

stages, in which the weaker antitoxin is inefficient, can still be brought under control by the use of more potent serums. He is also of opinion that large doses of the serum may prevent the recurrence of these sequelæ, but says that a decided opinion on this question could only be arrived at after a more extended experience. Under these circumstances it is important that these potent serums should be placed within the reach of the public as soon as possible and at a reasonable cost, since Behring's serum of this quality appears to cost £1 11s. 6d. a dose, which undoubtedly must restrict its extensive use.

In a communication to the Royal Society (London) on Feb. 20th, 1896, and which was also published in THE LANCET,<sup>1</sup> I described a method by means of which diphtheria antitoxins could be more rapidly produced than they had been in the methods previously described. This result was accomplished by injecting the horses with the diphtheria albumose described by Dr. Sidney Martin, which, though not at all a deadly poison, renders the animal very rapidly resistant to the disease. When the horse, on the other hand, is injected with the so-called ferment toxin which had been previously employed the animal is so susceptible to the poison that only very small quantities can at first be injected and the amount only gradually increased from time to time, so that the treatment extends over several months before a serum of any value can be obtained. On the other hand, when the horse has been subjected to the albumose treatment for a fortnight it is able to withstand large doses of the so-called ferment toxin, and at the end of the month yielded a serum which was at that time regarded as sufficiently powerful for the treatment of diphtheria. This serum contained 100 or 125 normal units of Behring in one cubic centimetre, and 1000 units would thus be present in a dose of 10 c.c. or less. In the same communication I stated that it was possible not merely to shorten the period of treatment, but that I hoped also to produce much more powerful serums than had been previously the case. In support of this I showed the rapid rise in the antitoxic value of the serum of four horses which had been undergoing the ordinary treatment for from six to nine months. The new method consisted in taking advantage of the cumulative action of the poisons so that through frequent injections of the toxins the horses were kept continuously under their influence and the cells accordingly in a condition of active stimulation. I have now had nine horses under this treatment and the number of normal units of Behring present per c.c. in their serum is set forth in the following table.

*Antitoxic Value of Serums.*

| Number of horse.   | Number of normal units present per c.c. | Quantity protecting against ten lethal doses of toxin. |
|--------------------|---|--|
| Horse No. 1 ... .. | 1009                                    | 1000th of a c.c.                                       |
| Horse No. 2 ... .. | 450                                     | 250th "  |
| Horse No. 3 ... .. | 400                                     | 250th "  |
| Horse No. 4 ... .. | 200                                     | 250th "  |
| Horse No. 5 ... .. | 200                                     | 250th "  |
| Horse No. 6 ... .. | 175                                     | 175th "  |
| Horse No. 7 ... .. | 150                                     | 150th "  |
| Horse No. 8 ... .. | 80                                      | 80th "   |
| Horse No. 9 ... .. | 50                                      | 50th "   |

The strengths of the serum given in this table were estimated in the usual manner on 250-gramme guinea-pigs, and I have since then ascertained, by comparing the toxin employed with some standardised by Professor Ehrlich, that their strength was rather under-estimated than otherwise. In the case of horse No. 1 the serum has been estimated directly by Professor Ehrlich's test toxin and found to contain the number of normal units (1000 per c.c.) claimed for it. It is at once evident from this table that all horses are not alike as regards their capacity for producing powerful antitoxins; indeed, they vary in the most startling manner. It is at present impossible to give any explanation of this fact, and in my opinion only a very extended experience, based on actual experiment on a large number of horses, could possibly give any indication as to those which were most likely to prove suitable for the purpose. After a certain period of

treatment a limit seems to be reached, and the value of the serum can be increased, if at all, only with the greatest difficulty. In addition to this, the antitoxicity of the serum from certain horses is liable to fall in value very quickly. It is evident from this accordingly that only a certain proportion of the horses experimented with can be expected to produce antitoxins which we should now regard as best adapted for the treatment of diphtheria. It will be seen from the table that out of nine horses only three furnished a serum of sufficient potency to contain 4000 units in a dose of 10 c.c. or less. It was one of these (Horse No. 1) which yielded the serum used by Dr. Martin in the treatment of his cases. The number of horses experimented with is of course far too small to permit of our forming any reliable estimation on this point; the proportion of horses producing strong antitoxin may be greater or even less. The method which I should recommend, and which is now being adopted in the production of antitoxic serum for the Metropolitan Asylums Board, is to get rid of such horses as prove unsuitable as soon as the limit of their antitoxin producing power has been tested, and in this way form gradually a "stud" yielding the higher-grade serums.

The only high-grade serums at present on the market are the extra potent serums sent out by Behring, which contain 3000 units in a dose of 5 or 6 c.c. This serum, which contains 500 and 600 units per c.c., is apparently only produced in very small quantity from the difficulty experienced in obtaining it; and the price, as already stated, places a great obstacle in the way of its general use, even were sufficient quantities on the market. This may be explained as due to the fact that under the ordinary method of treatment six or seven months must elapse before an opinion could be probably formed as to the suitability of any special horse, and this naturally presents a great difficulty as regards the weeding-out of unsuitable horses and selecting those capable of supplying the more potent serums. This difficulty is, however, overcome by a method which shortens the period of treatment. The use of the albumose instead of the so-called ferment toxin, as I have described, enables this to be done more rapidly and, at the same time, with less expense.

In my opinion, accordingly, the question of the production of a high-grade serum would be solved by the additional expense which would be incurred in weeding-out the horses which could not be raised to the required standard and in obtaining fresh horses until a sufficient number of those producing high-grade antitoxic serum had been selected. A certain time, however, would have to lapse before such potent serums would be available in this country and the Laboratories Committee of the Royal Colleges of Physicians of London and Surgeons of England (where these experiments were carried out) have had under consideration the question as to whether a certain amount of this serum might be distributed among the hospitals in London, where the more severe cases come under treatment, the cost of which would be defrayed out of the grant so generously made to the Colleges for such a purpose by the Hon. the Goldsmiths' Company, London.

The investigation was assisted by a grant from the Goldsmiths' Company's Fund, and I have also to thank Dr. Woodhead for enabling me to carry out on a practical scale a method which had proved so successful during the experiments, and to apply it to the horses which were supplying serum to the Metropolitan Asylums Board hospitals.

Balham, S.W.

## NOTES ON FOUR CASES OF PYLOROPLASTY.<sup>1</sup>

By RUTHERFORD MORISON, M.B. EDIN.,  
F.R.C.S. ENG. AND EDIN.,

SENIOR ASSISTANT SURGEON, ROYAL INFIRMARY, NEWCASTLE-ON-TYNE.

MANY stomach cases not benefited by medical means are amenable to surgical treatment. The most satisfactory of these are due to stricture of the pylorus. Loreta proposed in 1882, and has performed with success, the operation of stretching the strictured pylorus from within through an opening in the anterior stomach wall, but his operation in

<sup>1</sup> Two cases were exhibited at the annual meeting of the Northumberland and Durham Medical Society on Oct. 8th, 1896.

seldom heard of now. The dangers of it, performed, as it must be, in the dark, are such as to have prevented its general acceptance. The operation known by the name of pyloroplasty, suggested and adopted almost simultaneously by two operators—Heineke and Mickulicz—and said to be now given up by both of them, has, I believe, a permanent place in surgery. The notes of my first case were published in THE LANCET,<sup>2</sup> where full details of the case and of the operation I performed were given. A short summary of the conditions present in these cases, after consideration of each and all of them, may be of further use as directing attention to an ailment more common than is usually recognised, and one which only surgery can satisfactorily deal with.

With regard to diagnosis, in all there was a history of dyspepsia of many years' duration and recent rapid loss of weight. There was vomiting, preceded by pain, and a swelling appeared in the epigastric region. A larger quantity of material was vomited than was taken into the stomach, and the vomited matter was offensive or sarcinous in character. The pain and the swelling in the epigastrium were both relieved when the stomach was emptied by vomiting. There was evidence of a much dilated stomach on palpation, percussion, and auscultation. Occasionally the stomach could be seen to form a rounded swelling with peristaltic movements in it, and could be felt to harden at the same time. In two of the cases (1 and 4) a distinct hard nodule could be felt in the pylorus. In the other two (2 and 3) an indefinite but distinct sense of resistance in the neighbourhood of the pylorus was perceptible.

The diagnosis of these cases from cancer involving the pylorus is so difficult that I believe it to be impossible at present. With the pylorus outside the abdomen between my finger and thumb I have been unable to say whether the tumour and the induration present were due to malignant disease or to inflammatory hardening and cicatricial contraction. A long history would, of course, be against malignancy, and this appears to me to be the most important element in the diagnosis. Marked scarring of the stomach wall and adhesions in its neighbourhood would also be in favour of a non-malignant origin. The great majority of cases with the symptoms and signs I have described appear to be due to cicatricial contraction following ulceration in the pyloric end of the stomach. The operation—in some cases easy, but in others, as in Case 3, presenting difficulties of the gravest character—to be performed for their cure is to make a longitudinal incision from the stomach through the pylorus and into the duodenum, to convert the longitudinal incision into a transverse one by traction at the centre of the incision, and to retain it permanently in this position by sutures.<sup>3</sup> The result of the operation is that the old pylorus forms only a small portion of the new outlet, which will admit two fingers.

CASE 1.—The patient was a woman aged forty-eight years, sent by Mr. Sheraton of Sedgefield and Dr. Drummond. Previously to operation she weighed 5 st 11 lb. She could retain no food. The operation was performed on Oct. 16th, 1894. At the present date the patient weighs 9 st. 7 lb., and looks and feels in perfect health.

CASE 2.—This was a woman aged thirty-seven years, a patient of Dr. Dickie and Dr. Buncle of Morpeth and Dr. Drummond. There was a history of prolonged ulceration of the stomach, with obstructed pylorus. The symptoms were aggravated by washing out the stomach. (Here I should like to emphasise a point, for this has been the least successful case of the series. All the successful ones were relieved by washing out, and it seems not unlikely that this sign may mean that active ulceration is still present.) Previously to the operation the patient weighed 8 st. 12 lb. The operation, which was performed on Oct. 17th, 1895, was a very difficult one, for the stomach was firmly adherent to the anterior abdominal wall, and the structures in the neighbourhood of the pylorus were matted together. The patient left for home on Nov. 2nd. For the first month after the operation there was not much improvement. In the next fortnight she gained 16 lb. in weight and all the old symptoms disappeared. She continued well till the middle of January, 1896; she was then ill for twelve days. On May 8th last Dr. Buncle writes: "She recently has been ill again; vomited, evidently blood somewhat altered; had circumscribed pain and considerable tenderness over the region of pylorus, and is living on peptonised milk." These

symptoms, of course, point to a return of the stomach ulceration and may not interfere with the ultimate success of the operation.

CASE 3.—This patient was a man aged thirty-one years, sent by Mr. Sutherland of Rainton and Dr. Drummond. Previously to operation he weighed 7 st. 6 lb. 5 oz. He was very feeble and anæmic, although naturally a big, strong man. The operation, which was performed on Jan. 3rd, 1896, was very difficult, for the colon, pylorus, duodenum, stomach, and omentum were matted in one firm, hard mass. The colon was opened by mistake, for all anatomical landmarks were obliterated. Mr. Sutherland tells me that he met the patient in the street two months after the operation and did not know him so great was the improvement in his condition. He has gained three stones in weight and his health is restored.

CASE 4.—This was a patient of Mr. Martin of Darlington, a woman aged fifty-nine years. Previously to operation she weighed 5 st. 7 lb. 4 oz. The operation took place on April 12th, 1895. On May 6th she weighed 5 st. 5 lb. 7 oz., and on June 9th 6 st. 3 lb. She is now able to eat all kinds of food.

The relation of my cases sustains surely the belief I have expressed that this operation has come to stay. No cases in abdominal surgery have given me more satisfaction than these. In each case recovery from the operation has been without incident and the first and third cases have been veritable resurrections.

Newcastle-on-Tyne.

## EXCISION OF A LARGE CARBUNCLE OF THE BACK; SALIVATION FROM CYANIDE GAUZE DRESSING.

By W. THELWALL THOMAS, F.R.C.S. ENG.,  
HON. ASSISTANT SURGEON, ROYAL INFIRMARY, LIVERPOOL.

THE treatment of carbuncle by excision commends itself more than any less thorough method, and the number of cases recorded by Mr. Rushton Parker, who is the advocate for the proceeding in this country, encourages one in treating the condition by total extirpation of the gangrenous tissues.

On July 17th, 1894, a woman aged fifty-two years was admitted into the Liverpool Royal Infirmary, suffering from a carbuncle between the shoulders, apparently a little larger than the palm of a hand, from which pus was oozing through many holes. The surrounding tissues were cedematous and inflamed, and pressure applied two inches from the suppurating orifices caused more pus to exude; it was clear that the subcutaneous tissues were extensively involved. She appeared to be very weak and feeble; she looked very miserable and suffered great pain. The pulse was, however, very fair, and the urine was normal, so it was resolved to operate at once. A large supply of sponges was got ready and placed in very hot (1 in 40) carbolic lotion. An anæsthetic was administered and a circular incision six inches in diameter was rapidly made down to the muscles, hoping to clear the gangrenous tissue. The incision was quickly packed with sponges wrung out of the lotion as required. The sloughing mass was rapidly cleared off the deeper structures, a portion of the trapezius being sacrificed on account of its condition, and the whole cavity packed with sponges. An inspection of the edge of the portion removed showed suppurating points at each side, so a further crescentic portion was taken away towards each shoulder. The incision was now seen to have gone through clean, though inflamed material. The vessels which required ligature were few in number and were exposed and easily clamped by quietly peeling out the sponges one by one, each area being thoroughly attended to before the next sponge was removed. The aperture was an irregular oval nine inches by five inches and a half, the long axis being transverse. The total loss of blood was smaller than anticipated. The wound was packed with sponges wrapped in cyanide gauze, and a large pad of wool was placed over all under a tight bandage, to control some oozing that was taking place. The next morning the patient was wonderfully better. On the third day some suppuration occurred at the left side of the wound, where a small sinus

<sup>2</sup> THE LANCET, Feb. 16th, 1895.

<sup>3</sup> For further details see THE LANCET, loc. cit.