1. *Observations upon Stained Films.*

In the tracheal mucus from eight patients during the first or second day of disease occasional groups of Gram-negative bacilli resembling *B. influenzae* were seen, and in similar material from three patients these were present in considerable numbers. The total number of organisms of all kinds was small, the prevailing microbes being staphylococci, pneumococci, or Gram-negative micrococci. As the sputum later became increasingly purulent, the influenza-like bacilli increased greatly in number and in proportion to other microbes. In some cases in which the cough persisted they occurred in immense numbers to the practical exclusion of all other organisms. The bacilli were pleomorphic. Their size varied from 0.5 to 1.2 μ in length and 0.3 to 0.6 μ in breadth. Many were almost square; coccil and diplococcal forms 0.37 by 0.3 μ were numerous.

2. *Cultivation upon Blood Agar.*

Usually the total numbers of colonies which grew upon blood-agar plates implanted from a washed piece of tracheal mucus was small. From the sputum of fourteen patients (that is, nearly three-fourths of those examined) on the plate taken at some period of the disease, minute colonies of small Gram-negative bacilli were obtained. In five instances such colonies were very abundant.

In the primary culture from the sputum the colonies, after twenty-four hours' incubation, were from 0.1 to 0.2 mm. in diameter, hemispherical in shape, and quite clear. Those colonies which had developed in the neighbourhood of staphylococci or pneumococci were larger than the average. On subculture upon blood agar they grew well, the colonies increasing in size with each successive subculture until, in the case of some strains, they obtained a diameter of 0.5 to 1 mm. after twenty-four hours' incubation. They failed to grow, when subcultured, upon nutrient agar or serum agar, or inspissated egg-yolk media.

The bacilli were larger in cultures than they were in the original sputum, varying in dimensions from 1.5 μ by 0.5 μ to 0.6 μ by 0.4 μ . Some colonies exhibited some involution forms usually 5 μ to 6 μ in length, but sometimes as long as 20 μ .

Persistence of the Influenza-like Bacilli in the Respiratory Passages.

From one case, in which cough with expectoration of purulent mucus persisted for upwards of a fortnight after the temperature had reached normal, sputum teeming with organisms indistinguishable from *Bacillus influenzae* Pfeiffer was ejected each day.

There were very few other organisms to be seen or grown from this sputum. For the first ten days the organisms were not seen inside the leucocytes, but from that date onwards the numbers of polymorphonucleated leucocytes which contained these rapidly increased. Coincident with this increase in phagocytic activity a marked improvement was noticed in the patient's condition. The cough became less troublesome, the sputum more purulent but diminished in amount, and "slackness," which had been a marked feature, soon disappeared. In two other cases in which persistence of infection was observed the patients had been admitted on suspicion of having one of the enteric fevers. Both had some bronchitis, and the sputum contained influenza-like organisms in countless numbers. The sputum smeared over plates of blood agar afforded each day nearly pure cultures of bacilli indistinguishable from *B. influenzae*.

In these two cases also phagocytosis of the bacilli was not observed until the twelfth and eighteenth day respectively, and was coincident with a marked improvement in the pathological condition.

The fourth case was observed by accident. The patient was convalescent from cerebro-spinal fever and cultivations were made at intervals from his nasopharynx to exclude the presence of meningococci prior to discharge from hospital. On the serum-glucose-agar plate a number of colonies grew which possessed all the characters of *Bacillus influenzae*. In this case they had grown direct from the throat mucus without the assistance of blood, but in subculture they only grew on blood-agar. On inquiry it was found that the patient had suffered from a sore throat and fever for three days a fortnight previously when the epidemic was affecting the hospital staff. The bacilli were still present in the nasopharynx two weeks later.

Leucocyte Count.

Total and differential enumeration of the leucocytes in the blood was made in five cases. The total number varied from 8,000 to 12,000 per c.mm. and the distribution of the different varieties was within normal limits.

Agglutination of Patient's Serum.

The serums of five patients who had had a severe attack were tested fourteen days after they were taken ill for the presence of agglutinins for the bacilli isolated from the sputa. The highest agglutination titre, by naked-eye method, reached was only 1 in 40, and in two control serums it was 1 in 20. There was not a significant increase—a result which I believe is consistent with previous experience of influenza.

CONCLUSION.

There appears to me no doubt that the outbreak described above was an epidemic of influenza.

It was associated with the presence of haemophilic bacilli in the respiratory passages. The bacilli possessed all the characters of Pfeiffer's *B. influenzae*, but in the absence of any specific tests for this bacillus, identity cannot be established.

THREE CASES IN WHICH LAMINECTOMY FOR THE REMOVAL OF SHELL FRAGMENTS FROM THE SPINAL CANAL WAS PERFORMED.

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THE following three cases are published as they exemplify a condition which is relatively uncommon among the spinal injuries of war, and not because there is anything remarkable in them *per se*.

In each case the missile was a shell fragment with particles of clothing attached to it. In each it had caused some destruction of the bony covering of the canal, had opened the spinal dura, leading to the free escape of cerebro-spinal fluid when the opening was exposed, and was lodged partially or wholly in the spinal canal. In all cases the clinical evidence went to show that the spinal cord was not divided, thereby rendering the prognosis much more hopeful than is ordinarily the case.

CASE I.

Pte. P. (December, 1917). His story was that a shell burst close behind him, and that complete loss of power in the lower limbs followed immediately on the receipt of the injury. On admission to a casualty clearing station he was crying out because of intense pain in both legs.

There was a small wound of the back an inch and a half to the left of the mid-line, at the level of the third lumbar vertebra. The legs were completely paralysed, except that there was slight movement of the toes. There was inability to pass urine, which was drawn off by catheter and was normal. The chief alteration of sensation was intense hyperaesthesia of the legs and feet, so marked that the weight of the blankets could not be tolerated; indeed, while being x-rayed, he insisted that if anything touched his feet he would not hold himself responsible for breaking the machine. X ray showed a small foreign body, dead in the middle line, opposite the body of the first lumbar vertebra, and situated two and three-quarter inches from the skin (Captain Eustace).

Operation.

The entrance wound and track in the erector spinae were excised twenty-four hours after being wounded. The track led upwards and inwards to the left lamina of the second lumbar vertebra, which was fractured, the missile entering the vertebral canal through the upper part of it. Laminectomy was proceeded with as follows: Starting from the excised wound and extending upwards and downwards, a flap of skin was marked out, reaching from the last dorsal to the fourth lumbar spine, with its convexity to the left, the limbs of the crescent passing about one inch across the mid-line. The flap of skin and subcutaneous tissue was turned back. The erector spinae was separated on either side from the last dorsal and upper three lumbar vertebrae by vertical incision in the mid-line, followed by the free use of a rugine, haemorrhage being controlled by hot saline pack on one side while the other was being dealt with. The spines were nipped off by laminectomy forceps, and the laminae of the second and first lumbar vertebrae removed by ordinary skull nibblers, bleeding here again being controlled by pressure. A free exposure of the spinal

canal was thus obtained, and a small vertical slit in the dura mater showed where the missile had entered. There was a considerable escape of cerebro-spinal fluid. The dura was incised in an upward direction from this slit and the foreign body, a piece of copper driving band, half an inch by a quarter of an inch, was found embedded superficially in the spinal cord, about half an inch above its termination. It was removed, together with some fragments of cloth, the wound in the cord being bipped, and the canal sutured with fine catgut. The rest of the operation area, with the track in the erector spinae, was then bipped and the whole completely sutured, with catgut for the muscles and silkworm gut for the skin.

After-History.

The patient was retained in hospital ten days. The excessive pain and hyperaesthesia were much improved the following day, and disappeared very quickly. By the third day he was able to flex both knees and hips, and the power in his limbs increased up to the time of his evacuation. A catheter was passed night and morning at first, and the bladder washed out with boric lotion. On the fourth day he micturated himself, but for the next two days required a catheter again. From the seventh day he micturated regularly, and completely emptied his bladder. The wound had healed completely before his evacuation to the base, and his general condition was very satisfactory.

CASE II.

Pte. N., stretcher-bearer was admitted (April, 1918) with a wound of the back, about 2 in. to the left of the middle line, and opposite to the fifth lumbar spine. His chief complaint was of pain down the left leg, like sciatica, aggravated by the weight of the clothes. There was loss of power in the leg, though it was not completely paralysed, the movements being limited and weak. The right leg was much less affected. He said he had tried to pass urine and had failed, and there was a feeling of numbness in the penis. X rays were not available. A catheter was passed and normal urine withdrawn.

Operation.

About eighteen hours after being wounded the wound and damaged erector spinae were excised, and the track found to lead into the vertebral canal on the left side between the laminae of the fourth and fifth lumbar vertebrae, with fracture of the fourth. On introducing the beak of an artery clip along the track into the canal, it came into contact with the missile, the characteristic metallic sound being elicited. An attempt to extract the fragment resulted in its being pushed further up the canal, the manipulations being accompanied by contractions of the limb muscles. Laminectomy was proceeded with as in Case I, the skin flap being turned over to the right side, and the third, fourth, and fifth lumbar spines snipped off by nibblers. The foreign body, which was a piece of shell the size of a hazel nut, could not be removed till the laminae of the third as well as those of the fourth lumbar vertebrae were partially nibbled away. The fragment, which had particles of clothing attached to it, appeared to fill the canal, and there was considerable damage to the nerves in the cauda equina. The hole in the dura mater was quite ragged and there was considerable escape of cerebro-spinal fluid. The hole was not sutured. The whole operation area and track were bipped and completely closed, with catgut for the muscles and silkworm gut for the skin.

After-History.

On account of pressure the patient was only retained in hospital for six days. After the operation temperature and pulse were normal, and, apart from what he called a "chronic dyspepsia" his general condition was quite good. A catheter was passed night and morning and the bladder washed out. He complained of numbness in the left leg rather than pain, though he continued to have some of the "sciatic pains," which diminished in severity with time. In addition to the leg, he complained of numbness of the penis. The loss of power and the movements in the legs were about the same as before the operation. At the time of his evacuation to the base the wound looked quite well.

CASE III.

Bombdr. B. was admitted (June, 1918) with multiple wounds. His story was that he lost the power of his legs at the moment of being hit, and at the same time he experienced severe pain shooting down the legs, especially the left. Since being wounded, in addition to the pain, he complained of a feeling of "pins and needles," referred to the left leg particularly, as well as numbness and loss of power. The movements in the left leg were very slight, but quite good in the right. He had experienced no difficulty with his urine. His injuries consisted of:

1. A penetrating wound on the back of the left wrist.
2. Entrance and exit wounds of the left side of the scrotum, with a large haematoma.
3. A large dirty tangential wound on the inner side of the left thigh, close to the fork.
4. Entrance and exit wounds of the left buttock, superficial.
5. A small penetrating wound of the back 1 inch to the right of the middle line, at the level of the fourth lumbar spine, associated with considerable swelling.

Operation.

He was operated on about twelve hours after being wounded.

1. The wound over the back of the left wrist was excised, and a large piece of shell was found embedded in the lower end of

the radius. It was removed, and the hole in the bone scraped and cleaned. The track was then bipped and left open.

2. The entrance and exit wounds of the scrotum were excised, and much blood clot evacuated. The testicle was found to be destroyed; it was removed. The wounds were bipped and sutured up completely.

3. The thigh wound was excised and sutured completely.

4. The entrance and exit wounds of the buttock were excised, and the track cleaned and bipped. It was left open.

5. The small entrance wound of the back was excised. The track extended inwards, fracturing the spine of the fourth lumbar vertebra and passing across the middle line. It continued between the laminae of the third and fourth lumbar vertebrae into the vertebral canal, chipping the lamina of the third *en route*. On passing the beak of an artery clip into the canal the metal foreign body was struck, but it could not be gripped. Laminectomy was proceeded with as in the other cases, the skin flap being turned over to the left side. The spines of the second, third, and fourth lumbar vertebrae were removed, and the laminae of the third only. The missile had passed through the left side of the canal, and at the time of operating was half in the spinal canal and half impacted in the back of the body of the third lumbar vertebra. It was removed, together with some shreds of cloth, and turned out to be a shell fragment $\frac{1}{2}$ in. by $\frac{1}{4}$ in. There was the usual escape of cerebro-spinal fluid. The hole in the vertebral body was scraped with a spoon and cleaned. No serious damage to the cauda equina was noted. The whole area was bipped and completely sutured, with catgut for the muscles and silkworm gut for the skin.

After-History.

The patient was retained at the casualty clearing station for twelve days.

1. The wrist did quite well, and, as there was no inflammation, it was sutured up on the ninth day.

2. The scrotal wounds healed by first intention.

3. The thigh wound was slightly moist from repeated fouling, but no stitches had to be removed and it did very well.

4. The entrance and exit wounds of the buttock remained quite clean, and both apertures were sutured on the ninth day.

5. The spine incision healed completely by first intention.

The patient had no trouble with micturition from the beginning. Pain gradually diminished in the limbs, and sensation and power improved. He described himself as being "ready for anything" when he was evacuated.

Apart from the complications arising from the nervous injury, those that may be expected in cases of this nature are the same as in other injuries. Haemorrhage, which may be considerable both from the muscle detachment and the bone removal, is controlled, as has been mentioned, by hot packs and pressure, and, as in head cases, the application of bipp to the cut bone surface has been found to be of assistance.

Sepsis may lead to a spinal meningitis, but, in addition, prolonged catheterization is very liable to end in infection of the urinary passages, with serious results. At the same time, in cases like those here recorded, where probably it is a question of a few days only before micturition is re-established, one is loath to do suprapubic cystostomy. (The risk of this infection ceases with the re-establishment of micturition.) Unfortunately no report of Case II after his evacuation is to hand from the casualty clearing station, though one was asked for.

No shock was observed in any of the cases, and they were well from the first.

These are essentially the class of case in which x rays are of the greatest assistance, but they were only available in the first. Fortunately in the other two the missile could be actually felt in the canal on passing the beak of an artery clip along the track.

NOTE.—In a letter from England from Bombdr. B. (Case III) dated August 6th he says he is "out of bed for the first time." From it I judge his recovery was uninterrupted.

THE VALUE OF FLAVINE.

A CLINICAL APPRECIATION.

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CASUALTY surgical practice always affords a large proportion of septic injuries which, although "minor" from the point of view of the operating surgeon, nevertheless are extremely disabling to the patient for the time being, and, as in the case of finger lesions, may result in permanent impairment in the earning capacity of an artisan. Therefore I have devoted much attention to the treatment of these cases with flavine. The observations were almost