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11.

Notwithstanding the fact that at the present time the treatment of diphtheria is undergoing a complete revolution both in this country and on the continent by the introduction of what is known as the 'Antitoxin-serum treatment' I purpose in the following paper giving a description of the course, sequelae, and treatment of eleven cases of that dreaded disease, which occurred in an epidemic in Manchester during the winter of 1892 and 1893, a short time after I had started practice in the town.

I shall give the cases periclitin as they were put under treatment, dwelling perhaps at greater length on the first case than on the others, as it, I considered, was as severe as any case of diphtheria generally is that ends in recovery, and also because the treatment adopted in it, was with some modifications depending upon the age of the patient and the severity of the symptoms, almost a fac-simile of that adopted in the others.

After disposing of these cases I shall enter into the probable origin of this outbreak, and describe briefly the means taken, by which it was extinguished - this epidemic being

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the last of three consecutive ones that had taken place within the preceding three years. Lastly, I shall conclude this paper by giving the report of another case I have just had under my care at Woodside Cottages, in the neighbourhood of Mauchline, which was treated with Antitoxin-serum and is now convalescent.

Case I. Pharyngeal and Nasal diphtheria: recovery.

On Nov. 2nd at 9 o'clock A.M. I was called to see Miss Mary M^{rs} G., aged 12 years, who had complained on awakening on this morning of a 'sore-throat' and 'croup'. She is one of a family of eight children—six daughters and two sons—of whom two are dead; the cause of death being in both cases diphtheria. A daughter aged 5 years in the epidemic during the winter of 1889 and 1890, and a son aged 3 years during the winter of 1890 and 1891.

On examination of my patient I found the skin was hot and dry, the submaxillary and upper cervical glands at the angle of the jaws slightly enlarged and tender on pressure, especially on the right side.

and some stiffness in the muscles of the neck, difficulty in swallowing, and ill defined pains in the muscles of the lower limbs and in the lumbar region, were also complained of. The fauces and posterior wall of the pharynx were much injected, the uvula was pendulous, the tonsils considerably enlarged and on the anterior surface of the right a small yellow membranous-looking patch was present. This I removed with the handle of a teaspoon, but found that the mucous membrane underneath was intensely red, and threatened to bleed. The tongue was coated with a creamy fur, and the breath rather foul smelling.

Temperature 101.8. Pulse 120.

Respirations 22. The urine was high coloured, and micturition was very frequent. A trace of albumen was detected, but no casts.

On microscopic examination of the small patch I had removed, I found it to consist of a granular matrix with some fibrinous threads intermingling throughout its extent, and enclosing in their interstices groups of leucocytes and some epithelial cells.

In the meantime I had freely applied to all the inflamed parts

a solution of menthol in olive oil, (30 grs. to the oz.), and had the throat sprayed with permanganate of potas. solution (2%).

Externally hot moist fomentations were applied to the enlarged glands. A bronchitis kettle was set a going so that the vapour of boiling water impregnated with Eucalyptus was constantly inhaled.

Internally I put her upon 15 γ . doses of Liq. Ferri Perchlor. with Acid Hydrochlor. and Glycerine - gradually increasing the dose to 25 γ . every two hours.

Milk, beef tea, chicken tea or other nourishing soups were ordered to be given as frequently as possible.

At 1 o'clock P.M. the membranous patch had re-formed and was larger and thicker than on the previous occasion.

Observing this and after my cursory microscopic examination of the removed patch I had now no hesitation in pronouncing the disease to be that of diphtheria.

The subsequent events, coupled with a later microscopic examination, on staining with alkaline solution of methylene-blue by which the rod-shaped bacillus of Klebs-Loeffler was demonstrated, fully bore out my diagnosis.

Having had some considerable experience of the benefit to be derived in acute inflammatory affections of the naso-pharynx by the use of menthol as a pigment, I resolved to continue with its hourly application, by means of a large soft camel's hair brush, for the first day, at least; and, in addition to the spray of permanganate solution I had lime-water (1 in 4) used as a gargle.

At 8 o'clock in the evening the pseudo-membrane had extended rapidly and was now more than one and a half inches in length and three-quarters of an inch in breadth. All the symptoms complained of previously were aggravated, - with the exception that swallowing was somewhat less painful, and this I attributed to the local anaesthetic effect of the menthol. Temperature 102.6° . Pulse 128. Respirations 30.

One teaspoonful of Ext. *Scumae* Log. Lig. was at this time given.

On the following morning at 8 o'clock the whole of the right tonsil and anterior pillar of the fauces on the same side were covered with exudation. On the left tonsil a small white patch was present on its inner surface. Temperature 103° . Pulse 130. Respirations 30.

The bowels had moved at 7 o'clock, and had passed urine, in small quantity, five times during the night.

Two teaspoonsfuls of brandy in water were now to be given every two hours.

At 8 o'clock P.M. the exudation on the right side had extended forward over the palate. On the left all the tonsil was covered. Temperature 104°. Pulse 140. Respiration 36.

It is now I had recognized that I had a most serious case to deal with, on account of the rapid extension of the pseudo membrane over the severity of the constitutional disturbance.

Moreover, the knowledge that the two previous cases had ended fatally made me extremely anxious as to the ultimate issue in this.

Nov. 4th 8 o'clock A.M. the exudation was now almost continuous from one side to the other and came well forward over the palate completely enveloping the uvula. Breathing through the nostrils was accompanied by some snuffling and from the right nasal orifice there was a thin reddish discharge.

Fearing that the exudation was about to extend in this direction, I

douched out the nostrils with permanganate solution (2%), and had this repeated every hour afterwards. Temperature 103.6. Pulse 140. Respirations 36.

At 10 o'clock P.M. the exudation had come still further forward over the soft palate, and posteriorly on the right side covered the posterior pillar of the fauces, and was encroaching the pharynx. The discharge from the right nostril was increasing in quantity, but on examination with nasal speculum, after anethizing, I could discover no trace of pseudo membrane. The glands of the neck were much more swollen and painful. Tincturitions not so frequent as on the previous day.

At 8 o'clock P.M. no further extension of the exudation was noted over the pharynx or palate. Snuffling was much more pronounced, and the nasal discharge was copious and appeared to be acid, having an irritating effect on the orifice of the nostril and skin of upper lip - these parts becoming red and inflamed looking. Temperature 103°. Pulse 140.

The patient looked extremely ill. The cheeks were rosy-red and contrasted strongly with the waxy-paleness of the

surrounding skin and that of the forehead
and nose.

On Nov. 5th at Götzek, A.M. the pharyngeal
exudation had remained stationary from
the previous evening. But on examining
the nasal cavities a distinct membranous
layer was seen covering the floor and
superior turbinate bone, of right nostril.
The discharge from the nose was now
yellowish tinged and foetid, and the
irritation of the nasal orifice and skin
of upper lip which it produced, amounted
almost to excoriation. Consequently I
applied a Selve of Iodoform with
vasoline.

For the following four days the
patient got weaker and weaker, and
on the 9th day the nasal diphtheritic
membrane was visible at the orifice
of the right nostril without the aid
of the speculum, and was thick,
tough and firmly attached. The left
nostril was still unaffected.

The temperature became very erratic;
at one time in the day going down to
nearly normal, then in an hour or
two mounting up to 102° or 103°.

On the 10th day albumen was present
in the urine to about $\frac{1}{7}$. The faucial
and pharyngeal exudations were now

beginning to darken, 'to curl up' at the edges, and tending to fall off at parts. With dressing forceps I gently dislodged a large piece of membrane from the nostril. On Nov. 13th the urine passed was exceedingly scanty, with long intervals between each act of micturition.

The patient was now in a pitiable condition of collapse. She was greatly emaciated, the countenance pale, and the power of movement both of arms and legs was almost gone. Several good sized pieces of pseudo-membrane were dislodged from the throat with some little bleeding. From the nose the discharge was not quite so copious, and breathing was freer.

Temperature 97°. Pulse 56.

Nov. 16th the exudation was clearing off rapidly both from the throat and nasal cavity - the latter being almost free.

On Nov. 18th all the exudation had quite disappeared - being the 17th day from the commencement of treatment.

All topical applications were from this time discontinued, with the exception of spraying occasionally with permanganate of Potas. solution.

In place of the Liq. Ferri Perchlor. I now put her upon Citrate of Iron

and Quinine, with Arsenic and Digitalis. She slowly progressed for the next week or so and was able to take a considerable amount of nourishment.

The temperature gradually rose to normal, the pulse improved in strength and regularity, the urine increased in quantity - got more natural in colour, and albumen was almost gone. But, now she began to show symptoms of paralysis in various localities. The first to manifest itself was that of the soft palate, uvula and cheeks. On swallowing her food, the liquid portion persisted in coming down the holets, and grains of rice or any small pieces of meat getting between the gums and cheeks were fixtures, and had to be removed with the finger. The soft palate hung limp and quite insensible to the prick of a needle. A few days after the palatal paralysis developed, another very troublesome complication was retention of urine, in consequence of vesical paralysis, so that I had to relieve the bladder with the catheter - using a small glass one - twice, and occasionally three times, in the twenty-four hours. These symptoms gradually improved.

and by the end of another eight or ten days the soft palate had almost returned to its natural state. The bladder perosis, however, more slowly righted itself, being altogether nearly three weeks before this organ performed its function satisfactorily.

Somewhat over a month after convalescence was established, ptosis of both right and left eyelids developed; and with it, partial defect in vision - due to paralysis of accommodation -

Fairly large type could not be deciphered unless with difficulty. This affection of the eyes and eyelids, although the latest in appearing, was the most intractable; altogether continuing for over three months before thoroughly relieving.

Case II. Pharyngeal and Laryngeal diphtheria: death.

On the afternoon of Nov. 7th I was called hurriedly to see James W. aged 3 years, who was said to be suffering from an ulcerated throat and had got much worse since the morning of this day.

He was one of a family of five children, four sons and a daughter, all living. On enquiry I found that the child had been ill for the last three days.

but for some days previously 'had not been well,' inclining to be peevish and fretful.

On examination, the submaxillary and cervical glands were very much swollen, on the right side more especially. The face was distinctly cyanotic; breathing was stridulous, very rapid and laboured. The chest was clear, although air was not entering the lungs freely.

Internally, I found the palate, uvula, tonsils, and anterior pillars of the fauces completely covered with pseudo-membrane.

I could not see further down the throat on account of the presence of a slimy mucous discharge; but, from the character of the breathing, it was plainly evident that the larynx was implicated - all the extraordinary muscles of respiration being called into action.

It was impossible that the child could live much longer - the pulse being very rapid and thready.

Tracheotomy might have stayed the moment of death and relieved the child's distress, but the parents objected to its performance.

After vainly endeavouring to clear the throat by swabbing, I tried to administer an emetic of Sulphate

of zinc, but had to desist as I could not get it over. In little more than an hour after this the child died.

In the meantime I had made an examination of the other four children, and was not surprised to find that they all had throat symptoms more or less marked. Their cases follow as III, IV, V, and VI.

Case III. Pharyngeal diphtheria: recovery.

Agnes W. aged 5 years, when seen on Nov. 7th the cervical glands were slightly swollen. The skin was hot and dry. Difficulty in swallowing was not complained of, nor pain in the muscles of the neck. The palate and pharynx were deeply injected and the tonsils enlarged; but this latter was a permanent condition, the mother stated. On both tonsils however a number of small whitish patches were observed. Temperature 100.8°. Pulse 96. Urine high coloured, but contained no albumen.

The patches on the tonsils gradually increased in size, coalesced, and in four days the exudation had extended posteriorly, over part of the

pharynx, and anteriorly over the palate and uvula.

The topical applications as in Case I were regularly continued, with the iron mixture internally.

On Nov. 17th (the 10th day) the exudation showed signs of detaching, but the patient's strength was now greatly reduced - she had not sufficient power to keep her throat clear of foul discharge that was constantly collecting.

This had to be every now and then soaked out - using for the purpose a piece of sponge fixed on to the end of a pencil.

On the 11th day a large piece of pseudo-membrane was detached, and by the 16th day all the affected parts were clear. The urine remained free from albumen.

For the following weeks all went well, and then palatal paralysis made its appearance. The voice became much more nasal in tone - it being always thus to some extent on account of the permanent enlargement of the tonsils.

Swallowing was a matter of great difficulty for a number of days.

Happily no other post-diphtherial symptom developed and she made

an excellent recovery.

About four months afterwards I excised both tonsils with the tonsillotome.

Case IV. Pharyngeal diphtheria: recovery.

John W. aged 10 years on Nov. 7th had enlargement of the neck glands and hyperaemia of the tonsils and palate. On the anterior surface of right tonsil was a small greyish patch. Temperature 99°. Pulse 86. Urine normal.

The membranous patch rapidly increased both in extent and thickness, & by the fifth day, the palate, uvula and right tonsil were covered. Here the pseudo membrane stopped its invasion of the parts, and on the sixth day some small pieces were detached. Shreds of membrane from now continued to peel off daily, and by Nov. 19th the throat was clear.

This case was altogether milder in course than the preceding one. The highest temperature registered was 100.6° on the fifth day, and the pulse all through the attack was fairly good. But, the sequelae were much more severe and prolonged. In addition to paralysis of the palate, which appeared on the second day after disappearance

of the exudation, the heart became affected. The pulse got very feeble and irregular, and at times would run off for twenty or thirty beats. During these attacks the lips became quite livid, and continued for some time after, even although stimulation with brandy was freely resorted to.

On Nov. 17th he complained of his legs feeling 'numb' and 'cold'. On pricking them with a needle I found that sensation was almost absent as far up as the knees. Knee-jerk was much diminished. Motion was also affected as evidenced by his inability to bend the foot on the leg.

Under the influence of Iron, Strychnia, Arsenic and Digitalis, with 'massage' of the lower limbs, all these sequelae slowly gave way. But, for some months afterwards, he had a partial want of control over the movements of the legs.

Case V. Pharyngeal diphtheria: recovery.

William W. aged 7 years, an exceptionally healthy looking boy, when examined on Nov. 7th showed no apparent enlargement of the glands of the neck. The tongue was coated with dirty fur. The tonsils were slightly prominent, and with the palate, fauces, and posterior wall of the pharynx,

were red and inflamed, looking. Scattered
over the surface of the right tonsil were a
number of little yellowish-white spots.

Temperature 100.6°. Pulse 108. Urine
febrile, but contained no albumen.

On the following morning a number of
the small patches had coalesced and now
formed a layer over the greater part of
the tonsil: by the evening all the
patches had run together and enveloped
the whole tonsil.

On the third day pseudo-membrane
appeared on the left tonsil: and by
the evening of the sixth day the
exudation was continuous from side to
side, embracing an inch or more of the
soft palate in front of the uvula.

On Nov. 14th the patient was exceedingly
ill. The pulse 140. Temperature
102°. The urine very scanty and
contained about $\frac{1}{4}$ albumen. The
exudation was blackened with the *Pig.*
Terri Perchlor. and was loosening
round the edges.

Early in the morning of Nov. 16th a
large-piece was dislodged. Shreds
of membrane were now each day coming
off. The temperature came down to 99°
and the pulse to 110 on the 19th Nov—
the twelfth day of the disease.

By Nov. 24th all the affected parts were cleared of exudation. Improvement gradually set in, in the patient's general condition, and continued without intermission for the following fortnight. Albumen had almost entirely disappeared from the urine, and I was inclined to think there would be no post-paralysis. But on Dec 7th palatal paralysis came on quite suddenly, and almost at the same time incontinence of urine manifested itself. These sequelae very rapidly diminished, and disappeared within a week, from their onset.

Case VI. Pharyngeal diphtheria: recovery.

Alexander W. aged 12 years, on Nov. 7th had some redness of the palate, fauces and pharynx. The tonsils were but ^{slightly} enlarged, and no patches were visible.

Temperature 99°. Pulse 96.

I had this patient placed in a room by himself - keeping the other three together in the room that happened to be large and fairly well ventilated.

The throat was thoroughly gargled with permanganate solution, and then menthol was freely applied.

On the next morning the temperature was 99.6°. and as yet no patch was

discernible. Breathing was perfectly free and quiet. The same evening however a small patch appeared on the posterior pillar of the fauces on the left side.

Temperature 100° Pulse 90.

During the next two days this patch extended gradually forwards, coming over the tonsil on the same side and stopped at the edge of the anterior pillar of the fauces.

On Nov. 12th a number of streaks of pseudo-membrane were dislodged and by the 18th Nov. the only sign of its having been present was the raw condition of the affected parts. Convalescence was

uninterrupted, and no after-complications developed. No albumen was detected in the urine in this case.

On Nov. 16th I was called to see three children of M^r. Alexander B.

Victoria College. For the past week they had each been suffering from 'cold' and had occasional attacks of sickness and vomiting. At night got fevered and restless, and started up during sleep. These symptoms were, however, most marked in the case of the eldest child Agnes.

On this particular morning there was no improvement in their condition, and

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Agnes on awakening complained of her throat feeling very sore. M^{rs} B. on examining the throat was alarmed to see a white patch on either side, on the tonsils.

She then looked the throats of the other two children and found that they also had spots on the tonsils.

I should mention here that out of a family of six children - all daughters - three had died from diphtheria. One during the epidemic of 1889-90, and the other two in December 1891, within a few days of each other.

On making an examination of the children who were now ill, I found almost unmistakable evidence that they were all suffering from diphtheria in a more or less advanced stage.

Later on when the disease had more fully established itself I was able on microscopic examinations, after staining, to make out the typical rods of Loeffler, and by cultivation experiments on glycerine agar, to develop fairly characteristic growths.

The history of these three cases follows.

Case VII. Pharyngeal diphtheria: recovery.

Agnes B. aged 9 years, when seen on Nov. 16th had the cervical glands, and the submaxillary

on either side enlarged and painful. The palate, uvula, fauces and posterior wall of the pharynx were red and swollen.

Both tonsils were prominent, and on the inner surface of each a yellowish-white patch was present. These were firmly adherent and on my attempting to remove them, caused the patient pain. The urine

was scanty and high coloured and contained a slight trace of albumen or bit-

ing. Nevertheless micturition was very frequent - she had been up five times during the night.

Temperature 101.8°. Pulse 120. Respirations 24.

The treatment adopted was exactly as in the former cases.

At 9 o'clock the same evening, the exudation on both sides had increased in size.

Temperature 102.0°

Nov. 17th at 10 o'clock A.M. another patch had made its appearance on the anterior surface of the left tonsil, and those of the previous day were almost double their former size, thicker and whiter in appearance. The submaxillary and cervical glands were more swollen and painful, and swallowing was much increased in difficulty. She had

passed urine three times during the night. At 8 o'clock P.M. the exudation covered all

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the right tonsil and came forward over the anterior pillar of the fauces.

On the left side the two patches had joined. Temperature 103.4° . Pulse 136. Respirations 36. Nov. 18th at 9 o'clock A.M. the exudation was not much larger than on the previous evening.

For the next three days the pseudo-membrane, ceased growing. But, on the morning of the fourth day it seemed to have received a further stimulus: on the right side and had extended some distance over the palate, and by 9 o'clock A.M. Nov. 22nd it covered the uvula on the right side - giving to this appendage a curved appearance, with the concavity on the side with the exudation.

The exudation on the left tonsil had remained stationary.

Temperature 102.8° Pulse 136.

About $\frac{1}{2}$ albumen was present in the urine - which latter was exceedingly scanty.

Nov. 23rd 9 o'clock A.M. no further increase of the exudation was observed. Breathing was rapid and shallow. Pulse 136. Temperature 101.4° .

During the next six days the patient became more and more enfeebled. The pulse got intermittent and on the slightest

eviction would 'run off' for a number of beats. At the end of this time vomiting came on very persistently, and was accompanied by some diarrhoea, which, in the weak condition of the patient, were dangerous complications.

Small pieces of ice were given, the dose of iron was diminished, and very shortly these symptoms abated.

With the vomiting, large pieces of membrane were detached, with some bleeding from the denuded parts.

By Nov. 30th all the affected surfaces were clear.

The patient was now greatly emaciated.

The temperature had fallen to 97°; and the pulse was very weak and irregular, and averaging about 30 per minute.

On December 4th a rather unusual symptom developed, namely, oedema of the lower extremities.

This appeared first round the ankle joints, but each day got more extensive, and by the end of a week, 'pitting' on pressure could be distinctly made out as far up as the knee on the front of the tibia.

Round the ankles and dorsum of the feet, the oedema became extreme; filling and bulging out all the depressions.

There was now also some 'puffiness' of the eyelids. Concomitantly with the oedema there was partial suppression of urine - an interval of twenty hours was on one occasion noted between each act of micturition, and what urine was then passed was scanty, and contained about $\frac{1}{6}$ albumen. There was no retention as the hypogastrium was quite tympanitic, and the bladder could not be felt on palpation. Consequently I gave her a mixture consisting of Potas. Acetat., Suet. Scillae, Inf. Digitalis and Decoct. Scoparii, which increased the flow of urine, and was followed by a gradual diminution of the oedema.

For another week no other symptoms developed. The heart sounds kept fairly good, and the pulse, though still intermitting, got stronger.

On December 19th symptoms of palatal paralysis came on, and I found also about the same time, that she had some difficulty in making out fairly large printed letters. Slowly, but steadily, she improved, and in another six weeks was restored to health.

Case VIII Pharyngeal and Nasal diphtheria: death.

Mellie B. aged 2 years, on Nov. 16th had the glands of the neck slightly swollen. The fauces, uvula and palate were red and inflamed, and the tonsils were considerably enlarged. On the posterior pillar of the fauces and tonsil of right side a patch of thin transparent greyish membrane was visible. From both nostrils there was a profuse discharge, of yellowish-tinged mucus, which M^{rs} B. attributed to 'the cold' which this patient, along with the two others, was supposed to have. There was also some snuffling, and the breath very foul smelling.

Temperature 101.4°. Pulse 124.

Urine had been passed very frequently during the night.

At 9 o'clock P.M. the exudation was much more distinctly visible, being thicker, whiter, as well as more extensive. The nasal discharge was quite as copious. At 9 o'clock A.M., the following morning, the exudation had made rapid progress since the previous evening, and now covered all the tonsil and anterior pillar of the fauces on the right side. The discharge from the nostrils was thicker and tinged

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with blood. Snuffling was more pronounced, and breathing through the right nostril appeared to be obstructed.

These symptoms made it evident, that the pseudo-membrane had extended, at least, to the post-nasal passages. Temperature 102° . Pulse 128. Respiration 34. For the next two days the exudation in the throat remained stationary; but the nasal symptoms got much worse. The discharge had so irritated the nasal surface and upper lip, that these parts became quite excoriated.

On Nov. 20th at 9 o'clock A.M. the pseudo-membrane was visible in both nostrils.

The child was now exceedingly restless, tossing from one side to the other in bed, and was continually picking at the nose. By so doing she managed to make a scratch on the excoriated part of the upper lip. Small, though the scratch was, bleeding from it was profuse, and continued in spite of the mother's efforts to stop it, with applications of cold water cloths.

By the time I made my next visit—about four hours after the scratch was inflicted—I found that a considerable amount of blood had been lost. I tried various applications to check the bleeding but without success, and at last had to

a compress with adhesive plaster.

I observed that the blood which escaped was very dark in colour and coagulated slowly, which, of course, would account for the difficulty in arresting the hæmorrhage.

From the throat several pieces of membrane had been detached.

During the following three days the patient's condition got more and more serious. The countenance was exceedingly pale, and perspiration stood in drops on the forehead and nose.

On Nov. 24th at 9 o'clock, P.M. the temperature had run up to 106.6° F. the respirations were very rapid and shallow.

At 1 o'clock, in the morning she was semi-comatose; the pulse small and thready, and the temperature down to 104.4° . No urine had been passed for the last sixteen hours.

From the condition the child was in, it was apparent that the system was completely saturated, by absorption, of the foetid discharge of disintegrating membrane from the large mucous surface of the nasal cavities, and that now all chance of recovery was gone.

At 2 o'clock, A.M. she was perfectly comatose, and in another hour and a half, she died.

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Case IX. Pharyngeal diphtheria: recovery.

Jeannie B. aged 6 years, on Nov. 16th had some swelling and tenderness of the glands at the angle of the jaw on both sides. The palate, uvula, and fauces, were deeply hyperaemic. The tonsils were much enlarged, and the tongue coated with a brownish fur. On the posterior wall of the pharynx there was a faint yellowish-white patch, about the size of a sixpence. The urine was loaded with pink urates, but no albumen was present.

Temperature 101.8°. Pulse 98.

At 8:00 a.m. the patch of exudation had slightly increased in size, and was seen more distinctly. Temperature 102°. Pulse 104. Respirations 24.

Nov. 17th at 9 o'clock a.m. the exudation was now about an inch in diameter, and had seemingly increased more towards the right than left side.

Temperature 101.8°. Pulse 104.

For the succeeding three days the pseudo-membrane slowly extended, creeping forward over the posterior pillar of the fauces on the right side, then on to the tonsil which it covered. On the left side it was still limited to the posterior wall of the pharynx.

On the evening of the sixth day some shreds

of membrane were dislodged.

Pulse 130. Temperature 102.6°. Respiration 34.
The urine now contained a small quantity
of albumen.

For the next three days pieces of membrane
continued to fall off, and by the evening of
the tenth day the throat was clear.

On the morning of Nov. 29th,
after the bowels had been moved by an
enema of glycerine, the patient suddenly
collapsed. The cheeks got blanched, the
lips livid, and the pulse exceedingly rapid
and small.

After some brandy had
been swallowed she recovered, but for some
considerable time the lividity of the lips
continued. She was now
watched with redoubled vigilance, so
that no movement might be attempted on her
part.

But in the evening, about
7 o'clock, another attack, somewhat sim-
ilar to that of the morning, came on: this
time however not nearly so severe or pro-
longed.

From now onwards she steadily pro-
gressed. The colour returned to her
pallid cheeks, and the pulse daily got
stronger and more regular. On Dec. 5th
albumen had disappeared from the
urine.

Case X. Pharyngeal diphtheria: recovery

Annie B. Clelland Park, aged 9 years, had taken ill on Nov. 24th with a sore ^{throat} and I saw her on Nov. 27th at 2 o'clock P.M.

There was then some swelling of the sub-maxillary glands on both sides of the neck. The palate and uvula were hyperaemic, the tonsils swollen and prominent, and on the inner surface of both was a yellowish patch of pseudo membrane. The tongue was coated with fur, the breath offensive, and the skin hot and dry. There was also some difficulty of swallowing.

Temperature 101.8° Pulse 120. Respirations 22. The urine was febrile, but contained no albumen.

At 8 o'clock P.M. there was no apparent increase in size of the exudation, on either side. Temperature 102°. Pulse 124. Respirations 24.

Nov. 28th at 11 o'clock A.M. the pseudo-membrane on the right side had grown considerably during the night, and was now double the size of the patch on the left, and covered the greater part of the tonsil. Temperature 102° Pulse 126. Respirations 28.

At 11 o'clock P.M. the exudation on both sides had increased since the morning, and all the right tonsil was now covered. Temperature 102.6°. Pulse 130. Respirations 28.

Nov. 29th at 11 o'clock A.M. the exudation

on the right had extended forward over the anterior pillar of the fauces. On the left it was confined to the tonsil. The cervical glands were now hard and swollen. Swallowing however was not quite so painful.

Temperature 102.8°. Pulse 130. Respirations 20.

For the next two days the exudation on the right side continued to increase, and covered the uvula and part of the soft palate in front of it.

On Dec. 2nd at 11 o'clock P.M. the exudation had not further increased in superficial extent, but was now thicker and whiter in appearance.

Temperature 101.8°. Pulse 136. Respirations 30. The patient looked pale, and was very drowsy.

At 11 o'clock P.M. a piece of membrane had been dislodged from the left tonsil on coughing, and was followed by some bleeding from the denuded surface.

The edges of the membrane on the palate were darkened and "curled up".

The urine now contained a trace of albumen. Temperature 102°. Pulse 136. Respirations 32.

For the next two days pieces of membrane continued to be detached by the wearing of Dec. 6th the affected parts were fairly clean. The pulse was

now feeble and somewhat irregular. Albumen was present to about $\frac{1}{4}$.

From this time she slowly improved in her general condition, and took her food well.

Albumen rapidly diminished in quantity and by Dec 16th had disappeared. No paralysis of any part followed in this case.

Case XI. Pharyngeal diphtheria: recovery.

On December 6th at 4 o'clock P.M. I was called to see Jane M.L. aged 10 years.

Two days previously she had got wet on coming from church and since then had developed a cough with 'a soreness' in the throat.

On examination she looked fevered - her cheeks were rosy-red, and the skin felt hot, but moist. The submaxillary and upper cervical glands, on the left side chiefly, were enlarged and painful on pressure. The palate and fauces were red and swollen, and the tongue was dry and furred. The tonsils were also slightly enlarged, and on the left a greyish patch of membranous matter was present. On the right tonsil a number of yellowish spots were scattered over the surface.

Temperature 102°. Pulse 120.

The ...

was high coloured but fairly copious and contained no albumen.

At 9-30 o'clock P.M. the throat was much in the same condition; but a few of the spots on the right tonsil were larger. Temperature 102.4° Pulse 120.

Dec. 7th at 8 o'clock A.M. the exudation on the left had increased both in extent and thickness. Some of the spots on the right had coalesced, forming a patch about three quarters of an inch in length.

Temperature 102.6° Pulse 126. Respiration 28.

During the next three days the exudation continued to extend: and by the morning of the fifth day, the tonsil and fauces on the left side were covered.

On the right all the spots had coalesced and formed a continuous covering to the tonsil.

There was from now no further increase of the exudation.

On December 12th albumen was present to about $\frac{1}{8}$ in the urine. Shreds of membrane were now coming off continually: and by Dec. 17th the throat was clear, but presented a very ragged appearance, with the palate hanging flaccid and immobile.

This paralysis of the palate was the only post-diphtherial symptom that developed. Albumen was present in the urine up till January 4th.

Such is the history of these cases which came under my care in this epidemic. In general, the course of the disease was severe, so that there was some cause for feeling gratified at the results. (No doubt could be entertained but that they were all cases of true diphtheria, although bacteriological examinations were not made in every case.

The general subjective symptoms; the character of the pseudo-membrane per se; the rapid extension of the membrane from its primary seat to that of neighbouring parts and its firm attachment to the subjacent mucous membrane, were sufficient evidence I considered to justify me in pronouncing the disease to be diphtheria and to treat it as such; and, that consequently any further investigations from a diagnostic point of view were, for the time being at least, superfluous.

In cases I, VII, VIII and IX at a later stage of the disease microscopic examinations were made after staining, and in each instance the thickish rod shaped bacillus of Klebs-Loeffler were found.

In cases I and VII, in addition cultivation of periments were attempted on glycerine agar and fairly typical growths obtained. The exhibition

however, of one of the most characteristic sequelae of diphtheria in every case that recovered, with the exception of three, (two of which are not included in the foregoing eleven), namely, paralysis of various parts, and notably that of the palate and uvula, was sufficiently corroborative of the diagnosis that had already been made in all those cases in which the exudation was not bacteriologically examined.

I am fully alive to the fact that to draw conclusions from a limited number of cases is a fallacious proceeding. Yet, nevertheless, I feel in a manner justified, however rightly, in attributing the excellent results obtained as due in some measure to the beneficial effect of the topical application of menthol.

Almost innumerable remedies are extolled as local applications to the pseudo-membrane wherever situated. Some of these are employed, with the object of arresting the further extension of the membrane; and some with the intention of dissolving the membrane. Others are employed on account of their germicide, or antiseptic properties, with the hope that their application may destroy the diphtheria bacillus, and at the same time prevent if possible the absorption.

of the toxic products of the virus, by purifying the affected parts from the foetid discharge.

For this latter purpose I found menthol admirably suited.

Menthol is a powerful antiseptic, and from what I observed of its action in these cases, I was led to the belief that it considerably lessened the pain of swallowing food - at least after the first or second day of its continued application.

This effect, as I have already premised, at an earlier part of this paper, I attributed to its local anaesthetic action; and which action appeared to increase on continued application.

Further, it had none of the injurious effects, if swallowed, that might be attributed to the perhaps too frequent application of such antiseptics as mercuric chloride or bismiodide by the hand of an over-anxious and not too intelligent nurse (referring, of course, to those cases in which the services of a trained nurse could not be afforded).

I deem it worth while mentioning a series of symptoms to which my attention was markedly directed in three of the foregoing cases (I, VII, VIII), namely, the great increase in the frequency of micturition.

at the onset of the disease - but at the same time the total average daily quantity of urine passed was diminished -; then the manifestation of anuria when the acute stage had abated and convalescence was about to set in.

In case VIII this latter complication was accompanied by severe diarrhoea and vomiting, and oedema of the lower extremities and eyelids.

In cases such as these (which all through their course were exceedingly severe - one ending fatally) it would appear probable that the period of incubation terminated with the local manifestations of the disease presenting themselves almost simultaneously with symptoms of acute blood poisoning.

It seemed that the kidneys suffered a great amount of irritation - presumably on account of the exceptionally rapid entrance of the toxic products of the virus into the systemic circulation - , and, that this irritant action continuing resulted subsequently in more or less suppression of urine - possibly by giving rise to a nerve paralysis, seeing that diphtheria shows such a predisposition to bring about paralysis of peripheral nerves in other parts. There did not seem to be any great structural alteration

the kidneys, as the albumen in the urine in these cases was not relatively increased in amount to that in the cases in which anuria was not so manifest; nor could any casts be detected.

The bladder also suffered considerably, on account apparently of the highly concentrated state of the urine.

I concluded that the occurrence of oedema in Case VII, in which suppression of urine was for a time rather alarming, might be ascribed as in part due to the kidney affection, and in part to the enfeebled and general emaciated condition of the patient, associated with very weak action of the heart.

Most observers are agreed that oedema following diphtheria is a rare symptom. Oertel mentions a number of cases, which were fatal, that were accompanied by suppression of urine and dropsy, and are referred to by Hilton Fagge in his Principles and Practice of Medicine (Vol. I: page 270). But Fagge expresses a doubt as to their being pure uncomplicated diphtheria cases, favouring the view rather that they may have been cases of scarlatina accompanied by diphtheria.

In the case of my patient I satisfied myself, that there was no scarlatina present in her case, & no rash was at any time observed; the exudation in the throat had not the character of that of scarlatina-angina, being well defined, very adherent, thick, tough and spreading. No desquamation took place - not even a roughness of the epidermis.

The relation of diphtheria with regard to sewage emanations is still at the present time enveloped in some obscurity. Houses possessing the very worst forms of drainage defects may remain free from the disease; while on the other hand, houses though situated in the most salubrious localities and having perfect drainage systems, may be visited. With reference to locality more especially, Trousseau in his *Memoir on Diphtherite* (translated by R. H. Semple M.D. and published by the New Sydenham Society in 1859) says - "In the towns and hamlets of the Department of Loiret, which are remarkable for their salubrity and for their excellent geographical position, I saw diphtherite raging with excessive violence, while

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Some villages of Sologne situated in the midst of marshes remained exempt from the scourge. Nevertheless, it has been abundantly proved that diphtheria is more prevalent and more severe among people who are exposed to the exhalations arising from damp and impure conditions of the soil, and from sewage, in general.

Numerous cases have been reported which showed a direct relation, in their occurrence to air polluted with effluvia from sewers, drains or cesspools.

Dr. Parkes (Parkes' Practical Hygiene page 176) says - "if the sewage arrangements are defective allowing the escape of sewer air into dwellings it is a priori probable that the specific contagium arises in this manner gain entrance into the body."

Dr. Parker in his monograph on the "Nature and treatment of diphtheria" (page 12) says - "it can hardly be doubted that these effluvia - which are currents of sewer gas - are then loaded with the specific morbid germs and produce typhoid fever, erysipelas, or diphtheria according to the nature of the germs which happen to be present."

Dr. Eade in his "Medical notes and essays on diphtheria" mentions a number of cases which he directly traced to drainage defects.

In the "Lancet" for May 28th 1892 (page 1184) an interesting case is reported by J. Harvey, M.D. of undoubted sewage infection.

With reference to this outbreak, which occurred in Mauchline and of which the foregoing cases formed a portion of those attacked, sufficient evidence was I think obtained to point to sewage effluvia as being the carriers of the specific virus. Probably nevertheless, the meteorological condition of the atmosphere favoured the incidence of this epidemic and those preceding it, as they all occurred in the winter months. — bearing out what is the general accepted belief in this country, that "the damp cold days of November and the dry cold days of the early months of the year are the most prolific in cases" [from Dr. Fox on the Sanitary examinations of Water, Air, and Food. (page 398)].

Investigations were conducted as to the milk and water supplies, the ventilation of the school, and the condition of the houses generally, and all were found, as far as could be made out, satisfactory. All those houses in which cases had occurred in the previous epidemics had then been thoroughly disinfected, together with all furniture, bedding &c. — although, of course, no positive evidence could be obtained that the very tenacious diphtheritic virus was radically destroyed.

But, as the examination of the sewage arrangements revealed a very filthy state of matters I was forced at once to the conclusion, that here the cause of this fresh outbreak at least, was to be found.

The sanitary arrangements in
 for the disposal of excreta and house-
 hold refuse are partly, and chiefly carried out by
 the ashpit (privy midden) system and partly by
 water carriage. For the latter method a number of
 large tanks (cesspits) had been constructed in the im-
 mediate outskirts of the town into which the more
 solid matter was allowed to subside and the liquid
 portion to run off—being carried for some distance through
 earthenware pipes—into ditches, discharging into
 a brooklet which ultimately flowed into the river
 Ayr, about two miles distant.

Two of these cesspits,—one at the bottom of a rather
 steep incline, about forty yards distant from the
 house in which case I occurred; and the other
 from twenty to thirty yards from the houses in which
 cases II, III, IV, V, VI, VII, VIII, and IX occurred—
 were found covered over with a layer of soil, about
 three feet in depth, without any aperture for venti-
 lation being provided in either case, other than
 that of the discharge pipe.

On exposing the tanks they were found nearly filled
 with semi-solid filth, and the stench given off was
 horribly foetid. Now, these houses were
 the first visited with the disease in this epidemic,
 and were all in more or less direct communication
 with one or other of these unventilated cesspits.

In no instance was there any attempt
 at happing the drains leading from the houses,
 except in that of Case I in which a Buchanan's

was employed, but the ventilating grating was clogged up with soil and gravel. This house was provided with a water-closet placed at the side of the passage leading from the kitchen into the back garden. The sink in the scullery was also in connection with the cesspit. In the other cases the houses had privy-middens some dozen yards or so from the back-door, but in each case the sink in connection with the cesspit was placed at the kitchen window, inside the house. Further, in these latter instances, the kitchen was in general, used also for the purposes of eating, sitting, and sleeping—being as a rule provided with two beds. In the country, in working-class houses at least, kitchen fires are constantly kept on night and day during winter, and all apertures, as far as possible, are closed against the ingress of air, for the purpose of warmth. Moreover, at this season the family are more constantly indoors and generally collected in the kitchen in the evenings. The natural result being that the air is very much deteriorated, being loaded with respiratory impurities, as well as those from the combustion of gas or lamps. As a consequence the air, being warmer and moister, expanding escapes by every available egress at the higher levels, and also, of course, in great part by the chimney. Cold air is drawn in from all apertures at the lower levels to supply the place of the heated air which has escaped, and among these apertures of entrance may, with almost certainty, be included the uncovered grating of the sink.

People living in such an atmosphere, children in particular, have their general health more or less impaired. Should the sewer air contain specific germs then in these susceptible children they will find a suitable medium.

Let it be granted that the sewer air, entering by the sinks in the above cases, did contain the diphtheria bacillus, then, here we have in all likelihood the origin of this outbreak.

Buchan traps were advised to be put in, in every case, in order to dis'connect the houses from the drains leading into the cesspits. But in only three instances were they adopted — I suppose on account of expense. For the remainder ordinary syphon traps were made use of.

All the cesspits were thoroughly cleaned out; the sewers flushed, and defects in their course remedied. Earthenware drain pipes, thoroughly cemented, were substituted for open ditches; & on closing up the tanks sufficient provision was made for their ventilation.

A scavenger was then appointed and placed under the superintendance of the sanitary officer, to have all the cesspits, sewers, drains &c. regularly cleaned out at short intervals.

All the houses in which the cases took place, when convalescence was well established, were most thoroughly disinfected.

Up till the present time no case of any zymotic disease, has occurred in the town since the termination of this last outbreak of diphtheria.

In closing this description of the probable origin of this epidemic I may mention that along with it, and those that preceded it, cases of typhoid fever were every now and then sporadically breaking out among the more adult population.

Case XII. Pharyngeal, Laryngeal and Nasal diphtheria: treated with Antitoxin-serum from the British Institute of Preventive Medicine: recovery.

At 9 o'clock A.M. on Saturday May 25th 1895; I was called to see Helen B. aged 11½ months. The mother stated that the child had been fretful & fevered for three or four days, but on this morning she appeared to be much worse. The preceding night she had been very restless and had slept little or none. She could not breathe freely unless with the mouth open, the nose being partially blocked.

On examination, the chin felt hot and moist. The face was flushed and breathing snuffling in character and somewhat laboured. The glands of the neck were swollen, and tender on pressure. From the nostrils there was a sanious mucopurulent discharge, which was especially profuse

when nausea, and an inclination to vomit, were brought on as the examination of the throat was being made. On the tonsils and fauces of both sides large yellowish-white patches of exudation were present. These were very adherent: bleeding being produced on unsuccessful attempts to remove them. Temperature 102.6° in the groin. Pulse soft and very rapid. Respirations 56. The urine could not be obtained for examination.

At 10 o'clock A.M. I freely applied a solution of menthol in olive oil (30 grs. to the oz.) to the whole pharyngeal cavity; sprayed the nostrils with permanganate of Potas. solution (2%), and put her upon *Liq. Ferri Perchlor. with acid.*

Hydrochlor. and glycerine, in suitable doses. She was placed in a tent bed and the air kept moist with the vapor of boiling water impregnated with Eucalyptus. At 4 o'clock P.M. the exudation was rapidly extending, coming over the palate. There was distinct hoarseness of the voice noticeable when the child cried, and a slight croupy cough. Temperature 102.8° . Pulse 160. Respirations 56.

Having no doubts as to the nature of the disease, to my friend Dr. Frew of Kilmarnoch, I sent for, and obtained, some *Antitoxin-serum* and the necessary syringe.

At 11.30 o'clock P.M. the hoarseness of the voice was much increased. Breathing was hurried and very oppressed, and accompanied with some stridor, and recession of the chest. Temperature 103° . Pulse from 180 to 200.

At 12 o'clock midnight with sterilized syringe

15 c.c of Antitoxin-serum were injected under the skin of the abdomen.

At 1-30 o'clock A.M. the temperature had risen to 104°. The child was now exceedingly restless-tossing about from one side to the other in her crib.

May 26th at 9-30 o'clock A.M. the temperature was 100° Pulse 140. The throat looked much as on the previous evening, but altogether the child's condition was improved. She had slept from 6 o'clock A.M. till 8-30 A.M. Nasal discharge not quite so copious.

At 1-30 o'clock P.M. the temperature was 99.8° Pulse 140. Breathing was easier, not so rapid, and less stridulous. A large piece of membrane had disappeared from the right tonsil.

At 9 o'clock P.M. the temperature was 101° Pulse 144. 10 c.c. Antitoxin-serum were now injected under the skin of right hip.

At 12 o'clock midnight, temperature 100.2.

May 27th 9-30 o'clock A.M. the pseudo-membrane was disappearing exceedingly rapidly, only a small piece remained on either side. The voice was much clearer and breathing much less laboured. She had slept well during the night. Temperature 99°.

The forehead, chest, arms, and legs were thickly studded with small bright-red raised spots. Nasal discharge much less.

At 8 o'clock P.M. temperature 98.8. The throat was almost quite clear of exudation, but was very inflamed looking. Breathing was almost perfectly natural, and she had lost that distressed

appearance of the countenance which was so marked on the previous days. She now took nourishment greedily.

By 8 o'clock P.M. May 28th all trace of the pseudo-membrane was gone. On June 4th the rash had disappeared.

After the first injection of Antitoxin all topical applications were discontinued, with the exception of spraying with permanganate of Potash solution.

The child is now (June 10th) thoroughly convalescent and so far no complications have developed.

It may be asked, 'Was this after all a case of diphtheria?' I regret I failed to obtain specimens of the exudation both for personal examination as well as for despatching to the British Institute of Preventive Medicine.

But, the character of the membrane - which was yellowish-white in colour, very adherent and tough, with well defined edges and bordered by intensely red mucous membrane - and its rapid extension both over the palate and to all appearance into the post-nasal passages and into the larynx - the breathing becoming rarer and more laboured and stridentous, - left no doubt in my mind as to the true nature of the disease.

Still further, 'Would the child have recovered without the Antitoxin-serum?' I can hardly think that it would. The existing state

of matters and which, as mentioned, appeared to be rapidly getting worse, in a child of this age (11 1/2 months) required I'm sure no further proof of the seriousness of the situation, and placed the chances of recovery on a very small basis indeed.

Those in attendance upon the child marvelled at the rapid disappearance of the membrane, and the 'suddenness' with which the child's breathing was restored from utter distress to that of comparative comfort.

I confess that I shared in no small measure their astonishment. Consequently, on this, my first experience of the Autitoxin-serum treatment, I am thoroughly convinced of the legitimate value of the remedy.

