ON THE EXTREME DURATION OF INFECTIONOUSNESS IN MEASLES, MUMPS, SMALL-POX, SCARLATINA, AND DIPHTHERIA.

Abstract of a Paper read before the East Kent District of the South Eastern Branch.

By THOS. F. RAVEN, L.R.C.P., etc.

THOSE who have made a study of the natural history of infectious diseases, have established the truth of these conclusions:—that diseases preceded by a long incubation are, generally, characterised by well-defined illness, progressing by well marked stages to crisis, and so ending; that they are followed by insignificant sequelæ, and that the infection is usually short in its duration. A short incubation period, on the other hand, has been shown to precede, as a rule, a sudden sharp illness, running either a short or a long course, with a long continued infective power, having sequelæ of a definite and important character, and being often prolonged by relapses. So it may be regarded as an axiom that duration of incubation and duration of infection bear an inverse ratio to each other. Again, it is laid down and accepted that, when the incubation of a disease is long, the infection (even the most powerful infection) is developed early in the course of the malady, and that it ceases early; that, when the incubation period is short, the disease does not, as a rule, exhibit its infective power so soon, but that there is a time, even after the complaint is declared, when the danger of communication is but small. The rule, then, is, long incubation, early short-lived infection; short incubation, late and long infection; and, if exceptions prove the rule, then undoubtedly this is a rule, for the variations from it are numerous.

These variations from the standard may be well exemplified by the course of vaccinia. Although the progress of the vaccine vesicle has a remarkable regularity, yet deviation from the recognised period of incubation, and, from the usual course and duration of events, is not unfrequent even among infants vaccinated from the same source and under similar conditions.

Applying this rule, then, to the first of these diseases to be discussed, we find that Measles, having a long and fairly uniform incubation period of twelve days or a fortnight, develops its infection early—even early in the stage of invasion—and that the infection, thus early active, early disappears. According to a code of rules issued by the medical officers of schools, a pupil is allowed to rejoin his fellows in three weeks from the date of the measles rash. Dr. William Squire also states that the duration of personal infection is limited to three weeks after the appearance of the rash, provided all desquamation and catarrh have ceased. The early infection of measles points to the strong probability that catarrh is the principal source of danger to others; and it is not necessary to occupy time with proofs of what, probably, everybody will admit.

The catarrh being thus intensely infectious, even at an early stage, possibly at a later period it may still be dangerous. Therefore, when, after measles, catarrh from any mucous surface persists, it is wise to consider the possibility of its being a source of communication of the disease. But, granted the cessation of catarrh, and the disappearance of rash and desquamation, I am inclined to think, from general experience, but not speaking from any definite data, that the danger of infection is over. Three weeks from the appearance of the rash seems to me to be, in ordinary cases, an unnecessarily long time to keep a child in quarantine. From the initiatory fever to the cessation of desquamation, the disease very often runs its course in a fortnight, and it is doubted by some whether the stage of desquamation is one of infection at all.

But a curious freak which measles occasionally plays, may serve to prolong the infection. I have seen the two prominent symptoms—catarrh and rash—quite disconnected. I have recently had under observation a little boy who, ten days or a fortnight after exposure to the infection of measles, showed what were thought to be the early symptoms of the disease; but nothing besides catarrh appeared, and he was soon quite well again. A few days later, however, a well-marked rash, limited to the arms and legs, showed itself. The child seemed scarcely ill, and there was no catarrh whatever. This limitation of the rash led me to examine it with care before I could pronounce it to be the eruption of measles; but the distinctive raspberry colour, and the typical grouping of the spots into crescentic patches, left no doubt as to its nature. Once previously I have witnessed this curious course of the disease. It may be that what is de-

scribed and accepted as *rubeola sine catarrho* is of this nature, the early catarrh having been overlooked or forgotten before the appearance of the eruption. If so, *rubeola post catarrhum* would be a more exact term by which to designate it.

Mumps has also a long incubation period. It may last from fourteen to twenty-one days, or, as the longest period on record, twenty-two days; and, following the rule of infectious diseases already alluded to, mumps is very early infectious. So soon is the infection felt, that the removal of a case, although effected as soon as ever the disease is even suspected, rarely saves a family or a school from the spread of the disease. Mumps, also, like measles, is not communicable for long. According to authorities, the quarantine necessary is three weeks from the commencement of glandular swelling, provided the glands have resumed their natural size and condition. It will, perhaps, be possible to ascertain whether, independently of all glandular swelling and hardness, mumps is an infectious disease; also, when metastasis occurs to another organ, as the testis or mamma, whether the duration of the infection is thereby prolonged; and if, when abscess forms, the stage of discharge is one fraught with danger to others.

The incubation period of Small-pox is, perhaps, more definitely established and more uniform than that of any other acute disease—certainly than that of any of the diseases under notice. It is a long period of twelve days, and, although exceptions are sometimes met with, it is but little liable to variation. In some respects, small-pox follows the same rule as measles, in so far as having a long incubation period, the infection is early active. According to Marson, whose experience was immense, small-pox is communicable from the moment that the initiatory fever begins. He says: "It may be given by the breath of the patient before the eruption appears on the surface of the body." The termination of the infection in small-pox is definite. So soon as the crusts, scabs, and scales have separated, and have left a smooth surface, the fear of infection is over. My own experience fully coincides with this statement. During a severe and extensive epidemic of small-pox, I adhered strictly to this view; and in no instance did the disease obtain a fresh hold from any patient who was discharged from hospital, however short his sojourn there might have been. There is, however, a source of fallacy here, which is worth mention. It must be remembered that, when small-pox is rife, most people (especially the antivaccinators) make haste to protect themselves by vaccination. Hence, although the progress of the disease may be arrested, as happened in the epidemic to which I have alluded, it is possible that this desirable end is attained simply because there are no persons at hand susceptible of the disease. I have said that the termination of infection in small-pox is definite; but it does not follow that the period of infection is short. In this particular, small-pox breaks away from the rule of "long incubation—early short infection." The incubation is long, the infection is early developed; but it cannot be said that the infection is short-lived. I am well aware that, in many cases of small-pox, crusts and scabs and scales are soon detached, and the patient at liberty. But these are, generally, cases of small-pox occurring in vaccinated persons. True, unmodified small-pox, occurring in unvaccinated persons, is, as I take it, the disease which we are considering, and in such cases, when they do get well, the crusts and scabs adhere sometimes for a surprisingly long time; and as it is known that the crusts of small-pox, even when detached from the body, have the power of disseminating the disease, it is quite certain that any one, with a crust or scab or scale still adhering to his skin, is capable of communicating the disease. Independently of the pustular eruption, and of the crusts resulting from it, I have found small-pox to exert a powerful infection from those frightful examples, of the malignant form, where no pustular rash appears, but where hæmorrhage occurs in the skin, and blood pours from almost every outlet of the body.

I come now to two diseases in which the incubation period is variable and doubtful, namely, Scarlatina and Diphtheria. Scarlatina is said to have, generally, a short, often a variable, period of incubation. The occasional rapidity of its development is unquestionable, and sometimes quite surprising. I have seen a child exhibit the rash after twelve hours' exposure to infection. I have been told, on excellent authority, of a child who went into a shop where there was an intense scarlatina poison present. The child was sick on the spot, and went home ill, the disease developing from that moment. And if the incubation period varies so remarkably in this direction, it is reasonable to suppose that it may present as great a divergence on the opposite side. The scarlatina that develops itself with great suddenness after a surgical operation, or which comes on rapidly after excitement or change of air, may spring from a latent poison in the system suddenly called into activity by shock or by excitement. It

is, however, generally agreed that the incubation, as a rule, is short, and, accordingly, the infection does not become active very early. This has been abundantly clear to me on many occasions. Over and over again I have caused patients, with the rash of scarlatina well developed, to be removed from crowded lodging-houses, schools, and private families, without the occurrence of a second case; but if the infection does not soon become active, there is no doubt that it long persists. The rule generally observed with regard to scarlet fever is that, when six weeks have elapsed since the appearance of the rash, and provided that there be no desquamation in progress, and that discharges from the nostrils have ceased, quarantine may be discontinued.

Desquamation of the cuticle is looked upon as a fertile source of danger: not only that separation of fine powder from the surface which appears shortly after the disappearance of the rash, and which is believed to possess the poison of the disease in its most concentrated form, but also that late desquamation which especially affects the hands and feet, and which occurs not only once, but is sometimes repeated after the skin has regained its natural smoothness. Great stress, I say, is laid upon the peeling of the skin; but I have never heard any fear expressed in reference to desquamation originating in other parts of the body. Scarlatinal nephritis is often a lengthened, or may even become a chronic affection; and it may fairly be assumed that the desquamation of epithelium from the kidneys and bladder may be a process of the disease capable of conveying infection. So long as the epithelial scales are suspended in the urine, there may be no risk of infection from their presence; but should the urine containing them escape among the sheets, or be spilt on a carpet or on a floor, so soon as it has dried, and the epithelial scales have become freed from their menstruum, a danger of infection may at once be set up. Or the infective material may hang about drains or in cesspools, and exert its influence long after the epidemic by which it was engendered has disappeared. (Hence the importance of employing an earth-system for all excreta in scarlet fever.) And, occasionally, I believe, a hidden source of danger does thus exist, and of this I will give an example.

Some time ago, I was called to see a young lady who was said to be suffering from anæmia and febrile disturbance of some indefinite kind. I found that her urine was loaded with albumen, and microscopic examination revealed large quantities of epithelium and blood. The desquamation was so marked that inquiry was at once made as to whether she had recently suffered from scarlet fever, or any other acute disease, but no history of this could be obtained. There could, however, be little doubt as to the nature of the girl's nephritis, when it was found that one of her sisters had recently had scarlet fever, and that she also was suffering from desquamative nephritis; and this opinion was strengthened into certainty when I found that her two other sisters, neither of whom had shown any signs of illness recently, were also throwing off epithelium and blood from the kidneys. The mother and the one brother were the only members of the family who were free from albuminuria, and this was explained by their having had scarlet fever some years previously. I ascertained, many months afterwards, that albuminuria still persisted in the case of the girl who was first placed under my care; and that, with the other three cases, the affection had proved very tedious. Dr. Wm. Squire has recorded a case where, after sixty-six days from the appearance of the rash, and long after all signs of illness had disappeared, scarlet fever was communicated; and, as no mention is made in this case of the state of the urine, it occurs to me, as a possibility, that the infection might have been effected in the way that I have suggested.

Not only is desquamation of the skin a source of danger during convalescence, but the discharges from the nostrils, in severe cases, are believed to be highly infectious, and are to be as carefully observed as desquamation itself. As to the purulent discharge from the ears, which sometimes follows a sloughing throat in scarlet fever, it seems difficult to assign an exact limit to its power of conveying infection.

Diphtheria is the last disease of the category to the infection of which I have to advert. And here I am met at once by the question, What is diphtheria? When we find, on the one hand, physicians who draw distinctions between diphtheria, croupous pharyngitis, membranous sore-throat, follicular tonsillitis, and exudative catarrh of the tonsils; and when we know that, on the other hand, there are authorities who pronounce all sore-throats with exudation to be diphtheritic (but who are rather puzzled by follicular tonsillitis); and when, thirdly, we ascertain that diphtheria may occur without inflammation or deposit upon any mucous membrane whatever, it is not clear what the evidences are upon which a diagnosis of this disease is to be founded. For my own part, as to this point, I confess to

some agnosticism, with an inclination to characterise all sore-throats with exudation (with the exception of follicular tonsillitis, dissociated from known cases of diphtheria), as diphtheritic; and this makes a good working hypothesis. But I throw out this hint that we may, as far as possible, prevent any conclusions that we may come to from being vitiated by imputed false diagnosis. The incubation-period of diphtheria, according to the authority of Mr. Shirley Murphy, is unknown. However short it may occasionally be proved to be, it is sometimes, undoubtedly, of long duration. I have myself seen a child, removed from home in order to avoid the infection, remain free from the disease for a week. Dr. Isambard Owen has instanced a remarkable example of the occasional long duration of diphtheria-incubation in the case of a man who, having imbibed the poison of the disease on shore, went to sea, and the resulting illness was not felt until several weeks later.

The personal infection of diphtheria would seem to be actively exerted on those who are in close attendance upon victims of the disease, whereas its influence does not commonly spread to others in the same certain way as does the infection of measles, small-pox and other zymotic diseases. Undoubtedly diphtheria is often seen affecting many members of a household in quick succession, but in such epidemics I have hitherto found that there are general conditions existing to give origin to the disease, and that it is not often easy to prove its personal communication. It is worthy of note that the last generation of practitioners did not regard "croup" as a communicable disease. Sir Thomas Watson, in describing membranous laryngitis, a disease which he allows to be very fatal, distinctly says that, "the croup is not contagious."

As to the persistence of the infection of diphtheria, it would appear to be generally held that its duration is not great. The medical officers of Schools Association have determined that a patient, convalescent from diphtheria, may be considered harmless in three weeks from the date of symptoms, provided there be no longer any sore throat, or discharge from mucous surface, or albuminuria. Under certain circumstances, however, the infection may be indefinitely prolonged.

Dr. Astley Gresswell has recently drawn attention to what he designates "chronic diphtheria." As his communication to the Epidemiological Society has been so lately before the public, it is not necessary to say more than that he has submitted a theory, with substantial proofs to support it, that diphtheria, under certain conditions (chiefly the conditions of unwholesome surroundings) may become a chronic disease, and capable, from time to time, of diffusing the infection.

If, during the sequelæ of other diseases, infection is still active, it is reasonable to suppose that a patient suffering from diphtheritic paralysis, but otherwise well, may infect others. A suggestive case in point has occurred within my own knowledge. A family of children had diphtheria in London. All were affected except one boy. The family came to the seaside, and after many weeks the boy who had escaped, and who had been sent away from home, was allowed to join his brothers and sisters, one of whom was suffering from diphtheritic paralysis. Before he had been many days with his family, this boy had an attack of sore throat, with exudation upon the fauces. It was not severe, nor by any means a typical case of diphtheria, but the exudation was enough to make me very suspicious of its nature.

At the time when Dr. Russell Reynolds's *System of Medicine* was published, one of the distinguished writers in that work stated that the closest correspondence in the laws of infection exists in scarlatina and diphtheria. To this positive and comprehensive dictum (which Dr. William Squire seems to have endorsed) I am not altogether able to subscribe. Although I believe that the same poison may give rise both to scarlet fever and diphtheria; and though I am satisfied that I have seen diphtheria resulting from contact with scarlet fever—the analogy, or even the occasional identity of the two diseases being thus forcibly suggested—yet facts which have come under my own notice are arguments too strong to allow of my accepting this declaration.

I have repeatedly seen a single case of diphtheria occur in a house containing several children, where it has been impossible to establish any effectual isolation of the sick child, or to carry out any efficient disinfection, without the spread of the disease to any of the others. I will mention, in particular, an instance where, among a family of nine ill-fed, ill-clothed children, inheriting delicacy and disease from a phthisical parent, and crowded together in a small, badly built cottage, a case of diphtheria occurred. The conditions present were all favourable to the spread of the disease. The affected child died in a week with extension of the diphtheritic membrane to the larynx, but not another case occurred among the rest of the family. Would or could this have happened had the disease been scarlatina? Other examples of the same kind I could cite, but not, perhaps, so emphatic.

I am not disputing the communicability of diphtheria, but I do not believe that, in point of intensity, it can bear comparison with that of scarlet fever. I am disinclined, also, to allow that in either the incubation period, or the duration of its late infection, any close correspondence has been proved to exist in scarlet fever and diphtheria. The reasons for this opinion, which I submit with deference, may be gathered from what I have already written in this article.

The mutual influence of intercurrent infectious diseases is a matter which, I think, it is well not to lose sight of. The remarkable association of measles with whooping-cough is well known, and, when these two diseases are contracted together, they exhibit a mutual interference in their development and progress, one or the other being delayed in its course. In this way, measles may obviously become a disease of prolonged infective properties, and, in like manner, it is possible that some of the other diseases to which attention has been directed may be altered in their course, and protracted in their infection period.

THERAPEUTIC MEMORANDA.

CARBOLIC ACID IN THE TREATMENT OF WHOOPING-COUGH.

MR. W. F. CORY has recently recommended carbolic acid internally in the treatment of whooping-cough. Since then, I have used the glycerine of carbolic acid with great success among my out-patients at the Children's Hospital. I had previously prescribed alum, belladonna, the bromides, ipecacuanha, the salts of zinc, croton chloralhydrate, hydrocyanic acid, etc., in different cases, but never with any very satisfactory results. I have notes of twenty-three cases treated with glycerine of carbolic acid. Half a minim in peppermint-water is sufficient for a child a year old, the dose increasing with the age. In twenty cases, relief was quickly given; the general condition of the patients was at once improved, and the number and severity of the paroxysms of coughing diminished. None of these cases attended more than a fortnight, while the usual length of attendance is certainly twice as long. In three cases, the carbolic acid failed to give relief. There was no doubt as to the nature of the illness in these cases, for in all the characteristic cough was heard, or ulceration of the frænum present.

I have observed ulceration of the frænum to be present in 50 per cent. of cases of whooping-cough, and that its presence is pathognomonic of the disease. I believe carbolic acid almost deserves to be called a specific for pertussis.

C. W. SUCKLING, M.D.Lond., Birmingham.

A NEW CURDLING FLUID.

WHEY is frequently of much use in acute diarrhoea or vomiting in infants, or, when used for diluting milk, it forms a food which agrees well when other milk-foods fail. It has one disadvantage, however, namely, that it is not easy to prepare, unless some reliable curdling ferment is at hand. Calves' stomach can rarely be obtained, either in town or country, when wanted, as it generally is, in a hurry; and, moreover, unless used quite fresh, it is apt to set up lactic fermentation in the whey. Essence of rennet, when made with brine, is quite unsuitable for preparing infants' food; and the sweet essences of rennet, as I can testify from experience, are not reliable, some specimens proving quite inert. Under these circumstances, it may be well to state that Mr. Bengier has recently prepared an exceedingly active and reliable curdling-fluid, which I have put to some crucial tests, and believe it will be found very useful in preparing whey, and will supersede the use of rennet, or any of the essences. For the preparation of white wine whey, it will be found far better to prepare the whey first, using some of Bengier's curdling-fluid, and then adding some alcohol in the form of sherry, or, still better, brandy. It must be within the experience of many that some sherries fail to curdle the milk in the usual way; some of the inferior acid sherries being the best for curdling the milk, but the worst for the patient.

HENRY ASHBY, Manchester.

SURGICAL MEMORANDA.

COMPOUND DISLOCATION OF TIBIA.

JAMES S., aged 11, on May 15th, caught his left foot in the wheel of a cart, and had it severely wrenched. On examination, the lower end of the tibia was found cleanly dislocated, and sticking out of a wound, about three inches long, over the edge of the boot. Chloroform was

given, and the bone and the wound well washed with a five per cent. carbolic lotion, the bone reduced, and the wound sewn up, with the exception of the lower angle left open for drainage. It was then dressed antiseptically. In a few days, a large slough came away, formed of the bruised tissues, and the bare tibia was exposed; but this gradually became covered with periosteum, and the wound filled up with granulations, and is now healed; he has perfect motion at the ankle-joint. The highest temperature was 102°.

T. G. PARROTT, L.R.C.P.Lond., Bournemouth.

REPORTS

HOSPITAL AND SURGICAL PRACTICE IN THE HOSPITALS AND ASYLUMS OF GREAT BRITAIN, IRELAND, AND THE COLONIES.

SALOP INFIRMARY, SHREWSBURY.

STRICTURE OF SMALL INTESTINE: ABDOMINAL SECTION: RECOVERY, WITH ARTIFICIAL ANUS.

(Under the care of Dr. CURETON and Mr. EDDOWES.)

[Reported by Mr. R. HAMILTON RUSSELL, House-Surgeon.]

S. B., aged 46, was admitted on June 20th, 1885, for constipation, steadily increasing during six months. Fourteen days before admission, she was seized somewhat suddenly with abdominal pain, which had persisted ever since. For twelve days there had been no action of the bowels without enemata; complete constipation had existed for five days. There was no history of syphilis, tubercle, or cancer. The motions had never contained blood. She had lost flesh slightly. She had always been healthy, and was the mother of several children.

She was a spare florid woman; her face was pinched and anxious; the tongue was moist and coated; the pulse was 90, and of fair quality. There was no pain; the abdomen was distended, but soft and free from tenderness; the walls were very thin, and moving coils of small intestine were plainly seen; urine was of specific gravity 1030, high-coloured, and scanty, but contained no albumen.

For five days after admission, unavailing efforts were made to procure an action of the bowels; opium, long-tube enemata, aspiration of flatus, and castor-oil, being all tried in turn.

On June 25th, the symptoms being unchanged, Mr. Eddowes opened the abdomen in the median line by an incision 4 inches long between the umbilicus and pubes. A small quantity of peritoneal fluid mixed with lymph escaped, and the abdominal contents appeared congested. A stricture of the small intestine was soon found, forming a complete obstruction, impermeable even to flatus. It was decided, after some deliberation, to make an artificial anus, which was formed at the lower extremity of the abdominal wound, about 2 inches from the pubes. The bowel, when opened, at once giving vent to liquid faecal material, which continued to flow without intermission for some hours. No dressing was applied to the wound, which was brought together by deep and superficial silk sutures.

The operation was followed by a great sense of relief, and but slight reactionary disturbance. The temperature and pulse became normal at the end of a week. The deep stitches were removed after four days, at which period faecal material was seen to be oozing up through the lips of the wound in its lower part, causing that portion to open up, but producing no worse result than a somewhat protracted convalescence. She left the hospital, wearing an elastic support, in six weeks.

In January, 1886, seven months after the operation, she came to show herself. Her health was perfect, she had gained considerably in weight, and was able to go about her household work as before. The bowels acted very regularly every morning; the motion was generally formed, and in this case she had very good control, but she was unable to control liquid motions and flatus. On introducing the finger, it was felt to be distinctly grasped by a sphincter. It is worth noting that, according to her statement, none of her neighbours or relations, with the exception of her husband, are aware of her condition.

HOSPITAL SUNDAY.—The Lord Mayor has received, at the request of the Prince of Wales, through Sir P. Cunliffe-Owen, a cheque for £100 for the Hospital Sunday Fund, being the amount received up to the present time in Dr. James Aveling's "mechanical begging boxes" at the Colonial and Indian Exhibition.