The Complications Of Measles Which tend towards a Fatal Ending.

R. SCOTT FREW, M.B.
Belvidere.

During the winter of 1896-7 it was my lot to have charge of a number of measles wards in the City Fever Hospital at Belvidere. The epidemic of last winter was one of unusual extent, and an opportunity was given during that time of seeing a very large number of cases. I was struck at the time with the mortality attending a disease which is often looked upon as one of little importance, and with a view to determining the various causes which lead to this mortality I have made an investigation into the cause of death in a large number of cases. I selected a period of fifteen years, from 1880 to 1894 inclusive, and by a study of the ward journals have got together some clinical facts which may be of some value. During the fifteen years there were admitted 7,687 cases of measles - of these 692 died, giving a mortality of 8.5 per cent. For various reasons I have been able only to obtain particulars of the illnesses of 479 cases, and it is from a study of these and from my own personal experience

that I intend writing this paper.

For purposes of prognosis clinically measles might be divided into three classes:-

(a) Simple
(b) Secondary
(c) Complicated

The prognosis of Simple measles is almost uniformly good. To the healthy child it is a matter of little gravity and the normal course of the disease is mild. Such an accident as death in the course of Simple measles is, I believe, almost unknown. Apart from complications there are certain anomalies in the course of measles which may tend to endanger life, but which, in my experience, are extremely rare. Such anomalies may be connected with the character of the eruption or with the course of the pyrexia. I have been unable to find any instances of death being due to such causes, and I have never myself seen a fatal result from such anomalies.

By "Secondary" I mean measles supervening on the top of some other disease. The prognosis in such cases must be more guarded, the gravity de-

pending to some extent on what the primary disease is. One of the most common of children's diseases associated with measles is whooping-cough, between which two diseases there seems to be some special affinity. This combination is rendered all the more serious as it is more than likely to be complicated with broncho-pneumonia. Such affections, as gastro-intestinal catarrh in young children become more serious when followed by measles and general constitutional conditions, as scrofula, rickets, and syphilis modify the prognosis.

It is, however, to the complicated class of cases that measles owes its mortality. This is not to be wondered at when we consider the variety and the quality of the complications with which measles is associated, or the ages and conditions of the children affected and met with in hospital. The number of complications is probably larger than in any other of the exanthemata, some of them are very common, others very rare, many of them very serious.

The influence of age in determining the mort-

ality of measles is seen in the following table where the numbers of recoveries and deaths for fifteen years are arranged in age periods. From it it will be seen that measles is essentially a disease dangerous to very young children. Below the age of one year the mortality is 18.4 per cent. of children attacked. Of the number dying in the first year of life it might be said that the great majority were over six months of age, as children below this age are seldom attacked and then very mildly. The process of dentition in children of over six months seems to render measles much more serious. The heaviest mortality occurs between the ages of 1 and 2, being 24.8 in males and 23.8 in females. Above this the mortality declines inversely with the age until in young adults it becomes very slight. The fatal cases among young adults usually occur in young men and women recently come to the city from the Highlands, and who contract the disease for the first time at that age.

	Males.			Females.		
Age.	Recovered	Died	% mortality	Recovered	Died	% mortality
Under 1.	241	62	20.4	238	47	16.5
1-2	270	89	24.8	262	82	23.8
2-3	374	75	16.7	371	71	16.06
3-4	491	59	10.7	424	58	12.03
4-5	522	31	5.6	445	32	6.7
5-10	1269	31	2.4	1308	42	3.1
10-15	111	1	.89	107	3	2.7
15 & over.	241	4	1.6.	321	5	1.5
Total	3519	352	8.1	3476.	340	8.9.

From the above table it will be seen that sex has little or no influence in determining the mortality of the disease.

When the 479 fatal cases are arranged according to age periods and compared with the total number of fatal cases during the fifteen years, they appear as follows:-

	Percentage Mortality in 479 Fatal Cases	Percentage Mortality in 692 Fatal Cases
Under 1 year	13.8	18.4
1-2 years	24.4	24.3
2-3 "	23.3	16.3
3-4 "	17.9	11.3
4-5 "	9.6	6.1
5-10 "	9.1	2.7
10-15 "	.62	1.7
15 and above	1.4	1.5

Of the 479 fatal cases, all with the exception of 28, owed their death to complications. When the two columns above are compared, it will be noted that there is no very striking difference between them. This difference would probably be less were the cause of death known in a larger number of cases. From the similarity of these columns I think I am justified in inferring that nearly, if not all the deaths in measles are the result of complications.

Following is the list of complications, etc., associated with the 479 fatal cases in which the cause of death could be accurately ascertained:-

	Total Number	Per centage
Laryngitis	37	7.7
Capillary Bronchitis Broncho-Pneumonia	308	64.3
Convulsions	26	5.4
Meningitis	7	1.4
Stomatitis	4	.83
Cancrum Oris	19	3.9
Diarrhoea	21	4.3
Whooping-cough	28	5.8
Marasmus	29	6.5

From the above it is seen that by a very large majority the most dangerous complications are those affecting the smaller bronchi, and the lung parenchyma, as from these causes no less than 308 out of 479 cases, or 64.3% owed their death. It is, without doubt, to this liability of measles to be complicated with pulmonary troubles, that the disease owes its importance, and were it not for this the death-rate would be comparatively trifling. Next, in point of number, but a very long way after, comes laryngitis, of which 37 cases died, or a mortality of 7.7 per cent. Complications affecting apparatus, other than this respiratory, account for only a very small minority of the deaths.

Than those complications mentioned above, there are others, such as diphtheria, nephritis, etc., but their incidence and mortality are so small as hardly to affect the returns. Of the influence of measles on the pregnant state I am unable to say anything, not having had, so far as I am aware, any pregnant women under my care. In the few cases I have had of women recently delivered, the disease was not characterised by any special severity.

The incidence of the various complications according to age periods is shewn in the following table:-

Ages	Laryngitis	Bronchitis & Pneumonia	Convulsions	Meningitis	Stomatitis	Carcinoma Ois.	Diarrhoea	Pertussis	Marasmus.
Under 1	4	49	4	-	-	-	2	1	6
1-2	11	75	8	3	-	3	8	5	4
2-3	7	73	6	2	2	4	2	9	7
3-4	3	55	4	1	1	4	6	8	4
4-5	6	26	3	-	1	5	-	1	4
5-10	6	25	1	1	-	3	3	4	1
10-15	-	2	-	-	-	-	-	-	1
15 & upwards.	-	3	-	-	-	-	-	-	2
Totals	37	308	26	7	4	19	21	28	29.

Laryngitis.

Catarrhal laryngitis, as a complication of measles, is most commonly met with in the pre-eruptive or eruptive stages of the disease. During this time the larynx may be affected without any other portion of the respiratory tract - when laryngitis supervenes at a later stage of the disease, it is usually in conjunction with bronchitis or bronchopneumonia. In the early stages it may be met with in all degrees of severity, from the slight affection evidenced by cough which passes off in a few days to the condition which may terminate in death by asphyxia.

The onset of laryngitis in the early stage is probably due to the same causes as give rise to bronchitis, viz., exposure to cold before the rash has made its appearance. Why the larynx should become so markedly affected in some cases, and the bronchial tubes in others, is very difficult to determine. Most cases of laryngitis are accom-

panied by a certain amount of bronchitis but this may be so slight as to be quite overshadowed by the distress caused by laryngeal affection.

Mild cases are not of much importance except from the danger of the catarrh spreading down and involving the lungs. There is not, as a rule, much distress, the child is able to lie down, colour keeps good, and the only evidence of laryngitis is had in the hard cough and the husky voice. With the subsidence of the rash in many cases the cough disappears and the catarrhal condition clears up.

In more severe cases the picture is a very different one and the distress of the little patient may be very marked. The child is very restless, turns from side to side in the bed, lies for a moment with the head thrown back, and occasionally sitting bolt upright gasping for breath. Spasms of asphyxia coming on suddenly and passing off suddenly are very common. Respiration is noisy, being audible at some distance from the bed, inspiration is long and whistling, and expiration

is prolonged. The face has an anxious look, eyes are prominent and staring, the skin has a dusky hue. The voice is reduced to a whisper, and the cough is loud and hard in character. The lower ribs may be very much retracted during inspiration. The temperature is high, but at this time the rash is developing or at its height. The tongue as a rule is thickly coated and the breath is bad.

Cases which are going to recover usually manifest improvement when the rash begins to fade. The respiratory distress becomes less marked, the blood becomes more freely aerated and recovery gradually takes place. As a rule, laryngitis when severe, tends to be fatal. I have never seen a case, where the distress was so severe as to suggest tracheotomy, recover. The high mortality is probably due to the fact that very young children seem to be worst affected.

Instead of improvement setting in with the subsidence of the rash the distress may become more marked, the lividity increases in intensity, and

the child may very suddenly die of asphyxia. In many cases the end takes place in a violent convulsion with hyperpyrexia. In some cases the child sinks into a condition of coma, becomes very pale, and dies quietly. Death usually takes place during the first week of illness.

The laryngitis seen in later stages of measles is usually associated with bronchitis or bronchopneumonia, and may be a large factor in determining the mode of ending of these complications. As a rule its onset may be looked on as heralding the near approach of death. In some cases, however, it may occur where the bronchial or pulmonary involvement is so slight, as to warrant the performance of tracheotomy, but such occasions must be very rare indeed. During a period of fifteen years I can only find records of five cases where tacheotomy was performed under these circumstances, and in all a fatal result took place.

The affection is generally simply catarrhal. Post-mortem I have found on several occasions very

slight superficial ulcerations of the mucous membrane of the epiglottis and of the vocal cords. Very occasionally the affection is diphtheritic. Out of 37 cases which died in the 15 years, 2 are said to have been so. In my own experience I have seen one case.

Capillary Bronchitis and Broncho-pneumonia.

As has been shewn the most frequent complications of measles are those affecting the capillary bronchi and the parenchyma of the lungs. From a clinical point of view it is often very difficult to say exactly where the one begins and the other ends, and as it is probable that one does not exist without a certain degree of the other, for statistical purposes I have grouped together capillary bronchitis and broncho-pneumonia. It is on this special liability to involvement of the respiratory ap-

paratus that measles must base its claim to be one of the most deadly diseases of childhood, as were it not for this the death-rate would be comparatively small.

Of 479 fatal cases, the cause of death in which can be accurately stated, 308 were due either to capillary bronchitis or broncho-pneumonia, or 64.3 per cent. of the fatal cases owed their death to these causes.

With regard to age more than half of this number were under 4 years, viz., 252 and of these 124 were under 2 years of age. From this it will be seen that these complications are specially dangerous in very young children. Of 66 fatal complicated cases under the age of one year, 49 died from these causes. Children being nursed at the breast seem very liable to be affected.

Sex seems to have no influence in determining the incidence, males and females being affected very much alike.

The time of onset of capillary bronchitis is

very often difficult to decide. Nearly all cases of measles during the period of pyrexia have a certain amount of bronchial catarrh, and it is only when the temperature keeps up after the period of pyrexia in an uncomplicated case should be over, that the attention is directed to the idea that probably the catarrh has spread down and now is involving the smaller bronchi. Fever lasting more than 7 days from the onset of illness and in the presence of a fading rash is often the signal of impending danger. In some cases the pulmonary affection is concurrent with the development of the eruption, but in the great majority of cases the onset comes with the fading of the rash.

The onset of capillary bronchitis or bronchopneumonia is not heralded by a rigor, nor yet often by a convulsion, but attention is directed to the fact that the child does not pick up with the decline of the rash, and on close examination it is found that there is an increase in the number

of respirations with disturbance of the pulse-respiration ratio. In the few cases in which convulsions take place at the onset, death usually takes place in a few hours before physical signs have become at all well marked.

The child is restless, does not sleep well, is very thirsty, and will at first drink greedily, - later on in cases which are going to prove fatal he refuses to drink, apparently in dread of being choked. The aspect at this time and all through is very characteristic - the face has an anxious look, the alae nasi working, the angles of the mouth twitching, the lips and gums of a slightly livid tint, the degree depending on the amount of lung tissue involved. Early in the disease the tongue tends to get dry, and in many cases, especially where there is much weakness, the mouth is attacked by an aphthoms stomatitis which tends to hasten a fatal result. The sputum is seldom obtainable, the child almost invariably swallowing

it and this, I am inclined to think, may be one of the reasons why broncho-pneumonia is so often accompanied by diarrhoea. The pulse is rapid, its rapidity varying with the fluctuations of temperature, and its quality with the stage of the disease and the strength of the patient.

The striking feature of broncho-pneumonia is the course of the temperature, and by it a diagnosis can be made alone between catarrhal and croupous pneumonia. The type is remittent with occasional intermissions. At first the temperature may rise as high as 105^{o} in the evening, and the next morning after a gradual descent it is down to 99^{o}. The next evening the same rise takes place and so on for a few days, till the remissions tend to become less and the type to become rather more continuous, but never do you have the same continuous steady temperature seen in croupous pneumonia. Pneumonia in measles is as a rule catarrhal, and in my experience I have only once seen lobar-

pneumonia, and in that case I regarded it rather as a coincidence than as a secondary complication. The course of the pyrexia as regards duration is most variable, and the limits are far apart, about seven days acute illness in a recovering case being the minimum, and the maximum time extending into weeks and months till the case ends as one of chronic pneumonia or of phthisis. Without resorting to physical signs, a diagnosis of broncho-pneumonia as against acute capillary bronchitis can sometimes be made by the fact that the evening temperature is higher and the remissions less marked. In cases that are going to recover the evening temperature becomes gradually less and less, the remissions being less marked till at length it becomes normal. With a fatal result the temperature at the end may be variable, hyperpyrexia or collapse depending on the mode by which death comes. Physical examination of the chest in acute capillary bronchitis reveals in front a large number of coarse

loud bubbling râles indicating an involvement of the larger tubes which is always present at some period of an attack. These râles are so loud as to obscure the smaller and finer ones, and it is to the back that we must listen for the latter. Here a very fine moist crepitant râle accompanying inspiration and expiration indicates that the terminal bronchi, and perhaps also the air cells have become involved. When the latter become affected over small scattered areas, then the breathing takes on a somewhat tubular or wavy character over these areas. By and bye when consolidation of these areas takes place we have little patches of dullness to percussion scattered over the back of the chest. In a large proportion of cases, however, and especially large in fatal cases, the number of areas is so large that their coalescence may give to an entire base a distinctly dull percussion note. This note is not so dull, nor does it give the same feeling of resistance as the consolidated lung of

lobar-pneumonia. Over such a dull area the respiratory murmur is distinctly tubular. Unlike lobar-pneumonia the involvement of lung tissue is in most cases bilateral and it is to this fact and also to the accompanying bronchial affection that catarrhal pneumonia owes its large mortality. With the advent of lysis in a healthy child the process of resolution goes on steadily and in the course of about a fortnight from the fall of the temperature the physical signs will have for the most part disappeared. Along with this there is an improvement in the child's general condition - he begins to look about him and take an interest in his surroundings. The tongue becomes moist, loses its fur, diarrhoea, if there has been any, ceases, and convalescence is established.

But though the large proportion of broncho-pneumonia met with in measles are very acute, and terminate by death during the first week or by recovery after a few more days pyrexia, still there

is a very fair number of cases which assume a subacute or chronic form which may drag on for weeks or even months before recovery or death. Why the disease should take on this form, or what exactly is the pathological condition in play is often very difficult to determine. Children of a rickety constitution seem to me specially prone to this subacute variety. Their affection probably begins in the usual way with a fairly sharp illness, pyrexia of the remittent variety and signs in the chest of lung tissue going on to consolidation. At the time of lysis the child picks up somewhat but the evening temperature does not come down to normal. The course of temperature after this is intermittent, the evening rise varying from 102° to 104°. During the day the child is moderately well but the nights are marked by sweating and restlessness. The consolidated lung does not clear up. A certain amount of dullness still remains and there is some moist râle at the bases.

This condition of affairs may go on for about a month or six weeks and then signs of improvement begin to manifest themselves. The evening temperature does not rise so high, gradually it creeps down till some evening it is normal. The signs in the chest clear up - there is no dullness and the râles are gone. The child now sleeps well and takes plenty of nourishment. Such a change seems often to be the result of judicious nourishing diet in a case which would otherwise have progressed steadily down-hill. The prognosis in these cases is very uncertain, as it is often impossible to say whether or not changes of a tubercular nature are going on, and which will lead to an early fatal result. In these cases there is no improvement, the temperature does not come down in the evenings, the child gradually emaciates, the fingers become clubbed, the abdomen distends, diarrhoea sets in, and the child gradually sinks exhausted after an illness very suggestive of phthisis. At the post-mortem examination of such a case small abscess

cavities are seen in the lungs involving lung tissue, also bronchi dilated & pus, and caseating mediastinal glands. In cases where diarrhoea has been a feature the mesenteric glands may also be in a state of caseation. Occasionally, but not often, such cases are terminated by a basal meningitis. Many of these children die with signs which look like meningitis, e.g., squinting, twitching, etc., but which on post-mortem examination are found cannot be due to this cause.

Relapses in broncho-pneumonia are not uncommon. After the temperature has been coming down for some days it may suddenly go up again - a fresh piece of lung is found to be involved and after a few more days remittent fever it comes down again.

When acute broncho-pneumonia is fatal, the event usually takes place in the first week of the illness. Out of a large number of cases examined I find that the day most fatal is the 10th. day from the beginning of the attack of measles, which

usually means that the 5th. or 6th. day of broncho-pneumonia is the time of most danger. Many cases die before that day and many may go on past it and die, but it will be found that the 10th. day from the onset of primary illness is the critical one in broncho-pneumonia. The phenomena of approaching death vary in different cases. In some the patient is livid to the end, the face is dusky, the mucus membranes blue in colour and the child, gasping for breath, seems to die of asphyxia. These cases have as a rule considerable bronchial as well as pulmonary involvement. It is in this class of case that the final scene is accompanied by a convulsion or series of rapidly succeeding convulsions and a hyperpyretic temperature going up to 109° or 110° just before death. In another class death seems to take place from the heart. The temperature may have fallen down several degrees - it may even be subnormal. The child is of an ashy paleness, the face is pinched and drawn. The ex-

tremities feel cold. Towards the end the child refuses to or cannot swallow, and stimulant administered per rectum is speedily expelled. Between these phases there may be many varieties depending largely on the type of case, and the complications which may be running concurrent with the pneumonia.

Convulsions.

The occurrence of convulsions at the termination of a fatal attack of measles is very often assigned as a cause of death, but I think it would be very much better to look on convulsions as merely symptomatic of some other complication which was tending towards a fatal ending. That this view is the correct one will be borne out by the examination of a number of cases. I have before me notes of twenty-six cases in which convulsions occurred,

in almost all of them there were present other complications so severe as to make recovery hopeless, and the supervention of convulsions was merely an indication of the severity of the illness.

As in many other children's ailments the onset of measles is often accompanied by a convulsive attack, but this as a rule is not dangerous and I have never seen any child die at this stage. Such attacks are usually single, of mild severity, and quickly pass off, but I have occasionally noted that such children were liable to convulsions later on in the disease.

By far the largest proportion of convulsions is associated with broncho-pneumonia. Diarrhoea, whooping-cough, and stomatitis are also often terminated by convulsions, but the number of these is very small compared with the broncho-pneumonia. Such a complication as meningitis is, of course, often accompanied by convulsive attacks. Constitutional conditions, such as rickets, predispose, and teething children are liable to be affected in

this way.

The severity of the convulsions varies between wide limits - from the very slight local twitching to the universal fit in which consciousness is lost. As a general rule the more acute the complication the more severe is the convulsion. Invery slight cases there may be no more than a little twitching of the forearms with turning in of the thumbs on the palms of the hands; or there may be squinting with slight contraction of the facial muscles. In such cases consciousness may not be lost, and there may be many such seizures before death. Sometimes a child passes into a sort of status epilepticus, in which seizure succeeds seizure in quick succession.

In broncho-pneumonia the attacks are almost always of the more severe variety and more comparable to the true epileptic seizure. They occur as a rule during the first week of illness and their occurrence is always a sign of death coming on in a few hours. I have never seen a broncho-

pneumonia recover after convulsions.

When a case shews evidence of becoming asphyxiated as seen in lividity of the lips and duskiness of the face, then it is that convulsions may be expected. These are probably due in such cases to the nervous system being supplied with improperly aerated blood. Another feature of such cases is the very high temperature seen before or after a convulsion - 109° not being at all uncommon. This condition of hyperpyrexia may also have something to do with the condition of the blood causing the fit. The features of an attack have a strong resemblance to the epileptic seizure seen in older children, except that the period of tonic convulsion is usually shorter, and that of clonic convulsion longer. The onset is usually sudden - the children are too young and too ill to appreciate an aura if there be one - the limbs and body are extended, the head is flung back and the eyes turned up so that only the whites are seen, this period of tonicity lasts a few seconds. Then comes the clonic convulsions which may vary greatly in severity and duration,

and in which consciousness is lost. Occasionally a child dies in this stage. After the fit passes off, the patient is exhausted and may fall asleep. Sometimes only one attack takes place, sometimes there is a series of them in quick succession till death takes place.

The convulsions seen in the more chronic complications are not as a rule so severe as those met with in broncho-pneumonia. Patients with whooping-cough are liable to convulsions, and when this becomes associated with measles the liability seems to be much increased. In diarrhoea the attacks are as a rule slight and may only be local twitchings, but they seem, nevertheless, to be quite as deadly in their import.

In fifteen years there were 26 deaths associated with convulsions. In 18 of these broncho-pneumonia was present - in four whooping-cough and in one diarrhoea - in one case there were signs of rickets and in two the children were teething. Eighteen of the cases were below the age of three years.

Meningitis.

Meningitis, simple or tubercular, as a complication of measles, is, I believe, extremely rare. I have arrived at this conclusion from the study of many cases which during life presented symptoms like those of meningitis, and which on post-mortem examination gave no indication of meningeal mischief. I have, again and again, seen cases recover after a course of pyrexia, irregular pulse, vomiting and squinting have impelled me to think of meningitis, and I have also seen cases presenting much the same symptoms during life, present on examination no more than a slight oedema of the membranes of the brain. During my residence here I believe I have seen only one case of meningitis after measles. During the fifteen years 1880-94 I can find records of only seven cases - in 4 of these the disease was tubercular, - in the remainder simple. In one of the tubercular cases the meningitis was simply a part of an acute miliary tuberculosis, and one of the simple cases was due to an extension of

inflammation from mastoid cells.

A mistaken diagnosis of meningitis is apt to be made in cases of acute otitis media where the pent up pus give rise to intense pain, restlessness and screaming. If the tension is not relieved, convulsions and coma may give colour to the idea of meningitis.

Again, children dying of broncho-pneumonia may have, during the last 24 hours of life, very marked strabismus and slight twitchings of hands and face, but these seem to be symptoms of profound toxaemia and merely an indication of impending dissolution.

The onset of meningitis in measles varies both as regards time and mode. In the tubercular variety the time seems to be late. The symptoms may also be masked if the meningitis is part of a general tuberculosis supervening on caseation of a bronchial or other gland. In simple meningitis death seems to take place earlier, in the three cases of which I have notes, one took place in the second week, and two in the third week.

Stomatitis.

Stomatitis is a common enough complication of measles and acquires an importance, not that it often leads in itself to a fatal result, but from the fact that it is always the percursor of another and more fatal complication, viz., Cancrum oris. Many of the children admitted into hospital suffer from slight aphthous stomatitis which after a few days of cleanliness passes off, leaving a healthy mucous membrane. It is the ulcerative variety which gives rise to most anxiety. During 15 years there have been four cases in which death was attributable to this cause. Considering the large number of cases which occur, this number is exceedingly small and it is probable that in these stomatitis was merely the exciting cause of death in cases weakened by privation or other depressing complication. As a rule it is met with in children who are constitutionally weakly, or in those in whom the vital powers have been lowered by illness, e.g.. whooping-cough. It is occasionally met with during, and

shortly after the acute symptoms of measles, but more often I think, after the primary illness is over and the patient has been weakened by an attack of bronchitis. At the onset the patient is cross, cries when it is feeding, and saliva runs plentifully from the mouth and may cause excoriation of the face. The breath is noticed to be very foul. On examination there are seen round the roofs of the teeth, areas of dirty grey granulation tissue and debris. The incisor teeth of upper and lower jaws are usually first affected, but the ulceration soon spreads until all the teeth are surrounded by these grey patches. A carious tooth is often found to be a starting point. The tongue is foul, and diarrhoea is a very common accompaniment. As a rule there is little or no elevation of temperature unless the case be complicated with bronchitis. In a few days the teeth have become so loose as to be easily removable, and for purposes of treatment it is often desirable that they should be taken out that the diseased areas may be got at. The ulcera-

tion may go on extending and very soon there is so much loss of tissue that the alveolar border of the jaw is exposed and necrosis sets in. In process of time this necrosed part is removable as a sequestrum carrying with it any teeth which may be left in it, and leaves behind it a raw granulating surface. The disfigurement left is sometimes very marked - the whole alveolar border of a jaw may in this way be lost, but as a rule the loss is confined to a few inches.

Most cases of stomatitis seen in hospital do not go on as far as this, and are usually confined to ulceration of the soft parts, viz., the gums and floor of the mouth. In the course of about a fortnight such ulcers are healthy and healing. Such an event is only the result of very strict treatment, and were it not for this stomatitis would certainly be a very much more serious complication. The mortality from it outside of hospital must be very much higher than in here. When we take into consideration the fact that stomatitis is usually

associated with bronchitis and diarrhoea it will be seen that its occurrence may be of very grave omen and an indication that the vital powers of the patient are very much reduced.

E.R. aet 4, female, admitted May 19th. 1897 on 4th. day of illness. Well developed measles rash. Tongue and mouth noted as clean. Heart sounds normal. Bronchitic râle in both lungs. Temp. 102.2° $\frac{160}{44}$

On the 4th. day after admission a septic ulcer was seen on the alveolus of the lower jaw on the left side and extending on to the cheek. Base covered with grey debris. The breath very offensive. Temp. 99°. Round the bases of the two back teeth there is some debris. Removed the two back teeth.

On the 14th. day the ulcer was not healing and the infection had crept along and was now involving the front incisor teeth. These teeth were also removed. Smell very bad.

On the 16th. day the alveolar border of jaw was exposed and looked black and necrosed.

On the 26th. day the sequestrum was felt to be loose and two days after was removed, leaving a healthy granulating surface.

Temperature all through was seldom above 100°. The bowels were loose all the time, but were kept in check by astringents. Chest condition cleared up satisfactorily.

Such a result as the above could only be ob-

tained in children constitutionally strong, it is otherwise in children who are weak.

> M.C., aet 4, female, a small, weakly child was admitted April 23rd. 1897, on the 7th. day of illness. Tongue and mouth very dirty, there being numerous centres of ulceration round about the upper incisor teeth. Both lungs showed evidence of bronchitis. The bowels were very loose.
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> This case become progressively worse, all the upper teeth had to be removed. Breath was very offensive. The infection spread to the lower teeth loosening them. Diarrhoea continued, averaging 3-4 motions per diem till a few days before death when it ceased. The bronchial condition remained in play all the time. Temperature varied considerably reaching at times 103° and seldom coming down to normal.
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> Three days before death patient had several mild convulsions - each lasting about 30 seconds - and being very like the spasms of tetany. These continued till her death which took place on the 32nd. day of illness.

From stomatitis to cancrum oris is but a step, and there are many cases which are somewhat difficult to classify, there being really no line of demarcation between the two. I prefer to retain the name "cancrum oris" for these cases in which the soft parts of the cheek and face become

affected. During the years 1880-94 there were 19 deaths from this cause, notes of which cases I have before me. Unlike stomatitis cancrum oris is not a complication which occurs during the acute stage of the illness. In one case death took place on the 10th. day of measles, but in this case the child had already had whooping-cough for 4 weeks. In the large majority of the cases the child had been ill for weeks and months with pulmonary trouble, 10 of them had bronchitis, three broncho-pneumonia, one whooping-cough, and the remainder diarrhoea. Of the 19, 8 were males and 11 females, only one of the latter being attacked with noma.

The onset of cancrum oris is almost always preceded by a certain amount of stomatitis. The first external sign is usually a swelling of the cheek and a glaziness of its surface. On examining the inside of the mouth a sinuous septic ulcer will usually be seen creeping up from the roots of the teeth and involving the mucous membrane of the inside of the cheek. The child is cross, the

cheek being at this stage painful, and drinking accompanied by pain and difficulty. The temperature as a rule is not high. By the following day a black spot will probably have appeared on the outside of the cheek, at the summit of the swelling. An incision into this spot would give relief to large, black, foul swelling sloughs from the soft tissues of the cheek. The borders of the incision thus made would rapidly extend and in the course of another 12 hours there would be a large hole perforating the cheek, and exposing the teeth. The alveolus of the jaw is by this time probably stripped of covering and stands out of a dull white colour and dead. Should the child still live and the ulceration go on extending, there is almost no limit to the amount of destruction which may take place. But as a rule the child is either by this time dead, or the ulceration has ceased as the result of treatment. Many cases die before perforation takes place, and in 4 out of 19 cases the black spot appeared externally on the day of death. Most

cases linger on for a few days, and some shew a remarkable tenacity of life - one case living for 17 days with both cheeks and palate destroyed. It is an almost invariable rule that cases which go on to perforation die, and I have only seen one such case recover. As a general rule death takes place about the sixth day after the onset of the swelling. The proportion of cases which recover is very small, once destruction of soft tissue has taken place to any extent, but many cases which I have no doubt would go on to cancrum can be saved by early and prompt treatment.

> M.S. aet 4, female, admitted Nov. 9th. on the 5th. day of measles. Remained fairly well till the 21st. November when stomatitis attacked the gum around the two lower molar teeth on the right side. The teeth being loose were removed, the parts touched with a caustic and in a few days the stomatitis had disappeared.
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> On the 16th. December she contracted an apical pneumonia accompanied by very bad diarrhoea. By the end of the year the pneumonia was over and the diarrhoea practically better.
>
> On the 1st. January she complained of toothache. The upper molar teeth were carious and there were sordes round about them. The

right cheek somewhat swollen.

2nd. January. To-day the 2nd. upper right molar is loose and a patch of stomatitis is round about and spreading along the gum. There is also a small ulcer on the cheek. In the afternoon the two upper molar teeth were removed, the gum and ulcer were scraped and painted. The right eye was almost closed on account of the swelling of cheek.

4th. January. Yesterday there was no improvement. The left eye is now swollen, and there is considerable extension of the ulceration on the inside of the cheek. Odour from the mouth exceedingly foul.

In the evening the remaining teeth in the upper jaw were removed - the alveolus and the ulcerated cheek thoroughly scraped and painted with nitric acid. The ulceration now involves the posterior 2/3rds. of the upper jaw on both sides, and from these areas it spreads on to the mucous membrane of the cheeks. General condition fairly good, but strength evidently impaired by the pneumonia. Evening temperature 101° pulse 136, resp. 32.

January 5th. No improvement in the mouth, but left eye not so swollen. Temperature in morning 99.4°, pulse 124, resp. 32.

January 6th. Marked extension of the disease inside the cheek, and more swelling of the right cheek, on which a black spot has appeared about one inch from the right angle of the mouth. There is a profuse discharge of fetid saliva of a brownish red tinge. Both eyes are now closed.

January 7th. Great increase in the gangrenous area which has now crept to the

angle of the mouth. Perforation has not yet occurred.

Death occurred in the evening.

Noma is very rare. There is record of only one case, and that occurred in conjunction with cancrum oris. I have not myself seen a case, - in one child of a scrofulous habit there was a threatening, but as a result of prompt treatment the condition cleared up.

Diarrhoea.

The diarrhoea of measles which tends to endanger life may be looked upon as more of a sequela than a complication. It is true that in the pre-eruptive stage diarrhoea is very often a prominent symptom, but it generally mitigates with the appearance of the rash, and in a healthy child very

soon stops entirely. If, however, the child be unhealthy or if from any cause he be prone to gastro-intestinal dèrangement, the diarrhoea may go on and become a serious menace to life. But, my experience has been that, diarrhoea said to have existed before admission ceases very shortly after, although no doubt this is due in some measure to the dietetic treatment received, and I have never seen a child die of diarrhoea during the eruptive stage of the disease, though many cases die in that stage where diarrhoea is a prominent feature but not the exciting cause of death. The broncho-pneumonia which so frequently terminates fatally during the first ten days of illness is very often accompanied by diarrhoea, and yet it cannot be said that the diarrhoea is the cause of death though no doubt it very materially helps. In looking over the cases which have died during the first fortnight of illness and in which diarrhoea has been a prominent symptom, I cannot find any in which it stood alone - the majority had bronchitis or broncho-pneumonia,

some had whooping-cough, and in one there was a history of diarrhoea extending over some months.

The onset of severe diarrhoea after the acute symptoms have passed is dangerous. As a rule it comes on in children who have had pulmonary affections, even after these have, to a large extent, cleared up and seems to be an evidence that such children are prone to catarrh of the mucous membranes. The child does not recover properly after the subsidence of a pneumonia - it drifts into a low subacute condition with perhaps a few moist râles at the bases of the lungs - the temperature is erratic, occasionally going up at nights, it is in this condition that diarrhoea seizes a child and carries it off in a few days. Without diarrhoea the prognosis in such a case may be hopeful, but its occurrence will almost invariably lead to a fatal result. During 15 years there were 21 deaths attributable to diarrhoea. In all of these the acute symptoms of the disease had passed, and in more than half there had been bronchitis or broncho-pneumonia fol-

lowed by an imperfect recovery.

The bowels, which have tended to be loose all through, become suddenly very loose and may be moved as often as 6-8 times in the day. The motions are green and offensive in smell at first, but later on tend to become more watery or may only consist of mucus and blood. The child very rapidly emaciates, the face becomes pinched, dark rings form round the eyes, the breath becomes offensive, aphthous patches gather in the mouth and the tongue is thickly furred. Sickness and vomiting very often accompany the diarrhoea. The abdomen becomes distended and painful on palpation. With this constant draining, and the child's inability to retain nourishment it gradually sinks and dies exhausted. Death in some cases is preceded by a convulsion. As a rule death takes place in from about 3 days to a week from the onset of the diarrhoea. Post-mortem examination of such cases reveals in some a catarrh of small intestine, the lesions in many cases being slight and almost in-

appreciable to the naked eye. In other cases the colon is the part most affected and there is distinct ulcerative loss of the mucous membrane.

Marasmus.

The class of cases which die of Marasmus or Atrophy seem to be larger in measles than in any other of the exanthemata. The cause of this is no doubt largely to be found in the large number of children affected with measles, at an age when they are liable to chronic functional derangements interfering with the proper assimilation of food. That the majority of cases is associated with functional derangements is quite true, but there is a large number also due to organic changes of a slow and chronic kind, which cause general wasting and ultimately death. In a number of cases also it is difficult to say definitely what is the cause, many children seeming to die simply of asthenia.

Roughly marasmic children may be divided into two classes, viz., those in which the symptoms are mainly pulmonary and those inwhich gastro-intestinal symptoms are most prominent. Apart from these there are cases which seem to be constitutionally affected as by rickets, syphilis, tuberculosis, etc. I have notes of 24 cases in which death took place from Marasmus - in 10 of these there were pulmonary symptoms, - in 7 chronic gastro-intestinal symptoms, 3 were affected with rickets, one with syphilis, and in three no definite disease could be found.

These cases in which the pulmonary are most marked are generally the result of a broncho-pneumonia not clearing up in an unhealthy child, or one with tubercular tendencies. After the subsidence of the more acute symptoms the disease may take on a subacute course. Small patches of consolidation may remain or eventually undergo a caseous degeneration. The temperature assumes a hectic type. Emaciation takes place gradually, vomiting and diarrhoea may set in, and the child dies ex-

hausted. The diagnosis of such cases is a very difficult matter, and it is almost always impossible to say whether tubercular changes may or may not be taking place in the lungs or bronchial glands. Occasionally the diagnosis is settled by the child taking a general tuberculosis and dying of meningitis.

Phthisis pulmonalis is occasionally a cause of wasting, and I have now seen several cases in the adult where measles was followed by a consolidation at an apex going on to softening. These cases have happened in men, apparently in the best of health before the onset of measles.

The gastro-intestinal catarrh which so often accompanies measles is another frequent cause of marasmus. In weakly children this very often persists, leading eventually to atrophy of the glandular structures in the alimentary canal. In some cases vomiting is the chief symptom pointing to a gastric catarrh - in others diarrhoea seems to indicate that the intestine is the seat of the mis-

chief, but in most cases the entire canal seems to be involved. The onset is marked by diarrhoea and vomiting. The stools are loose, may be green in colour, and contain much mucus. The abdomen becomes distended with gas and is painful on palpation. As time goes on and the symptoms are unchecked the child begins to emaciate. The skin becomes dry and shrivelled, and the child's face assumes a pinched, wizened look. Aphthous patches appear in the mouth. The skin on the buttocks becomes excoriated from the diarrhoea. Abscesses may form in different parts of the body. Eventually the child sinks into a semi-comatose condition and dies, perhaps in a convulsion.

The emaciation seen in children affected with rickets is no doubt associated with the proneness of such to gastro-intestinal catarrh.

The association of measles with whooping-cough is one of great danger, and it seems to be a fact that whooping-cough children are easily infected with measles. This is probably due simply to the fact that such children are run down and unable

to resist the invasion of infection. It is also not uncommon for children, who have been dismissed from measles wards, to return in a short time with whooping-cough. The danger lies in the liability to pulmonary catarrh. This is quite to be expected when we consider the state of the respiratory system in whooping-cough. I have notes of 28 cases in which measles was associated with whooping-cough and which proved fatal, and in nearly all of these death was due to either capillary bronchitis or broncho-pneumonia. Diarrhoea was the cause of death in some others. The liability to pulmonary catarrh will no doubt vary with the stage of whooping-cough in which the child is attacked. In the early stages when slight catarrh is the rule, I should fancy measles would be more dangerous. In several cases I have noticed the whoop returning with the onset of measles.

Diphtheria is occasionally met with. I have seen only two cases. In one of these the disease

was tonsillar, in the other laryngeal. In both the disease was coincident with height of the eruption. Both cases died. In the laryngeal case there was considerable capillary bronchitis and the temperature ran very high for a few days before death. The diagnosis in both was made by bacteriological examination. Death seemed due to exhaustion.

Albuminuria, other than the transient form during the febrile stage, must be very rare. I have been unable to find records here of any cases, where it was quite possible to exclude the chance of scarlet fever being the cause and personally I have not seen any.

Gangrene of extremities is a rare mode of termination. I have had in my practice one case, and one other case is reported in the journals. The latter case came on after the child had been

exhausted with chicken-pox and whooping-cough, and proved fatal in 24 hours. The right arm was the limb affected.

In my case, a boy of 2 years, there was a very severe and extensive broncho-pneumonia, also diarrhoea. Three days before death dry gangrene appeared in the toes of the left foot. This quickly spread up the limb to the middle of the thigh. The right limb became similarly affected, so that both limbs were dry and shrivelled. The child was extremely pale and died in a collapsed condition. The temperature during the gangerous process, did not exceed 101°.
