The Wallsend Small-pox Epidemic of 1883

James Aitchison
Newcastle-on-Tyne
April 1884
Description of Township

Though it may be considered irrelevant, and unnecessary, to range beyond the field proper of the theme for subject matter, I shall preface my observations on the Wallsend Smallpox Epidemic, I hope not without advantage, by giving a brief geographical, and historical, summary of the Wallsend Township.

The Township, and Parish of Wallsend, is situated on the river Tyne, midway between Newcastle, and Shields, about four miles E. N. E. from the former town, in the County of Northumberland; and is intersected by the Tynemouth Branch of the North Eastern Railway Company.

It is said to have derived its name from its position at the eastern extremity of the great Roman Wall, built by the Emperor Hadrian; which wall, commencing at the Solway Firth, terminated in a field, a short distance to the east of the site, now occupied by Carville Hall. At present the north fosse of the wall
may be traced. Extensive coal mines exist in the neighbourhood; and the place formerly gave its name to an excellent house coal. Wallsend Colliery was opened in 1777, and has been the scene of many dreadful accidents.

The Parish is governed by a Local Board of twelve members. The population of the Township in 1861 was 6,335, and of the entire Parish 13,721; but within the last two years these estimates have undergone a considerable increase, owing to the commencement of new branches of industry, and the consequent influx of workmen.

The area of the Parish, including the ecclesiastical districts of Wellington and Howdon, is 2,330 acres, rateable value £57,175; and the area of the Township 1,202 acres, rateable value £36,367.

The inhabitants are not now miners, but are mostly engaged in the large manufactories, which thickly fringe both banks of the Tyne from Newcastle seawards.

The manufacturing industries at present in active operation are, three iron-shipbuilding firms, one chemical, one copper smelting, one marine
Before passing to the consideration and elucidation of the facts obtained during the reign of the epidemic, it may be expedient to notice briefly the following topics: 1st. Past and Present Health-record of the Township; 2nd. Sanitary Condition of Township; and 3rd. The Vaccination History of the Township, which may serve the better to introduce the theme.

Past and Present Health-record of the Township

Wallsend has been generally considered a healthy township, though in common with other townships near large cities, it has been visited by cholera, small-pox, typhus, typhoid, and the infantile forms of febrile disease. There is good reason however to suppose, these things being so, that the quantity of disease (by such expression I mean in its tendency to spread) may compare very favourably with that of equally populated localities, and rarely assumes epidemic form. This has been supposed to be due to the free admixture of antiseptic gases,
Ferret products of combustion in the manufacture of alkalies, with the air; which gases, when strongly charged the atmosphere, no doubt interrupt, nullify, or destroy the invisible syringe germs, when they exist in a free condition. The pernicious effects of these gases (hydrochloric and sulphurous acids, chlorine, sulphuretted hydrogen &c.) are very clearly written on the foliage of the trees, and hedge-rows, and so we may infer that, what destroys the one, will destroy the others, forms, of organic life. The health of the community seems in no way to suffer from the evolution of these gases, excepting perhaps those residing in proximity to the chemical works, who have made complaints from time to time of being almost choked in damp and foggy weather, though it is uncertain that even in their case health was much affected.

Strict measures have lately been brought to bear on these manufacturers, and so the escape has fallen off considerably.

**Sanitary Condition of Township**

Wallsend stands high being situated on the north bank of the Tyne,
therefore it has the natural adaptability for a quick sewer drainage into the river. The Privy or Midden System is that at present adopted, which though very imperfect as a system, often leading to stoppage in the drains and consequent overflow of sewage, is on the whole fairly effective and well managed. Seeing that the growth of the Townships has within the last year been very vigorous, and promises to continue so for some time; and that the question of drainage has of late received greater prominence than hitherto, it is to be hoped that the Sanitary Authority will devise such schemes, and work out such measures, as shall tend to make the future of Wallsend more hopeful and healthful than the past.

The next topic, which deserves to be more minutely considered, as it has a special bearing on the theme, is that of Vaccination.

**Vaccination History of Townships**

Vaccination has been carried on regularly and systematically for a lengthened period. There is a Vaccination Station provided for the accomoda-
tion of the parents and their children about one and a half miles from the centre of the Township, within easy access of the Parish population. The Public Vaccinator has been in office for nearly a quarter of a century.

Four groups of incisions are made on the arm after the lymph has been applied. Vaccine capillary tubes, and ivory points are used to store the lymph for emergencies. An ordinary bleeding lancet is the instrument that the Vaccinator uses, as it is handier, more easily cleaned, and less painful, than any other. The lancet is cleaned in warm water after each operation.

Erysipelas has seldom if ever followed the operation. No instances of syphilitic infection, transmitted through vaccination, have occurred; though occasionally the operator has been blamed for causing eruptions of Favus, Eczema, Impetigo etc. There have been few, if any, cases insusceptible to the vaccine virus; though it is in our memory that one or two cases have been given, certifying to that rare condition. In such reported cases the mother may sometimes be blamed; for I have seen at the Station...
Mothers wringing off the mixture of blood and lymph, when the vaccinator's back was turned. In proof of this assertion that insusceptibility is probably a condition of system unknown, during the epidemic, children, reported to be insusceptible, developed the disease.

Some (one, or two, or) small-pox deaths were in those, who had on presentation been referred back for future operation on account of sickness, and having removed the meanwhile to neighbouring districts, returned in time to their former quarters to catch the disease, unprotected by vaccination. The public vaccinator, for the credit of vaccination in the public esteem, avoided the probably untoward result of the operation on an unhealthy subject. Infants, who occasionally, and unfortunately, might have only one ill-matured vesicle, were advised to reappear at a future time; but I need hardly say they were not often seen again at the station.

The epidemic of small-pox seemed mostly to luxuriate among those few aforementioned unsatisfactory cases; among the badly vaccinated, and un-
vaccinated stranger—population, of which, at this time, there had been a great
influx, owing to the commencement
of new branches of industry in the Town-
ship, and among the improvident, and uncleanly. The Public Vaccinator
has always received the Government
grant for successful vaccination.

Having thus cursorily opened up the
way for an analysis of the material at
hand, I shall begin my Thesis by
giving a concise narrative of the
genesis of the epidemic.

Narrative of Epidemic.

For well nigh a year, the Township
of Wallsend repelled the advances of
small-pox, which ravaged its sister
Township of Walker during the months
of 1882, and it was not until February
20th, 1883 that the first case appeared.
In one of our streets, where resides a
somewhat unpretentious class of the
Township's population, a man, and his
wife, occupied a room in tenement
property. The man's sister, in course
of time, favoured them with a visit,
which extended over a period of 14 days; and during her brief sojourn frequently accompanied her brother in calling upon a family of relatives at Byker, the most eastern suburb of Newcastle, a district, at this time, and for some considerable time previously, infested with the scourge.

But "miserable dictu" the house of the aunt, which brother, and sister, took so much pleasure in visiting proved to be the concealed abode of "death"; for there they contracted the dreaded disease, which had a fatal result in both cases. In this house three of their juvenile cousins were one after another affected with smallpox; but so lightly did the "enemy" harness his subjects, and so subtle was his "modus operandi," that no anxious thought disturbed the peace of the visitors. At last the truth spread out, and that in a very unpleasant manner. Twelve days after the brother's last visit to Byker (so it was reported by his wife), he was laid prostrate at his own house in Hedley Street, Wallsend, with a virulent attack of confluent smallpox, which,
acting upon a constitution unprotected by vaccination, led to an untimely issue. In the mean time his sister had removed to Penrith, where, some days after her arrival, she too developed a bad attack of small-pox, and succumbed, being also unprotected by vaccination. This (in the case of the man, James Quinn) became the first centre of small-pox development within the Township. About a week after Quinn's death, his wife was laid prostrate with a severe attack of small-pox, but being protected by vaccination she recovered.

On the 14th of March a man, and his wife, residing in the same tenement house, and occupying a room above the Quinn's, were next attacked. Its third manifestation was noted in a house opposite, in a family the mother of which had bravely nursed the four cases just alluded to, her bravery having been kept aglow by alcoholic imbibition. Then the disease spread to the next tenement house; and so made rapid strides in house-to-house visitation fashion around this centre.
Second centre - On the 18th of March a boy, Andrew Patterson, residing at Bankham Terrace, a street 1/16th a mile distant from the first centre, took small-pox. This was the ninth case. Here the history of its commencement was in one or other of two ways. Either it was contracted in the boy passing through the infested street, where at this time eight cases existed, or in taking his father's dinner to Walker, an infested township. In this part of the township small-pox simply began, and ended, at this early stage of its vagaries.

Third centre - The only other part of the district that the epidemic could be said to have an independent origin, was at Glover's Row, nearly a mile from the other centres. Here there was clear proof of its being imported from Walker, a township one and a half miles off. A daughter, a member of the Glover's Row family, went to nurse a friend at Walker expecting confinement, and when staying there small-pox broke out next door. After having fulfilled
her mission, she revisited her home, and soon was laid down with the disorder. This was the 10th case. In many other instances, the epidemic, after having fairly got a footing, broke out in places to some extent isolated; but in all there was a true home bill of cause, and effect. The epidemic commenced in February, and ended in October, 1883. An isolated case broke out, some four months after the cessation of the epidemic, in Lowness Street. A person came from Sunderland to Wallsend, to escape small-pox, but in 14 days he was bed-ridden "pro tem." with that plague. There was no further increase from this newly developed centre. In all, there were 121 cases of small-pox, and 15 deaths, giving a percentage mortality of 12.34.

The accompanying table gives the monthly return of cases, and deaths.

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</table>
Rough Diagram of Small-pox Dwellings (first centre).

Explanations: Yellow circle shows number affected in each dwelling; red circle, death. Tenements numbered in order of visitation with red ink.

I now pass on to the consideration of the disease proper. There is, underlying the surface ground of epidemic diseases, a mine for the practical pathologist, the ruins of which having been struck, bid fair to out-vie, and eclipse, the greatest recent
discoveries in medicine.
To-day intellects are ever startled by
some new discovery. The subtle fer-
ment, the first cause, and origin, of some
well-known devastating scourge, is so
portrayed with the skilled eye of the
observer, that we seem to know little
of what we previously thought, we had
known all.

It has often been remarked, that there
is probably no infectious disease, the
ferment of which is so powerful in
its baneful effects, than that of Small-
pox. Such has assuredly been the
conclusion I have come to, in watch-
ing the course of this epidemic.

Pathological conditions of blood
and lymph fluids.

With a view to discover, if possible,
the specific cause of Small-pox, I
subjected the blood, and lymph, to
microscopical examination, the results
of which I now propose to detail.
The specimens were got from an
unvaccinated fatal case of confluent
small-pox, two days before death.
Some were examined at that time,
October 8th, 1883, and others kept for later study. Lymph was also obtained from a discrete case with doubtful vaccination history.

Fresh small-pox lymph—There was no difficulty in distinguishing numerous micro-organisms; some free and some adhering to the lymph corpuscles. That they were not within the cell structure was made evident in focusing; for before the surface, and outline, of the corpuscles were distinguishable, these avoid, bluish, translucent, homogeneous, refractive, bacteria were detected adhering, some in a circular arrangement, others irregularly, to the cell. When free they were frequently in strings, in irregular masses, four-square, two-beaded lengths, and solitary. The attached bacteria had considerable activity, moving about the corpuscle, but disinclined to leave: yet after prolonged inspection, they were seen breaking loose, and floating away. The chain-forms varied in length, being composed of from 14 to 15 or even more, bacteria placed endwise in straight, bent, and spiral positions. They also exhibited feeble
movements with change of situation. What seemed to be the head of the chain was a bacterium of larger size and brighter appearance. After the first or head of the chain came others of smaller size (but gradually increasing their size as they approached the chain-tail). A string of bacteria might be seen hanging on to a corpuscle, as if deriving sustenance from the mass of protoplasm.

When seen in irregular masses of 6 to 10, the bacterial were very lively, and seemed to be entangled in a web of protoplasm, derived from a disintegrated cell. Circular, lunar, linear, cruciform, and rhomboidal, changes were made every few seconds by the unceasing migrations of the individual members of the mass.

The square-shapes moved similarly to the bacterial masses, rotating around one another. The groups of two, and the solitary bacteria, seemed to possess a dancing forward motion, and somerset-like action.

The lymph corpuscles were few, and scattered, mostly. The liquor lymphhe contained a transparent, indefin-
able corpuscular debris, in addition to the bacteria and corpuscles.

**Small-ply blood** - Fresh drawn small-ply blood from a confluent fatal case was dark and smoky. Coagulating and on being blown out of the capillary tubes, a short time after, gave off a very offensive odour.

Solitary bacteria were seen freely floating in the liquor sanguinis, but not in such abundance as in the lymph fluid. They were also attached to the red blood corpuscles in a concentric arrangement and individually.

On coagulating a red corpuscle the granule, or granules, of haemoglobin (like minute scarlet bacteria) could be seen in the centre, and the bluish bacteria at the circumference. A bacterial chain could be seen breaking off.

Bacterial masses, groups of four and two, were also seen, and possessing active movements.

On April 15 or 16, 1874, I again submitted specimens of lymph and blood to examination, which had been stored in hermetically sealed capillary tubes nearly six months.

**Small-ply blood** (6 mths. old). Half the
number of red, and the white corpuscles, showed well marked amoeboid movements. The active red corpuscles were of irregular, but well defined outline, strongly refracted the light, and were invaded by bacteria. The inactive ones had a regular, faint, circular contour, and very indistinct. There was an enormous increase of bacterial life. The field swarmed with dancing solitary organisms, and the chain forms were seen in great numbers. These chains were Moreover fairly uniform: some seven strong equal to the diameter of a corpuscle, and some 14 strong doubled that length. A great length of chain was sometimes noticed, broken at intervals with beaded organisms of larger size, but this in time resolved itself into distributive forms of equal length. Close upon 40 separate chains were counted on the field at one time, possessing an eel-like side to side motion. A two-beaded string broke from one of these, and floated away. Probably these strings are the growing organisms, and tape-worn
like drop off the fully matured bacteria, which live solitarily awhile, and then beget other generations like their parent.

Small-pox lymph (6 mths. old). The lymph fluid presented exactly the bacterial changes seen in the blood. Dendriform crystals of serolin were also seen.

Vaccine lymph. Many observations were made on vaccine lymph, on specimens fresh and stored. In all, the groups of active moving bacteria seen in small-pox lymph, and blood, were found. Several lymph corpuscles, with bacteria attached, were discerned breaking up at parts of their circumference, and bulging. Others had undergone a tri-partite cleavage, probably due to destructive change brought about by the bacteria. In some specimens bodies were seen, not unlike blood corpuscles, but smaller, attached in some four, some two, string-like way, with bacteria adhering.

Blood corpuscles, with adhering bacteria; small round, and pyriform, masses of protoplasm, showing vital movements;
and corporeal debris, were also noticed. The bacteria, after having broken up the cells, seemed to float away in the protoplasmic structure, and live in it for a time.

That the disease of small-pox is caused by the entrance of these bacteria into the blood, and their propagation there, I think is extremely probable for the following reasons:
1st. We know that the specific virus exists in the vesicular contents.
2nd. We know that it is fostered in the blood current; a fact which inoculation generated.
3rd. Small-pox lymph contains these bacteria.
4th. Small-pox blood contains these bacteria.
5th. No other organisms, in addition to these bacterial forms, have as yet been discovered in the lymph, and blood, of small-pox patients.

The specimens forwarded were obtained at the Newcastle Small-Pox Hospital on April 17th, 1844, and prepared at the bedside.
Infection

Small-pox probably originates by the entrance of minute forms of organic life into the blood, and their dissemination, and propagation there. Their mode of introduction, by means of the air through the walls of the air sacs, is possibly not so much by inherent penetrative power, as by suction from within. They, no doubt, also find access to the human economy in the process of digestion. From the blood stream they reap the pabulum wherewith to further maturation and production. Their presence in the blood-stream is the cause of all the untoward symptoms, and results, which characterize this affection. Infection is the one mode by which the disease is communicable from person to person. There is a second element in its dissemination namely fear, which, though scarcely credible theoretically, yet seemingly bears a weight of evidence, that we durst hardly explain away on other grounds. It shows itself not in smell, for
that would be infection, but in a look. Probably in some, it may be all, of the cases, where fear seemed to play a part, there was already a tainted blood-stream, or the germs peculiar to the disease may have become detached from the dregs of the convalescent one, and been inhaled; and, with this latter, a feeble constitutional tendency to resist, and annihilate the septic organisms. For in the cases where fear acted, there was no closer contact than speech required, and nothing injudicious beyond the convalescent addressee.

**Infective epoch.** As to the time when one attacked with small-pox would endanger the health of his fellows, we would reasonably suppose, that, from the day of infection to the onset of symptoms, communication might be harmless, seeing that the zymosis had not been perfected within the blood-stream. Subsequently to the period of incubation, commencing with the invasion of symptoms, showing maturation, and initiating migration of the small-pox bacteria, real danger would begin.
At this stage the organisms would readily find an exit in the exhalations and secretions. When the papules appear a modicum of the power of infection, through the blood (as the infective distributive agent), begins to wane, because the bacteria are now leaving the blood-stream and settling under the skin. By the time the vesicles are fully matured this previous power is almost nugatory, and when the crusts are shed it is absent altogether. At the time of shedding the height of virulence is reached; not from the blood however. The pent up bacteria are released from their prison cells; and lying mepred in the sebaceous and scaly effluvia, soon thickly pervade the air of the sick chamber, and deposit themselves on whatever is exposed to atmospheric contact. Infection seems most often contracted in families during the early manœuvres of the disease.

Patient's narratives in regard to infection - It is interesting to notice the strangeness in the modes of
infection as furnished by the narratives of small-pox patients.
A butcher is serving meat to his customers: a purchaser enters the shop with blemishes of small-pox on her features; he feels ill at the sight: he catches the disease.
On the appearance of the rash, the butcher is removed to a lodging apart from his wife, and family. After several days, when he is convalescent his wife clandestinely visits him. She only sees him through the window, but the locality is infected: she too develops small-pox.
A bar-maid blames serving one, recently restored, with beef. One dates her attack from the time she looked into a barber's shop, where was a man with the rash out on his face. A child for a few hours plays with another child convalescing, and is infected.
A man fixes his onset of small-pox to a strange smell, emanating from the clothes of a girl nursing small-pox patients. A carpet is removed from the house.
of a man recently deceased, and is
exposed on an open meadow: two men
play at quoits beside it: one gets
small-pox.
To illustrate how infection is spread,
I will briefly cite the following:
A man unvaccinated is seized with
small-pox and dies: one relative pierces
a carpet, another a chest of drawers;
small-pox is thereby introduced to
both families. The same carpet is
aired on an open square: children
are seen dancing on it: small-pox
visits the homes of these children.
(At this time there was a change
being made by the Sanitary Authority
in regard to their Inspector.)
Brother and sister unknowingly visit
relatives having small-pox in a neigh-
bouring township: brother brings
small-pox to Wallsend: sister takes
it to Penrith.
A lodger in a small-pox tenement
house wishes to leave, and, in opposi-
tion to threatened proceedings, does so:
results probably fruitful.

**Incubation**: As to the length of
the incubative period, or that period
from the date of infection to begin-
ming of fever, there was great difficulty in arriving at precise, and definite data. Only by personal observation can reliable information be obtained, and even then, in the majority of instances, accuracy is not easily determined. By selecting first cases occurring in isolated families, where the rest of the members were not exposed to other, than their own family, infection; and then observing when the second case broke out: only thus the nearest approach to fixity could be made.

Ex. I. In a girl, the rash appeared 15 days after it was noticed in her sister: but as the latter only lived 4 days after rash-development, it is most likely infection was got during that time, or previous to that time. If we deduct the invasion period, 2 days, from the 15, we obtain an incubative period of 13 days as a probably furthest limit; for it is not likely that the morbid poison would be so freely disseminated in the air, in such quantity to reach the system, during the invasion period. And as the deceased
girl only lived 4 days after eruption, by subtracting 4 from 13, we get 9 days as the earliest possible date of infection. (The deceased was buried directly, and her room fumigated and closed).

Ex. II. A boy after being in company with one convalescing for a few hours, developed the rash on the 12th day. Here we have an incubative period of 10 days, as invasion lasted 2 days.

Ex. III. Mother and son, doubtless exposed to no infection foreign to their own home, developed the rash simultaneously, 17 days after it appeared on the father. If we subtract the invasion period of each, which was 3 days, the outside limit of incubation is 14 days. The inside limit cannot be defined in this case.

Ex. IV. In a butcher, the eruption was seen 12 days after being in close quarters with a woman, in a highly dangerous convalescent stage.

With an invasion epoch of 2 days deducted, we obtain an incubative period of 10 days.

Ex. V. The wife of the above came out with spots 17 days after her.
husband: but seeing that he was removed on the 3rd day, in her case the incubative period must have a wider range, i.e., 12-15 days, after deducting the 2 days of invasion stage.

Ex. VII. On the servant, the rash was seen 14 days after her mistress' rash. The fever stage (invasion) was of 3 days duration, so that 11 days is the outside limit of the incubative period. Here again the inner limit could not be fixed.

Ex. VIII. Another butchess, exposed to no other infective cause, came out with small-pox spots 14 days after playing spots beside a carpet teeming with the specific organisms, which was removed from the house of a man, unvaccinated, who had died from a confluent attack. The length of invasion was 3 days, leaving an incubative epoch of 11 days.

Ex. VIII. The wife of the first case that occurred in the district, showed the eruption on her face 15 days after that of her husband; and having 3 days of an invasion period, would likely possess an incubative period.
of 12 days at the outside.

XXX. A person comes from an infected town to Wallsend, and develops small-pox 14 days after. The invasion period of 3 days having been deducted, gives 11 days as the time of incubation.

From these observed cases, only in four is there a certain fixed incubative period; in two 10, and in two 11 days.

Taking 10 days as the earliest period of incubation, and knowing the latest of the rest, we can make the mean as follows,

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<tr>
<td>Mean range</td>
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<td>11</td>
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Therefore 11.16 days is the mean duration of the incubative stage of observed cases.

INVASION. As to the invasion stage, or that period from the commencement of fever to the development of the rash, a more reliable conclusion can be secured. Observations on 40 cases were carefully compiled, and the results are as follows. Eleven were unwell several days prior to
Dec 1996

Mr. Cuthbertson,

Dear Sir,

I beg to forward the house for Hope, which might have been the means of saving his life. I feel that the fault was mine, as I only received his letter two days ago. Honourable graduates only last month, and perhaps I was not prepared to give the same instruction as a professor. I sent him my letter of congratulations, but he wrote a note to the effect that he has got all in his box with the exception of 200 medals, which I forwarded to him. Thank you.

Yours sincerely,

[Signature]
appearance of the rash, the greater number of these for 7 days. The remaining 29 were well up to the beginning of invasion.

Table giving lengths of sickness in days during incubation & invasion

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We find, on analysing the foregoing tabular statement, that although there are 27.5% of the cases with a history of illness during the greater part of the incubative period, the greater number 72.5% are free from such lengthened illness, also that 48.2% of the latter have a three days' invasion epoch. Supposing we take an average of the 29 cases, 2.68 days of invasion is the result obtained.

Symptomatology. During the invasion period the symptoms complained of were vomiting, headache, backache, coldness in limbs, pains in limbs, shoulders, abdomen, chest and
neck, giddiness, rigors, sweating, convulsions, diarrhoea, delirium, restlessness and grinding of teeth. Notes were taken in 26 cases.

Enumerating in their frequency of occurrence; backache was present in 24, headache in 19, vomiting in 18, neuralgic pains in 13, coldness in 2, giddiness in 2, rigors in 2, sweating in 1, convulsions in 1, diarrhoea in 1. Delirium was present in all of the confluent, and most of the semiconfluent cases; and occasionally in the discrete. The most frequent were vomiting, backache, headache and neuralgic pains.

Stage of Eruption. The eruption in this epidemic followed its usual course, appearing first on the face, then neck and shoulders, arms, body, and last on lower extremities. In some modified cases of small-pox to be hereafter noticed, this order was not followed.

The types were confluent, semiconfluent (adhering), discrete, and haemorrhagic. Of 78 cases, 53 were discrete, 12 adhering, 9 confluent, and 2 haemorrhagic. It was very difficult to be decided in the correct classification.
Discrete small-pox.

Boy Reid: no marks, but said to be vaccinated in one place & taken.
of the confluent, and adhering, types of eruption; for in most of the latter an abundant coalescence of the vesicles were noticed.

Growth of eruption. The papular stage lasted not much longer than a day; for in most of the cases the minute vesicle could be discerned on the second day. The length of the vesicular stage varied greatly, being longest in the worst confluent cases, and shortest in the discrete. Indeed it was difficult in the severest forms to detect a certain pustular, except what was due to the thickening of the vesicular contents, the change of the opaline matured, into the yellowish brown of the rapidly decaying vesicles.

In a good many cases with a copious discrete rash of small size, and irregular form, there was pustulation as early as the 3rd or 4th day, and yet they ran a course of great length before desquamation.

The eruption on the face generally browned on or about the 5th day, and three or four days later on the limbs: yet in some discrete cases crusts were formed as early as the
5th or 6th day, and in some confluent cases as late as the 12th day.
The temperature in discrete cases rose from 99 to 102.6, according to the extent of blood poisoning, during the invasion period, and falling after the eruption appeared: except in severe forms of this variety, there was not usually a second rise. In the confluent type, the same rise and fall of temperature were noticed; the fall being slight as the invasion period passed away, and showing a tendency to gradual rise from 103.4 in critical, to 105.8 in fatal cases. The pulse varied from 104 to 124 in discrete, to 136 or 160 in confluent cases.

In those instances of small-pox, which ended fatally, death took place in the confluent, from the 9th to the 12th, and in the haemorrhagic, on the 5th or 6th days of eruption. Characteristics of Eruption. The special characteristics of the different types of the eruption may here conveniently be noted. There were four forms that require mention: First, the vaccine-vesicle-looking eruption seen in 21 cases,
Haemorrhagic - diphtheria
(Chol. Morris - died 5th day
3rd stage)
composed of large (confluent), or small (adhering) abrupt-edged flat vesicles; of round or oval form with central depressed surface, and rising from the level of the skin vertically to the height of an eighth of an inch, or non-inflammatory base (confluent) or with red areola (adhering); with opaline contents, and short purulent stage, if any: seen in confluent and adhering small-pox.

Second, the globular or hemispherical eruption, seen in 45 cases of discrete small-pox; with umbilicated or dimpled apex, and having a circular broad base of attachment to the skin; with an apparently purulent stage, and elevated 4 of an inch above the skin level; with marked red (rose-coloured) areola; sometimes hard and prominent, forming tubercous projections, which remained for a considerable time after desquamation.

Third, the acuminated acne-looking eruption, with swollen and extensively red, indurated base; projecting high and cone-like; of small, though varying, size, and irregular contour; quickly becoming postular or oftenes
several spots never possessing a vesicular stage; generally associated with numerous stigmata, and accompanied with maniacal delirium at times; sparsely punctate, or sparsely coving this mark of diagnostic value: seen in 7 cases of discrete type with manifestation of uncommon severity. Fourth, the hemorrhagic eruption; in size, midway between the acuminate and globular types of eruption: on an asthenic brick-red areolar base, having sero-sanguinolent contents, and accompanied with non-elevated sub-epticemic purple and brick-red discolorations, slightly elevated purpuric spots and red stigmata. Modified small-pox. Besides these common types, there were present some peculiar forms of eruption, which is interesting to detail.

Case I. E. S., aged 16, residing in Hedley Street, with 3 good cicatrices on arm, first noticed eruption on 29th of April 1843. When seen the whole skin-surface on face, hands, feet and large districts on body and limbs, was covered by a swollen erythematosus rash. On or about the 15th of May vesication
Peculiar small-pox eruptions

Case I.
commenced, and progressed, until the face, and hands, hung in huge blebs containing yellowish green serum. On May 5th the face blebs had collapsed, but the hands were still very much swollen, hanging in huge blisters with characteristic depressions, on an inflamed surface. The right shoulder had one great oval red patch (6 x 4 in), studded with confluent and discrete green vesicles. On the arms the patches of redness were some smaller and circular, and others larger and irregular with glistening (due to thinning of envelope) opaque-serous contents. On the back the inflamed districts of skin were more than an inch in diameter, but the vesicles were collapsed and undiscernible. On the 8th the redness on the feet and hands was nearly absent, and the blebs opaque and shrivelled. In two more days the blebs had disappeared. The constitutional symptoms were not nearly so grave as the appearance of the patient might lead one to expect. (See water-colours case I)

Case II M.A.R., aged 9, Back High St., with four good scars, sickened on 23rd May, with symptoms of free vomiting, back-
Peculiar small-pox eruptions.

Case I.
ache, headache, sore throat, pains in shoulder, and coldness. (Father and brother ill with discrete small-pox at same time.) The rash came out on the night of the 26th May. As seen on 28th, the eruption consisted of wheel-shaped rose-red patches chiefly on the inside of the joints, with uncoloured center, and best seen at the inside of both knees (see painting, case II). On the inside of one ankle there was an irregular circinate rose-pink patch, and on the outside a few pink maculae. An isolated group of maculae were seen on the outside of the right hip, but none on the left. Over each olecranon of the elbow there were a few rose maculae. No other regions of skin were affected. The rash disappeared on the 30th, having been out 4 days.

Case III. M. A. F., at. 13, Wanless St., with two good scars, sickened on June 6th, 1883 with pains in head, back, and vomiting. The rash appeared on the 9th. When seen on the 12th the skin affection was erythematous, like the first case, but the vesicles differed in being more numerous, minute, and acuminate: where a few had coalesced this
Case II

Peculiar small-pox rupians.
acumination was lost. On the 14th the legs and feet were purply-red with hemorrhagic stigmata; the vesicles were pointed and filled with greenish serum, (though some few were opaque, and others had collapsed). On the 15th all were dried up, and the patient was soon well. (see pl. fig. case III)

Case IV. J. W., dec. 13, Birket St., with 5 scars, sickened on 8th of June with complaints of pains in head, knees and shivering. An erythematous papular and patchy rash came out on the legs on the 12th, and disappeared on the 14th. He was soon well. (see pl. fig. IV)

Case V. W. W., dec. 24, Birket St. (brother to above) with one good cicatrix, had been ill a week before he sickened, on 13th of June 1883, with symptoms of vomiting, back-ache, and headache. On the 14th red patches appeared on his hands: there was no vesicular development; and though his temperature stood at 102.6 on the 14th, he soon recovered. Another member of the same family had discrete small-pox at this time.

Scarletinal papular rash.
A scarletina-looking rash preceding
the true small-pox eruption was present in 4 cases. It lasted during the stage of invasion, and as it faded the true papules began to appear. This eruption seemed to indicate a favourable attack of the disease, for in all such cases the subsequent development was discrete, and benign.

**Diagnosis** In diagnosing small-pox cases in this epidemic, there was no difficulty. The only difficulty to my mind is at the commencement of an epidemic, or in judging a sporadic case, when chicken-pox may be guessed at, instead of the graver disease. And this is the more likely to happen if, as occurred in this epidemic and the previous one 12 years ago, there is an antecedent run of chicken-pox. He is a careless diagnostiker, who would offer an opinion on a papular eruption without any inquiry as to semiology, and confound measles with small-pox.

In the case of chicken-pox, there are points of similarity between it, and small-pox. The headache, back-ache, and sickness, belong to both; and if, as not infrequently happens, the pap
Peculiar small-pox eruptions

Case II.
ular stage has passed before the patient is seen, the crop of vesicles appearing is somewhat embarrassing. But if we are able to obtain a true account of the antecedent features, there ought not to be any difficulty in their discernment. In small-pox, seen at this early stage, the vesicle is minute with deep red areola (only defined in comparison), and possessing the dimpled apex; whilst the chicken-pox vesicle will be large, globular and glistening with faint red areola, and not punctuated; several perhaps collapsed with brownish depressed centre (the point of doubt). Small-pox vesicles, too, have a uniform appearance and first come out on the face; chicken-pox vesicles may be seen at all stages, papule, globule and depressed collapsed vesicle, and come out on the back first.

**Prognosis.** The question of prognosis in any given case is always a difficult and hazardous one to solve; and perhaps in none more so than in the disease under consideration. We have found that, what promised to be discrete at the commencement
of the vesicular stage, developed the semi-confluent or confluent varieties in a few days. More than once I have committed myself in my notebook.

Treatment. The medicinal treatment, which the patient received, was apyretic, and aperient, for the first few days, consisting of Sulphate of Magnesia, Nitrate of Potash, and Tartaric of Antimony, in doses of a drachm, 15 grains, and 4, respectively. Afterwards, as maturation of the pox was approached, it was tonic and stimulant, preparations of iron and alcohol, the latter only in bad cases. This line of treatment seemed to answer exceedingly well. The diet consisted chiefly of milk, nutritious foods and meat-soups: fruits were allowed.

Concomitant Affections. These may be dismissed in a word or two. Sore throat, due to the development of the eruption on the mucous membrane of the fauces was more or less present in all cases. Inflammation of skin, oedema of cellular tissue, were seen in the most severely affected. Tympanitis occurred once, as did pneumonia.
During the abatement, the hair was lost in two cases; two had abscesses of the leg; two had ulcers; one had boils; one had a corneal ulcer, the result of conjunctival pox. In all there were 5 patients affected. Putting on Potash-mark. Seeing that permanent disfiguration of the countenance is sure to follow a severe attack of Small-pox, we are most anxious to adopt any feasible plan, which may moderate or annul this painful result, and so I attempted to do something in furtherance of this commendable object, hoping that benefit might accrue.

Experiment I. D.C. Oct. 11, Benham Terrace, with 2 scars, and discrete Small-pox. The method adopted is briefly this: The face was thickly smeared with 1-40 carbolic oil by a camel's hair brush (to hinder irritation of skin by lymph). Each vesicle, at an early stage, was pierced through and through with a broad sharp needle. Pads of absorbent cotton wool were then placed on the collapsed vesicles, the surface of wool lying next the skin having previously been bathed
with equal parts of carbolic acid and glycerine. Result: When seen on March 20th, 1884, a year after operation, I could detect 3 scars, one on nose, forehead and chin, about two feet off; and on cheek bones, on very close inspection, a few pin-point scars. He was pretty severely affected with small pox, and I think the operation a success.

Expt. II. W. T., Oct. 11. Vaccine scars and with discrete small-pox, High St. West. On May 24th face was painted with carbolic oil 1-40: punctured large confluent vesicle on brow between eyes, vesicles on left of nose and left of chin, as these regions were worst: dusted collapsed vesicles with powdered boracic acid. Result: Seen on Dec. 24th, 1883: Only a few shallow cicatrices on forehead, the other parts operated upon being free.

Expt. III. J. C. R., Oct. 5, Hedley St., unvaccinated, confluent small-pox, died. On May 27th, 1883, two large bullae on inside and outside of left leg, 2 inches above the ankle, were painted with carbolic oil, punctured and dusted with boracic acid powder: one bulla
on right shin above ankle left untouched to compare results.

Expt. IV. M.A. B., d.t. 19. 2 scars, High St. west, discrete small-pox. Painted bulle on right ring finger at junction of 1st and 2nd phalanges, and bulla on dorsum of same hand with equal parts of glycerine and carbolic acid; overlaid same with absorbent cotton wool, the side next skin being soaked in same exudate, after puncturing vesicles; and bandaged to keep dressing secure. A bulla on left little finger at metacarpal phalangeal joint left untouched to compare results.

Result. Examined in October, but no difference between the two hands, as neither were scarred.

Expt. V. G. J., d.t. 140, 1 vaccine mark, High St. west. On May 26th punctured vesicles over whole of forehead, and painted on Jn. Ferri Perichotis.

Result. Forehead, though worst affected, is not so broadly pitted as other parts of face. This was a severe discrete small-pox, with large globular vesicles on prominent indurated bases.

Expt. VI. M. R., d.t. 11, 3 marks, discrete small-pox, Berke St. On May 20th,
punctured one large confluent vesicle on upper lip, under right ala of nose, and brushed in Mr. Ferri Perch.

Result. Has left a pin-point cicatrix.

**Expt. VII.** R. D., d. 25, 1 mark, High St. west, adhering small p. On May 27th painted face with carbolic oil 1-40 and punctured vesicles all over left cheek, all forehead and all nose; (right cheek, angle of right nose, and chin, left untouched to compare results) dusted with boracic acid.

Result. Right cheek (one untouched) better than left (one punctured). Nose badly pitted (punctured). Chin not much marked (untouched). This is only case which failed.

**Expt. VIII.** J. R., d. 23, 3 scars, discrete adhering, Hedley St. On May 29th painted forehead, nose, and cheek bones with carbolic oil; punctured vesicles and dusted on boracic acid. Did same to confluent bullae on outside of metatarso-phalangeal joint of great toe, and on dorsum of feet.

Result. Not quite so good in results as others, in regard to face; probably due to hard bases of vesicles and their shrinkage. Effects on feet better.
Expt. IX. M. G., Oct. 4th, 1 mark, sever discrete small-pox. On June 14th, painted chin, and back of left hand with carbolic oil, punctured vesicles, and dusted with boracic acid.
Result. Seen Oct. 12th. 1883. On chin only 2 faint scars; rest of face well pitted; no comparable difference in the hands.

Expt. X. W. J. S., Oct. 25th, 2 scars, adhering small-pox. On May 26th, painted vesicles on forehead, and cheek bones; punctured, and dusted with boracic acid.
Result. Seen Dec. 14th. 1883. No marks on cheek bones. Forehead much less slightly scarred than rest of face.

In these experiments, the parts chosen for the purpose of trial, were those on which there was severest vesicular development. As a rule the results were satisfactory, but not eminently so. The cicatrices on the parts operated upon were much less in breadth, and depth, than those left to follow a natural course. The etiology of small-pox scars rests in all probability on the destructive
effects of the hoards of bacteria, and their lymph fluid, on the cutis vera, and subcutaneous cellular tissue. The shrinkage in the process of healing forms the pit, and the fibrous tissue deposited, the white scar. When there was much inflammatory deposit, and induration of pock base, the resulting pits were very deep. This was well exemplified in Expt. V, a severe discrete case, with the best show of the globular vesicle. These globular vesicles were placed on & projecting tumour-like bases, only seen in this solitary case, and which hard bases remained for a considerable time after casting the scabs. The resulting depressions were not broad, but very deep. If another such case had presented itself, I would have been disposed to try the effect of sub-vesicular incision of the raised base.

In confluent small-pox, where exists no inflammatory deposit in the skin and subjacent tissue, but merely great oedema, and where the skin destruction is limited to the extent of surface covered by the flat vesicles
the resulting cicatrices though broad, and unseemly, are not more sunken, than what may properly be attributed to fibrous tissue contraction, following destruction of cutis.

There are two features of interest associated with the epidemic, which may advantageously be dwelt upon; first, the effects of smallpox on the pregnant condition; and second, the effects of vaccination and revaccination, on the mortality, and spread of the disease.

**Puerperal Smallpox.** Three cases so constituted came under notice, two at the full term, and one at a viable period. The character of the eruption was confluent in one, *discrete-hemorrhagic* in the two. Two of the mothers and all the infants died; one mother died on the day of confinement, the other three days after, but both on the third day of the eruption. All the mothers had been vaccinated. She, who recovered, was revaccinated, as her husband was ill at the time; yet the rash appeared in
8 days' time afterwards. One infant was vaccinated two days after birth; in two more days the small-pox eruption appeared: the child, after having lived 14 days, died on the 21st day of eruptive stage. Two children lived only 15 minutes. We might reasonably infer, from this short abstract, that small-pox, in association with pregnancy at advanced periods, comport itself untractably, even in those protected by vaccination; and that revaccination may do much in the way of lessening the fatal issue, though secondary to the virus, if perchance done early enough. In allusion to the infant, which presented the small-pox eruption 4 days after birth, and 3 days after that in its mother; if, as this record proves, there is an uterine infection (and it is reasonable to suppose that it could not be otherwise; for just as easily as the small-pox bacteria invade the bloodstream of the mother through the air cells of the lungs, so as easily may they permeate the delicate fringes of the villi from the placental sinuses)
we may at once discard the hope that vaccination can be prophylactic to the new born infant. It is doubtful, seeing that the labour is induced at the end of the invasion period or after eruption; and that there is but a 3 days' advancement in the mother over that in the fetus, whether infantile vaccination can be early enough to control, much less to prevent, the affection.

It would be an interesting question to solve, if vaccinated or revaccinated parents are able, per se, to give their offspring any power to resist small-pox. Seeing that the primal germ has concealed within it, not only the external proportions, featural similarities, and mental characteristics, but also the morbid creating and morbid destroying tendencies, of its parents, it is in every way likely, that acquired power over disease in the parent may be transmitted to the offspring.

Whether, after a long succession of twin-parental vaccinations, the last begotten would have acquired insusceptibility, I do not know; though I believe it to be exceedingly probable; but in the
case of revaccination, I feel sure, that power would be obtained. I will close this subject by giving the history of a puerperal small-pox case.

H. B., oct. 23 yrs., 2 slight scars, first seen on March 18th, 1883; suffered from severe pains in loin and abdomen of a jerking uterine character, which lasted a few seconds, but recurred every few minutes. On vaginal examination maternal parts were of very high temperature, and no impression was noticed at the "os", on onset of spasms. Opiates did not relieve the wearing-out pains. On 21st a discrete small-pox rash appeared, but chiefly on chest and abdomen; the few seen on the face and arms disappeared next day, giving place to a sub-epidermic purple rash, and mottling. On 23rd eruption was vesicular, and contents were sero-sanguineous, with brick-red hemorrhagic areola, and deep purprute stains interspersed, the size of a pin-head. This day, early in the evening, she was delivered of a fetus at full term, which lived 15 minutes, and complicated with severe haemor-
phage. Temperature, and pulse, then fell, and she seemed to have a hopeful future in prospect. However, these favourable symptoms soon disappeared, and she died somewhat unexpectedly late in the evening.

Vaccination effects on mortality and spread of small-pox.

Of 16 cases of small-pox, unprotected by vaccination, there were 8 deaths, including infants born at full term, making a mortality of 50 p.c. If we, with the foregoing, include those having a history of insusceptibility (2 cases), and those without cicatrices, but reported to have been vaccinated, the percentage mortality is reduced to 40. Among vaccinated cases, 74 of which were observed, there were 3 deaths, a mortality of 4.05 p.c. But if we deduct 3 per cent cases (2), one of which was ineffectively vaccinated, the percentage mortality is reduced to 1.35. The record in regard to numbers of vaccine scars is as follows: 16 cases with 4 scars, one death (hemorrhagic); 17 with 3 scars, no deaths; 13 with 2 scars, one death (puerperal); 9 with one scar, no deaths. In the remaining 19, to complete the 74 vaccinated cases,
the numbers were not noted.
The following records are interesting
specimens of the protective influence of
vaccination on those unprotected by in-
fantile vaccination.
P. M. and his wife, both unvaccinated,
and living upstairs in the tenement house,
where the first two cases occurred, were vac-
cinated. The wife was done first, the day
before the first case died, on March 3rd, 1883,
and the husband 3 days later, March 6th.
The specific rash appeared on both at same
time, on the woman 11 days, and on the man
8 days after vaccination. She had a mild
discrete attack, but his was confluent, and
both recovered. In another family, composed
of 3 children all unvaccinated, the eldest
child developed small-pox on June 18th, 1883,
and had a severe confluent attack, which re-
sulted in great disfiguration afterwards.
On 19th (next day) his little brother and sis-
ter were vaccinated, and to such good pur-
pose, that both escaped any infection.
The modifying effect of vaccination, on,
and secondary to contagion, was well seen
in the case of an infant 3 months old,
which residing in an infected house, was
vaccinated 6 days before the rash appeared.
The attack was slight, and the child
made a good recovery.

Revaccination. Revaccinations were practised as extensively as the wishes of individuals would permit. Its exceeding protective power was mostly given to those who were in the greatest danger, those living in juxtaposition to "loci" of infection, and to members of households having the virus in their midst. In no instance did a revaccinated individual imbibe the "seps" of small-pox. Revaccination is, without doubt, the small-pox annihilator.

Having thus sifted, and presented in order, the material bearing upon the Wallsend small-pox epidemic of 1883, I believe: that however little of freshness, and originality, there may be in the theme; and however great are its imperfections in the manner of treatment, and in committing it to paper; that the time spent in observing the disease, in collecting and epitomizing the facts, though perhaps inoperative in its results to others, is a positive gain to the experience of the Author.