CASE VIII.

Female, aged 53, had suffered from recurring pharyngitis, laryngitis, and bronchitis. The present attack persisted for over a month in spite of treatment by drugs and inhalations. She complained of difficulty in getting her breath, hoarseness of voice, dryness of throat, and tired feeling. Smears from the sputum showed streptococci; an autogenous vaccine of streptococcus and *Micrococcus catarrhalis* was made up. Treatment by vaccine was begun on June 19th, 1912.

Three injections were given in the course of eleven days—doses of 50 up to 100 million. There was the usual negative phase after each injection, followed by an improvement in the symptoms. The voice was not so husky, the throat was moist, the tightness of the chest was relieved, and there was more energy and feeling of well-being. All the symptoms cleared up after the third injection.

In the foregoing eight cases no drug treatment was given while the vaccines were being administered, except in Case IV, who had an expectorant mixture for a few weeks.

Three of the eight cases recurred. Of these, Cases II and IV soon recovered again after a few injections, and Case IV is at present improving.

The injections were given without opsonic control; this method of control has of late been largely discontinued. The dosage was judged by the effect produced by the first and subsequent injections on the general symptoms as well as by the amount of local reaction at the site of injection. The first injection in each case was well within the recognized dosage. If there followed very little or no negative phase the next dose was often doubled. If the negative phase was marked, the same dose (or a smaller one) was given in about ten days' time. But usually I was able to increase each dose by about one-third to one-half of the former one, and my aim was to try and obtain a reaction during the following twenty-four hours.

It has been recognized that a course of small doses where reactions have not occurred may be ineffective in producing immunity.

CONCLUSIONS.

Where failure occurs in treatment by vaccine-therapy, the question should be considered whether the failure was due to the patient's feeble powers of response, or to the method of preparation and dosage of the vaccine. With this in view one would pay particular attention to the following points:

1. Make sure what micro-organism is the cause of the trouble and whether others are associated with it.
2. Use an autogenous vaccine in preference to heterogenous.
3. Make it up from *fresh* sputum; try different media for its preparation; grow the micro-organism for not more than twenty-four hours if you can get sufficient growth in that time; avoid subculturing as far as possible; sterilize by heating to 60° C. for a quarter of an hour instead of one hour, or in some cases merely by the addition of 0.5 per cent. carbolic.
4. Give doses large enough to produce a reaction but avoid a prolonged negative phase.

Though vaccine-therapy may be said to be still in its infancy, yet it has already achieved a great deal, both in the prevention and cure of various bacterial diseases. And now that serum-therapy can be combined with vaccine-therapy by giving sensitized vaccines, it seems probable that in the future it may accomplish still more, especially in acute cases such as pneumonia and septicaemia, and will eventually largely replace the treatment by drugs in those diseases which are caused by micro-organisms.

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LAST year the Royal Institute of Public Health held its annual congress in Berlin; this year it is to be held in Paris from May 14th to 18th, in response to an invitation from the Municipal Council. There will be five sections: (a) State Medicine, (b) Bacteriology and Comparative Pathology, (c) Eugenics and Child Study, (d) Naval, Military, and Colonial, (e) Industrial Hygiene. Facilities will also be afforded for visiting the various public health educational institutions in Paris in connexion with the Board of Health, municipality, universities, etc.

SUPRACLAVICULAR ANAESTHETIZATION OF
THE BRACHIAL PLEXUS.

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THIS form of anaesthesia was first brought to notice by Hirschel¹ in 1911, and later in the same year an article was written by Kulenkampf² giving an account of 100 cases. Early in 1912 Borchers³ published the results of 35 cases; since then it has been used extensively on the Continent.⁴ It is convenient, appears to be free from danger, and by its use severe operations on the arm can be performed painlessly and without shock.

The technique of the injection is easy after a little experience. The brachial plexus is injected at a point which roughly corresponds to the middle of the clavicle. Here the plexus lies close under the skin, so that in many cases its position can be defined by pressure over the first rib. It emerges from under the scalenus anticus muscle, and lies in loose tissue which is easily infiltrated. The area into which the solution is injected is bounded internally by the subclavian artery, externally by the clavicle, and below by the first rib.

The patient sits with head turned slightly towards the opposite side. The position of the subclavian artery is defined by palpation, and the puncture made just external to the artery. The site of the puncture is usually just internal to the point at which the continuation of the external jugular vein joins the clavicle; but in some cases, in which the artery lies further out than usual, the puncture must be made external to this point. However, the artery is the chief guide to the position of the plexus, and after a little experience we find that it can be used as the sole landmark. A fine needle 4 to 5 cm. long should be slowly inserted in a direction backwards, downwards, and inwards towards the second or third dorsal spine, so as to strike the upper surface of the first rib. As the plexus lies about 1.5 to 3 cm. from the surface just superficial to the first rib, it should be encountered before the first rib is reached. If the plexus is not struck before the first rib is reached it generally means that in order to avoid the artery the needle has been inserted too far out. The needle must be partially withdrawn and altered in direction, usually towards the artery, until the plexus is struck. When the needle reaches the nerve cords paraesthesia is produced in the arm and hand; when the paraesthesia has been definitely obtained the syringe is carefully attached to the needle and 20 c.cm. of a 2 per cent. solution of novocain with adrenalin injected. No solution should be injected until paraesthesia is definitely obtained, and it is important to remember that when the point of the needle is on the first rib it is too deep for the plexus. Apart from the skin puncture the injection is not painful, the paraesthesia in the arm is not severe, and any necessary alteration in the position of the needle is not accompanied by pain. We do not consider it advisable to make a subcutaneous infiltration, as it tends to obscure the landmarks; besides, with the fine needle, very little pain is caused on puncturing the skin, and only one skin puncture should be necessary.

The anaesthesia comes on gradually, and is usually complete in from five to fifteen minutes, but may require as long as thirty minutes to fully develop. The onset is associated with sensations of heaviness and tingling in the arm, and is usually accompanied by paresis. The extent of the paresis is in direct relation to the depth of the anaesthesia. The anaesthesia does not always develop simultaneously over the whole arm, and one part, usually the back of the forearm, may retain slight sensation for a short time after the anaesthesia has become complete over the rest of the arm. The area of anaesthesia extends up the arm to about 2 or 3 fingerbreadths below the acromion process, but usually a small sensitive area is found on the inner side of the arm, corresponding to the distribution of the intercosto-humeral nerve.

The duration of the anaesthesia is usually from one and a half to three hours, depending on the depth of the anaesthesia; we find that at least one and a half hours of anaesthesia can be relied upon.

To obtain satisfactory anaesthesia the following points must be strictly adhered to:

1. Definite paraesthesia in the arm or hand must be obtained before any solution is injected.
2. The injection should consist of 20 c.cm. of a 2 per cent. solution of novocain. If these points are not adhered to the anaesthesia is likely to be light and patchy. Any solution injected near the plexus before paraesthesia is obtained may interfere with obtaining this paraesthesia, and so prevent localization of the plexus.
3. To allow sufficient time for anaesthesia to develop, usually five to fifteen minutes is sufficient, but as long as thirty minutes may be required.

This form of nerve blocking is free from danger, but the following objections have been raised against it:

1. The risk of injuring the subclavian artery. This should be avoided, as the artery can be distinctly felt. It has been proved that puncture of the artery by a fine needle produces no ill effects.⁵
2. The pleura may be injured, and the solution injected into the pleural cavity. This is avoided if the instructions are carried out and the needle inserted until it comes into contact with the first rib, but no deeper.
3. The possibility of paralysis of the nerve trunks of the arm arising as a result of the injection. There is only one case on record.⁶ In this instance there was paresis of the musculo-spiral, median, and ulnar nerves, which lasted a few weeks. We have not met with any cases of paresis, and we consider its occurrence very unlikely.

Care should be taken not to inject the solution into a vein. To prevent this, the plexus should be sought for with the needle alone, when, if a vein is punctured, the blood will flow freely from the needle. Puncture of a vein produces no ill effect beyond a slight swelling in the neck.

As we have found novocain the safest and most satisfactory drug for local and regional anaesthesia we have used no other in our series. We have had no toxic effects in any of our cases from using 20 c.cm. of a 2 per cent. solution. And as will be seen from a study of the cases when a weaker solution was used the anaesthesia was not so complete and was slower in developing.

We use a fine platinum-iridium needle, 6 cm. in length. (These have been made for us by Messrs. Down Bros.) These needles stand sterilization better than, and are not so liable to break as, steel needles of the same calibre.

The cases below are the first forty tried at this hospital, and include all our failures:

No. of Cases.	Operations.	Remarks.
2	Amputation through forearm	One incomplete anaesthesia.
4	Amputation of fingers	One incomplete anaesthesia.
6	Reducing impacted Colles's fracture	Two failures.
6	Setting fractures of forearm	Complete anaesthesia.
11	Suturing tendons and lacerations of arm	Two failures and one incomplete anaesthesia.
4	Incising cellulitis of arm	Complete anaesthesia.
1	Sequestrotomy of humerus	" "
1	Reducing dislocation of shoulder	" "
1	Plating radius and ulna	" "
1	Wiring olecranon	" "
2	Moving stiff elbow	" "
1	Scraping necrosed metacarpal	Incomplete anaesthesia; only 20 c.cm. of 1 per cent. was used.

In 36 of the cases we injected a 2 per cent. solution of novocain, using 20 c.cm. for an adult and about 15 c.cm. for a patient under 16 years. In this series there were three failures (Cases 8, 24, and 32). In the two cases (Nos. 1 and 16) in which we used 1 per cent. solution, the anaesthesia was incomplete. It was also incomplete in Cases 3 and 15, in which we used 20 c.cm. of 1½ per cent. solution.

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CASES.

We give a brief account of the most instructive cases:

No. 1 was a girl requiring amputation through forearm. At the first attempt we only obtained patchy anaesthesia, but on a second attempt three days later the anaesthesia was good except that the ulnar nerve was slightly sensitive.

No. 3. In this case anaesthesia was light and patchy, paraesthesia not being definitely obtained before injection was made, the puncture being made too far out in order to avoid the artery. A general anaesthetic had to be given.

No. 4. Sequestrotomy of humerus; the anaesthesia was good, but as the incision extended almost to the acromion process a line of infiltration had to be made to cut off the fibres of the cervical and intercosto-humeral nerves.

No. 8. This man had a marked deformity of the clavicle following a fracture, and owing to the alteration in the relation of the clavicle to the plexus we were unable to strike the latter.

No. 15. In this case we used 1½ per cent. solution. There was anaesthesia of the whole arm, but it was not deep; however, it was sufficient for amputation of contracted fingers.

No. 16. Necrosis of metacarpal; 20 c.cm. of 1 per cent. was injected; anaesthesia of radial side was incomplete.

No. 18. Boy, aged 11. Compound fracture of both bones of forearm; 15 c.cm. of 2 per cent. solution was injected. This was the longest anaesthesia we obtained, being complete eight hours after the injection; in twelve hours sensation was beginning to return.

No. 19. In this case a vein was punctured, but no ill effect resulted beyond a slight swelling in the neck, which only lasted a short time.

No. 22. Male, aged 35. Malunited fracture of radius and ulna. As it was a very difficult fracture to plate, this is the severest test the anaesthesia has been put to by us. The anaesthesia was absolute.

No. 23. Female, aged 50. Dislocation of shoulder. This case is interesting, as it shows the extent of the field of anaesthesia. Before the injection was made the patient was complaining very much of the pain in her shoulder, but about three minutes after the injection she said her arm felt comfortable. On induction by Kocher's method she felt slight pain, which we considered to be intercostal.

No. 24. In this man the plexus was very deep, over 2 in., and we could not get satisfactory paraesthesia; we injected 20 c.cm. and waited thirty minutes, but the anaesthesia was incomplete. This case illustrates the anatomical difficulties likely to arise in some cases and to which the failure must be partially attributed, it also bears out the point that definite paraesthesia must be obtained.

No. 25. Male, aged 38. Wiring fracture of olecranon. The anaesthesia was fairly good, but he was a most unsatisfactory patient; just after the injection was made he had a "hysterical fit." As he was so noisy a whiff of ether had to be given to distract his attention. He said after the operation that he did not feel any pain.

No. 32. Male, aged 28. Reducing Colles's fracture. At first attempt we had difficulty in finding the plexus and anaesthesia was very slight. At a second attempt next day we found that the plexus was much deeper and further out than usual; the anaesthesia was perfect.

No. 35. Boy, aged 16. Colles's fracture. Only 14 c.cm. of 2 per cent. solution were injected. Felt slight pain when the fragments were manipulated.

In our 40 cases we had only four failures—Cases 3, 8, 24, and 32; in the first three of these a general anaesthetic had to be given, in the fourth case complete anaesthesia was obtained at the second attempt. In four other cases the anaesthesia was light or incomplete, but was sufficient to allow of the operation being performed; in these cases a weak solution was used. Thus in 80 per cent. of the cases the anaesthesia was complete, in 10 per cent. it was a failure, and in the other 10 per cent., although the anaesthesia was incomplete, it was sufficient for the operation.

We hope to show in our next series of cases that, with experience, the percentage of failures can be reduced by a considerable margin. However, we admit that a small percentage of failures is bound to arise in consequence of anatomical difficulties that will be met with occasionally.

We are indebted to Dr. Paley, assistant house-surgeon at this hospital, for his valuable suggestions for improvement of the technique, and for kindly permitting us to include in our series the cases done by him, particulars of which he left at our disposal.

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