks	Total Deaths
0 - 1	4	2 (50.0)
1 - 5	12	4 (33.3)
5 -10	6	1 (16.6)
10 -15	5	0
15 -20	2	0
20 -30	2	2 (100.0)
30 -40	1	0
over 40	1	0
<u>All ages.</u>	<u>33</u>	<u>9 (27.27)</u>

The figures in brackets give the case mortality per cent, but of course the figures are only small for such calculations.

2. Turning now to the nature of attack in the several classes as a whole, and in the same classes at different age-periods

1. Of the 33 unvaccinated cases 13 were discrete and 20 were confluent attacks.
2. Of the 101 once vaccinated cases 85 were discrete, 13 were confluent, and 3 were haemorrhagic attacks.
3. Of the 9 revaccinated cases all were the mildest possible discrete attacks, the worst case having but eight spots.
4. Of the 4 "doubtful" cases 1 was discrete, 2 confluent and 1 haemorrhagic.

Thus, taking the proportions of discrete and confluent cases to total cases in each class, we find that in the once-vaccinated the discrete cases were in double ratio to such mild cases in the never-vaccinated, and that the confluent attacks in the never-vaccinated class were nearly five times greater in proportion than among the vaccinated.

The nature of attack in the once-vaccinated and never-vaccinated classes at different age-periods is shewn in the following Tables.

ONCE VACCINATED.

Age in Years	Character of Attack			Deaths.
	Discrete	Confluent	Haemorrhagic	
0 - 1	2	0	0	0
1 - 5	2	0	0	0
5 - 10	2	0	0	0
10 - 15	3	0	0	0
15 - 20	5	1	0	0
20 - 30	29	2	0	0
30 - 40	31	5	0	2
over 40	11	5	3	3
All ages	85	13	3	5

UNVACCINATED

Age in Years	Character of Attack		Deaths.
	Discrete	Confluent	
0 - 1	2	2	2
0 - 5	5	7	4
5 - 10	3	3	1
10 - 15	2	3	0
15 - 20	1	1	0
20 - 30	0	2	2
30 - 40	0	1	0
over 40	0	1	0
All Ages	13	20	9

From these Tables it will be apparent:-

1. That the more severe cases did not appear in the vaccinated class until a comparatively late-age and that as age advanced the number of severe cases increased.

The occurrence of three haemorrhagic cases at ages over 40 is to be noticed: the exact ages of these patients were 43, 45 and 59 years.

2. That in the unvaccinated class the greater number of severe attacks were at early ages.

The facts as to the re-vaccinated cases are set out in the following Table.

Age in years	Sex	Character of Primary Scars	Character of Attack
35	F.	3 medium sized, foveated	4 spots
37	F.	1 ditto ditto	8 spots
38	M.	1 ditto slightly foveated	6 spots
22	M.	2 ditto ditto	7 spots
29	F.	Not observed	Few abortive spots.
29	F.	ditto	Ditto
22	M.	4 large sized, foveated	4 spots
17	F.	Not observed	5 -
18	M.	3 medium sized, foveated	5 -

In all of these cases the re-vaccination was performed after the appearance of smallpox in the house or in the immediate neighbourhood: that is

after risk of infection had been incurred. Needless to say all these cases recovered, none of them being confined to bed at any stage of the disease.

As a further means of shewing the influence of vaccination upon the nature of attack we may consider the number of "abortive" attacks in each class the term "abortive" being here applied to those attacks (which were always discrete) where the eruption did not attain the pustular stage at least. In the majority of these "abortive" attacks the eruption simply became papular and without any vesiculation taking place the papules died away.

ABORTIVE ATTACKS

	Unvaccinated.....4 (see below Note A)
Under 10 years of age	Once Vaccinated...4
	Revaccinated.....None
Over 10 years of age	Unvaccinated.....None
	Once Vaccinated...24 (see below Note B)
	Revaccinated..... 9

Note A. of these 3 cases one was vaccinated on the 5th day of incubation but the vaccination marks beyond causing some slight irritation for a few days did not apparently take. In another of these cases the vaccination was performed on the 9th day of incubation but shewed no external sign

of having "taken".

In a third case vaccination was performed on the 8th day of incubation: the marks became papular and then died away.

In all three of these cases it is conceivable that the vaccination had some effect in modifying the disease although it shewed no special local evidence of having "taken".

Note B. In one of these cases revaccination was performed on the 6th day of incubation but gave no external sign of having been successful.

The figures referring to attacks at ages over 10 years of age are in favour of vaccination and strongly in favour of revaccination as agents modifying the severity of attack.

Some interesting relations are brought out by a consideration of the condition of the once-vaccinated class more particularly. I propose therefore to examine this class as to the relationship between the severity of attack and mortality at all ages and:-

1. The number of vaccination cicatrices.
2. The area of scarring
3. The condition as to foveation.

1. The number of Vaccination Scars

Exact information was obtainable with regard to 80 cases and these may be classified as below.

No of Scars.	Discrete Attacks		Confluent Attacks		Haem. Attacks		Deaths	
	No.	Per cent of total cases	No.	Per cent of total cases	No.	Per cent of total cases	No	Per cent of total cases.
One Scar	10	12.5	2	2.50	-	-	1	1.25
Two Scars	17	21.2	1	1.25	2	2.50	1	1.25
Three Scars	27	33.7	5	6.25	-	-	1	1.25
Four Scars	16	20.0	-	-	-	-	-	-

Thus it is seen ~~that~~ (1) that the percentage of discrete attacks is greater in persons with two scars than in those with one, and is greater in those with three scars than in those with two, whilst in those with four scars there is a decided advantage over cases with but one scar though this does not hold good with the two and three Scar cases. (2). The four scar cases however shew a total absence of attack by the severer forms of the disease and ^athe total absence of deaths.

2. Taking next the condition of the same 80 cases as regards total scar area, and adopting as the maximum an area of $\frac{1}{2}$ square inch the particulars are as set out below.

Area of Scars	Discrete Attacks		Confluent Attacks		Haem Attacks		Deaths	
	No	Per cent of total cases	No	Per cent of total cases	No	Per cent of total cases	No	Per cent of total cases
Under $\frac{1}{4}$ sq. inch	5	6.25	3	3.75	2	2.50	1	1.25
$\frac{1}{4}$ to $\frac{1}{2}$ sq. inch	44	55.00	4	5.00	-	-	2	2.50
$\frac{1}{2}$ sq inch and over	21	26.25	1	1.25	-	-	-	-

Thus the percentage of discrete attacks was large in cases with medium and large sized scars, and the cases with the largest scar area shewed the smallest percentage of confluent attacks and a total absence of both haemorrhagic attacks and deaths.

3. FOVEATION OF SCARS

Classifying the same cases on this basis we get the following table.

	<u>Discrete Attacks</u>		<u>Confluent Attacks</u>		<u>Haem Attacks</u>		<u>Deaths</u>	
	No	Per cent of total cases	No	Per cent of total cases	No	Per cent of total cases	No	Per cent of total cases.
Foveated Scars	58	72.5	4	5.0	1	1.25	1	1.25
Unfoveated Scars.	12	15.0	4	5.0	1	1.25	2	2.50

Practically the only safe conclusion we can draw from this is that almost three quarters of the cases with foveated scars were discrete cases.

Taking together however either the number of scars and foveation, or the total scar area and foveation as set out in the following large table (which is based to a considerable extent on that issued by the "British Medical Journal" in 1893) I think it will be obvious that in persons with a good sized and well foveated scar area the prognosis may safely be given as a favourable one.

I have condensed the particulars of the large Table on this point into a smaller Table for the sake of clearness.

Nature of Scars	Nature of Attack			Deaths.
	Discrete	Confluent	Haem	
One Scar Foveated	5	2	-	1
One Scar Unfoveated	3	-	-	-
Two Scars Foveated	15	-	1	-
Two Scars Unfoveated	2	1	1	1
Three Scars Foveated	22	2	-	-
Three Scars unfoveated	5	3	-	1
Four Scars Foveated	14	-	-	-
Four Scars unfoveated	2	-	-	-
TOTAL	68	8	2	3

DURATION OF STAY IN HOSPITAL

The evidence which this supplies on the influence of vaccination is, in this case at all events, not specially valuable.

A rule was made, for example, in the early days of the Hospital that no case, however mild, should be discharged within fourteen days of admission and this naturally lengthened the average duration of stay of the mild cases whilst it did not affect the severe ones.

Another thing which to a considerable extent discounts the value of statistical data on this point is that in a good many cases a child a few weeks or a few months of age was admitted suffering from smallpox in a severe form: owing to the fact of the child being breastfed, or at least being too young to be separated from its mother, the latter was admitted with the child and was revaccinated on admission— this being made a condition of admission. The mother in several cases contracted a mild form of the disease, lasting perhaps a week or ten days, but the precaution was not taken of entering her case up as having been admitted on the first day of the disease and as having been discharged when the disease had terminated. The actual dates of

admission and discharge in company with the Child
were entered, and therefore the duration of stay
of the Mothers mild case was made coincident with
the child's severe case. However I give the
averages subject to this explanation.

Average duration of
stay in Hospital.

Never-Vaccinated Cases --- 25 days

Once-Vaccinated cases -----23 days

Revaccinated cases ----- 17 days

The averages are in favour of the once-
vaccinated and revaccinated cases, but not to
such an extent as they might have been had they
been based on proper observations.

PARTICULARS OF SMALLPOX AND VACCINATION IN
QUARANTINED PERSONS.

During the epidemic 83 families were kept in "quarantine" by the various local authorities concerned, and the statistics in regard to them give the most reliable evidence obtainable, perhaps, of the protection afforded by vaccination and revaccination, for the persons concerned had been exposed for as a rule at least 2 days to the infection of smallpox, and were living under the same conditions of life &c.

In the 83 families there were 277 persons at all ages of these,

16 were unvaccinated,

78 were once - vaccinated

and 183 were revaccinated.

And of the 277 persons 37 contracted smallpox.

Of 78 persons under 10 years of age.

13 were unvaccinated

54 were once-vaccinated

11 were re-vaccinated

and 16 contracted smallpox

Of 199 persons over 10 years of age:-

3 were unvaccinated

24 were once-vaccinated

172 were revaccinated

and 21 contracted smallpox

Of the 78 persons under 10 years of age five once-vaccinated persons contracted smallpox, and all 5 cases were discrete and non-fatal.

The incidence of attack on the once-vaccinated class was thus 9.25 per cent and the case-mortality nil.

Of the same 78 persons 11 who were unvaccinated contracted smallpox, and of these 11 cases 7 were confluent, four discrete and three fatal.

The incidence of attack on the unvaccinated class was thus 84.6 per cent., and the case mortality 23.0 per cent.

Thus the once vaccinated persons under 10 years of age shewed a more than nine-fold greater immunity from attack, compared with the unvaccinated when placed under the same conditions of exposure to the infection of smallpox.

Of the 11 revaccinated cases, ^{none} contracted smallpox.

Taking next the 199 persons over ten years of age, we find that of those who were once vaccinated 12 contracted smallpox and with the exception of two haemorrhagic cases at advanced ages (43 and 59) all the attacks were discrete and non-fatal.

The incidence of attack on the once-vaccinated class was thus fifty per cent and the

case mortality 8.33 per cent.

Of those who were unvaccinated all three contracted smallpox and one died, the other two having severe discrete attacks.

Thus even in persons over 10 years of age we have ⁱⁿ the vaccinated a two-fold immunity against ~~the~~ attack and a four-fold immunity from death by smallpox.

Of 172 revaccinated cases 6 contracted smallpox and in all cases the disease was discrete and non-fatal.

The incidence of attack on the revaccinated class was thus 3.48 per cent and the mortality nil.

Thus the revaccinated class as compared with the once-vaccinated class over 10 years of age shewed a 14-fold immunity against attack and an 8 fold immunity against death by smallpox, and as compared with the unvaccinated class at the same age-period the revaccinated class shewed a 28-fold immunity against attack and a 33-fold protection against death by smallpox.

NURSES AND ATTENDANTS. In this special class I propose to consider briefly the cases of 20 persons, 12 of whom lived inside the smallpox hospital and 8 outside. All these persons as their occupations will shew, were exposed directly on innumerable occasions to infection from the most virulent as and indeed from all kinds of cases of smallpox. The nurses, for example, must have inoculated themselves time after time with variolous matter & this surely affords a crucial test of their protection.

The hospital attendants, cooks, ward-maids, laundry-women, care-taker, porter, ambulance men disinfectors &c. were in the wards many times during the day & of course lived under the same roof & in the next rooms often to the smallpox patients.

Those attendants who lived outside, such as extra ambulance men, extra laundry-women, house disinfectors &c by reason of their work came into close & daily contact with infected clothing, infected persons, infected houses &c.

Yet of the 12 inside attendants only one, a nurse who had been twice vaccinated unsuccessfully contracted smallpox & the attack was a very mild abortive discrete one, so mild that she was never off duty during it. The others were all revaccinated & escaped entirely.

Of the 8 outside attendants one had smallpox at the beginning of the epidemic, six had been revaccinated, and one, who was employed only for a

few hours in fixing a stove &c inside the hospital had been vaccinated in infancy and stoutly refused revaccination. The latter was the only person to take the disease. He was 53 years of age, had 3 small unfoveated scars, contracted a confluent attack & was 50 days in Hospital.

REMARKS In connection with these statistics I may say that the cases recorded affected, with only two exceptions of men from a common lodging house, entirely the better class of artisans & that the habits, work, surroundings at home & at work were similar in both the vaccinated & unvaccinated class. No single one of the cases recorded came from an overcrowded or insanitary part of the town.

The previous health was always inquired into, but in only two fatal cases (one vaccinated & one unvaccinated) could any unsatisfactory history be discovered: these two cases were both alcoholic.

I have several times been asked if in any case the copious eruption interfered with the appearance of the vaccination cicatrices or rendered their discovery difficult: my answer has always been in the negative.

I have also been asked whether in any of the unvaccinated cases illhealth has been given as a reason for not having had the vaccination done: my answer has always been that I have been alive to the possibility of this but have never found it to be the case.

Influence of Hospital on Surrounding Houses.

Taking the Hospital as a centre there are 17 inhabited houses with about 85 persons living in them within the quarter mile radius.

Only one case of small-pox occurred in these houses during the whole of the epidemic and this was traceable to personal convection. This house was situated 250 yds from the Hospital.

In the zone between the $\frac{1}{4}$ and $\frac{1}{2}$ mile circles there are ¹⁴³⁶~~1426~~ inhabited houses with a population of about 7180 persons living in them. Of these 1436 houses 16 were visited by smallpox: all the 16 were outside the $\frac{3}{8}$ mile radius and most of them were near to the extreme limit of the half-mile radius.

In all, 30 cases occurred in the zone between the quarter and half mile radii.

I cannot think that these cases owed their origin to radiation of infection from the Hospital for the following reasons.

1. Three of the cases affecting 2 houses were imported from outside districts.
2. The Hospital was situated on a hillside at an elevation of 300 feet above sea level whilst the average altitude of the affected houses was 190 feet above sea-level.

3. A fairly dense wood intervenes between the Hospital and the affected houses.

4. Most of the affected houses were on the main road passing through Brighouse from the adjoining large towns of Halifax and Huddersfield and this main road is literally infested with tramps.

Others of the affected houses were on the side of the main road joining Halifax with Wakefield and Leeds, and this road is similarly favored by vagrants.

5. Had the Hospital been a source of infection one would have expected to find the greatest number of cases in the houses nearest to the Hospital, whereas almost the exact opposite of this was the case.

6. Had the Hospital been the source of infection one would also have expected the greatest number of cases to have occurred at a time when the Hospital contained the greatest number of cases or the most severe cases. But the greatest number of the cases mentioned occurred towards the end of the epidemic when there were only a few mild cases in Hospital.

These considerations seem to me to render it highly improbable that the Hospital acted as a centre of infection to the neighbourhood.

MEASURES ADOPTED DURING THE EPIDEMIC

Briefly these were:-

1. Free vaccination and revaccination, of all persons who had been exposed to infection, by the Hospital Authorities.
2. Prompt isolation of all notified cases.
3. Disinfection of houses, and whilst this going on the inmates sent to Hospital to have disinfectant bath and have all clothing &c disinfected by steam.
4. Quarantine of Inmates of infected houses.

This calls for some special remark.

It was only carried out throughout the whole epidemic by one of the districts concerned, the expenses being considered by the other districts as illegal and liable to be surcharged by the Auditors of the Local Government Board. As a matter of fact however the accounts for quarantine, which were heavy, met with no adverse remarks from the Auditors, the presumption being that in a time of epidemic and more or less general panic a local authority is justified in going a little beyond the actual limits of the law for the good of the town.

There was no difficulty experienced in getting people to remain in quarantine for 14 days even when shops and public houses were concerned.

The inmates were visited daily by a man who took a list of the provisions &c required and obtained these at the Local Authority's expense, due regard always being paid to the reasonableness of the demands.

All quarantined houses were visited by me daily in order to detect any further case without delay.

Personally, I think that where prompt isolation of the Patient, disinfection of the House &c, and vaccination or revaccination of the inmates can be carried out at an early date quarantine is quite unnecessary; the house should simply be kept under medical supervision, and a Certificate might be given in necessary cases to employers stating that all known ^{precautions} ~~vaccinations~~ had been complied with and that unless they heard to the contrary no further danger need be feared from the house in question. Where these precautions were not adopted by the inmates of infected houses a note might be sent to the Employers stating this and warning them of possible danger.

Of course the two objections to this system are, firstly, that to the popular mind it is "making fish of one and flesh of another" and it might not therefore meet with the approval of Local Authorities, and, secondly, that the whole

matter would really be left to be decided by the Employers who might on the one hand refuse to continue the employment of persons who had adopted all these precautions, or on the other hand might continue the employment of those who had taken no precautions.

But I have tried it in a fair number of cases and met with no difficulty of this kind.

5. As smallpox is frequently spread by mild cases which are mistaken either for measles or chickenpox I advised my board to include these diseases temporarily amongst those compulsorily notifiable, and to issue special notices that the "dual" notification by householders or as well as Medical men would be insisted on. I feel confident that this would be of great benefit in checking the spread of an epidemic, and had it not been that it was towards the end of the epidemic when I suggested it I think the Local Board would have adopted it.

It appears to promise as much benefit as the temporary notification of "diarrhoea" in cholera times.

I should state that when I made this proposal I was asked why it should not be extended to other diseases simulating smallpox - such as syphilis, aene, Herpes &c. I replied, that syphilis and Herpes at least were probably not of such

common occurrence as to warrant this, and that none of them were so commonly confused with smallpox as measles and chickenpox. These last, too, have in common with smallpox a sudden onset and a febrile and infectious nature which the others have not.

P A R T 3.

CLINICAL AND OTHER OBSERVATIONS

on 215 Cases of Vaccination.

CLINICAL AND OTHER OBSERVATIONS ON

215 cases of Vaccinia.

In performing these vaccinations I invariably used glycerinised calf lymph supplied from Dr. Renner's³ establishment: with a small capillary tube of this I have produced as many as 18 vesicles of from $\frac{1}{4}$ to $\frac{1}{2}$ sq. inch in size, but I found it better to use it freely.

I invariably performed the operation by free scarification so as to draw a minute quantity of blood.

I observed in all cases in children & in those cases in young adults in which the skin of the arm was soft & vascular that for a few minutes after vaccination there was produced a transient redness or areola, round the insertions, about 2 to 4 square inches in size. At first, I imagined that this was due to the introduction of the lymph, but afterwards I found that it followed mere scarification and was present before the lymph was put on to the scarified areas. However, those insertions which shewed this areola invariably were successful, whilst of those in which it was not shewn some were and some were not successful.

I found it advisable to perform vaccination as follows:-

1. Cleanse the arm with weak perchloride of mercury and afterwards dry ^{thoroughly} with a clean towel. Roll the sleeve &c well up.
2. Pass the Lancet through the flame immediately before use.
3. Scarify three areas, each about $\frac{1}{2}$ square inch in size and situated well apart from each other, in such a manner as just to draw the slightest amount of blood possible.
4. Break the capillary tube and dab the lymph well on with the flat of the lancet, using the lymph freely.
5. Allow the lymph to dry well in, for several minutes.

Inasmuch as vaccinia is a constitutional as well as a local disease and often needs constitutional as well as local treatment, I made a practice of seeing my Patients several times during the fortnight following vaccination and always if possible during the ninth and twelfth days.

There is frequently some febrile disturbance on the ninth day when the areola begins to form, and often there is a hot brawny swelling round the vesicles and inflammation of the axillary glands. For this I used to prescribe with marked benefit a brisk saline purgative, a small

linseed meal poultice over the vesicles, and a sling to keep the arm elevated and at rest. Afterwards I recommended the smearing of weak carbolic vaseline round about the vesicles and the application of a pad of wool over the vesicles themselves, kept in place by a piece of lint passing completely round the arm and fastened by strips of plaster. This had to be changed at once if any fluid oozed through, the old wool and lint being burnt. None of my patients were allowed to use "vaccination shields".

By taking these precautions I avoided having any difficulty or trouble with my vaccinations, except in one single case where a non-specific dermatitis ensued extending down to the fingers. The patient in this case was a woman who had been using her arm on the 8th and 9th days very freely for washing and mangling: rest and cold water applications very soon cured it.

VACCINATION DURING INCUBATION STAGE OF SMALLPOX.

I have vaccinated persons on every day of the incubation stage of smallpox from the first to the twelfth. Even when performed as late as the ninth day of incubation it has appeared to be a benefit in modifying the course of the disease, and this remark may be applied with increasing

certainty to vaccinations performed on the 8th, 7th, 6th and 5th days of incubation.

If performed not later than the 4th day of incubation I believe it to be of effect in the large majority of cases in preventing the onset of smallpox altogether, and if performed on the 3rd day of incubation I regard it as a certain preventive against smallpox.

I believe that vaccination even in those cases where no local result is observable is yet often of service in modifying an attack of smallpox; at any rate I have observed cases which apparently admitted of no other explanation.

COMPLICATIONS OF VACCINIA

1. In a number of my cases crops of supernumerary vesicles developed. I believe these are more common when glycerinised calf-lymph is used, for the reason that this is more or less hygroscopic and seldom dries completely on the skin as the watery human lymph does: it is therefore more likely to become smeared over the surrounding skin and to give rise to auto-inoculation.

2. In one case the vaccinia assumed a generalised type. The vaccination, a primary one, shewed nothing abnormal until the 9th day, when a large number of what I deemed at first to be merely supernumerary vesicles appeared over almost the whole of the upper arm. On the 10th day however, vesicles were to be found on the other limbs, and

trunk and head in a scattered and sparse eruption. These became pustular about the 15th day, and had completely vanished leaving only a few small scars here and there by the end of the third week. There was scarcely any constitutional disturbance at any time.

3. As shewing the influence the exanthemata have upon vaccinia I may mention the following case.

J. W. aged 3, unvaccinated, was suffering from scarlet fever. His mother was expecting parturition and her Medical man thinking that it would not be wise to have a case of scarlet fever in the house during the puerperium asked me if I would take the child into the Hospital which was then only being used for a few cases. I gave my consent, stipulating of course that the child should be vaccinated at once.

He was vaccinated in three places with calf lymph July 1st. As no sign of papulation appeared on the 4th I then vaccinated the other arm in the same way: still no sign of success. Again on the 8th and on the 11th I vaccinated him without success, and still again on the 14th.

The last vaccination was successful - papulation commencing on the 17th and three large well-raised vesicles being formed on the 23rd: these passed through a normal course.

The child shewed no signs of smallpox although he was during the whole time in a ward with several smallpox cases. I think this case too points to the fact that vaccination may exert a protective influence without any external manifestation of its activity being present.

(Signed) Meredith Young.

Meredith Young