corpuscles 1,100,000 per c.mm., haemoglobin 23 per cent., colour index 1.1, white blood cells 2,400 per c.mm. Megaloblasts and megalocytes were present, and there was also anisocytosis.

Treatment.—This was the same as that given in Case ii.

Progress.—The patient continued to become weaker, and on December 5th, despite a blood transfusion performed early the same day, he died.

Post-mortem Examination.—The liver, kidneys, and spleen gave a marked iron reaction, and the bone marrow showed a megaloblastic reaction. No other disease was present, except anthracosis of the lungs.

The remarks applied to Case ii by way of comment also apply to this last case.

These three cases afford some evidence against the prevalent view that every true case of Addison's anaemia must necessarily be benefited by liver therapy. So far, very few unfavourable results following this treatment have been published, but two of Fraser's series failed to respond for no accountable reason. G. Guiani of Genoa found that 15 per cent. of his cases gave no response to liver, but possibly many of the patients were moribund when they came under treatment, and their bone marrow was thus unable to respond. If the existence of a small proportion of unsuccessful reactions to liver therapy is established it must materially alter the prognosis of Addison's anaemia; above all, it imposes the necessity of withholding the promise of a hopeful outlook until the effect of liver administration has been observed for a sufficient period.

It has not been suggested that liver destroys the exciting cause of the anaemia. As, moreover, it is known that agents as essentially different as malaria and benzol can give rise to an Addisonian anaemia, it is probable that there are many different exciting causes, and it can hardly be expected that liver should prevail against every one of them. It seems reasonable, then, to assume that in some cases the exciting cause is so powerful that it overcomes any benefit that might be expected to accrue from the administration of liver.

In conclusion I wish to thank Dr. A. F. S. Sladden, pathologist to the Swansea General Hospital, who examined the blood in each case and conducted the post-mortem examinations, and Dr. Daniel E. Evans, senior physician to the Swansea General Hospital, who allowed me to investigate and report on the cases.

THE ACETIC ANHYDRIDE TEST IN CEREBRO-SPINAL FLUID.

BY

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THIS test was described in 1923 by Boltz, who found positive results in all cases of general paralysis and certain other types of neuro-syphilis. During the next few years various authors concluded that the reaction was of diagnostic value in these conditions. The test is performed as follows: to 1 c.cm. of the cerebro-spinal fluid 0.3 c.cm. of acetic anhydride is added, and the mixture is shaken; 0.8 c.cm. of sulphuric acid is added very gradually, drop by drop. A positive result consists in the development of a colour which has been described as "blue-pink," "lilac," or "purple."

The test is similar to the glyoxylic reaction of Hopkins and Cole, which was discovered as a result of their investigation of a test for protein described by Adamkiewicz. This consisted in the development of a violet colour when protein was treated with glacial acetic acid and concentrated sulphuric acid. Hopkins and Cole showed that the reaction was dependent on the presence of glyoxylic acid as an impurity in the acetic acid. The constituent of proteins responsible for the reaction with glyoxylic acid is tryptophane.

In 1927 the similarity between the "Boltz test" and the glyoxylic reaction was pointed out by Duncan, by Blix and Backlin, and by Walker and Sleeper. These authors brought forward evidence that the acetic anhydride test was identical with the glyoxylic reaction, and that the positive results in cerebro-spinal fluid were due to protein.

Positive results were obtained when the acetic anhydride test was applied to tryptophane solutions, or to egg-albumen solutions of concentrations of 0.03 per cent. and over. As would be expected from these facts, it was found that many non-syphilitic cerebro-spinal fluids yielded positive results.

The appearance recently in the *British Medical Journal* of a paper by Piotrowski prompts me to draw attention to these findings, and to record some personal observations which confirm the view that the acetic anhydride test is a protein reaction similar to the glyoxylic reaction.

Several samples of acetic anhydride were examined, and all gave a positive reaction with protein. The less pure samples gave the more intense reactions, but the purest samples obtainable gave positive results. The colour produced showed the same absorption spectrum as the colour produced in the glyoxylic reaction.

A series of twenty-four cerebro-spinal fluids from various cases was tested; these included cases of epilepsy, cerebral tumours, general paralysis, disseminated sclerosis, hysteria, and various types of meningitis.* The intensity of the colour given in the "Boltz test" was roughly proportional to the total protein content of the fluid, and the colour given by fluids from cases of general paralysis was indistinguishable from that given by fluids of the same protein content derived from non-syphilitic patients. For example, the fluid from a case of general paralysis (total protein 0.18 per cent.) and the fluid from a case of meningitis (total protein 0.15 per cent.) gave colours exactly similar in tint and intensity. On another occasion the fluid from the same case of general paralysis had a lower protein content (0.05 per cent.), and then gave a negative result with the "Boltz test."

It appears impossible to fix a limiting concentration of protein below which the reaction is negative. Apart from the variations in the samples of acetic anhydride used, there are variations in the conditions of the test as ordinarily employed. The heat developed during the addition of the sulphuric acid is an important factor, and different results can be obtained with the same protein solution by varying the rate at which the sulphuric acid is added. If the mixture is carefully cooled after the addition of each drop of sulphuric acid, so that the temperature of the mixture is not allowed to rise above room temperature, no colour develops, even in fluids which give a definitely positive reaction when treated in the ordinary way. This applies to the fluids from cases of general paralysis as well as non-syphilitic cases. If the mixture, which has been kept cool during the addition of sulphuric acid, is subsequently heated the typical colour develops.

Owing to the crude method by which the test is usually performed, a definite limit of protein concentration below which reactions are negative cannot be fixed accurately, but, in my experience, with pure samples of acetic anhydride it is approximately 0.03 to 0.05 per cent.

It is therefore probable that the "Boltz test" is a protein reaction similar to, or identical with, the glyoxylic reaction. It may be due to some substance (? glyoxylic acid) present as an impurity in the acetic anhydride, or derived from the acetic anhydride in the course of the test. If acetic anhydride is completely hydrolysed by heating with an excess of water for an hour under a reflux condenser, the product still gives the violet colour with protein on addition of sulphuric acid.

If the view here taken is correct, it seems surprising that the test should ever have been regarded as diagnostic of syphilis of the central nervous system. As far as the earlier papers on the subject are concerned, the explanation seems to be the lack of fluids of high protein content among the non-syphilitic controls. In the investigations of Boltz, Grossman, and Harris all the fluids came from patients with mental disease. No figures for the protein content of the fluids are given, but in any such series it would be expected that the syphilitic fluids would have the highest protein content.

Among those who regard the test as diagnostic of general paralysis or neuro-syphilis, Greenfield and Carmichael seem to be the only authors who have studied non-syphilitic cases

* For the majority of these fluids I am indebted to Dr. E. A. Carmichael.

in which the total protein content of the fluid was raised. These authors make a distinction, which in my judgement is not possible, between the "clear lilac" colour of a positive test, and various other tints—for example, "brown-lilac," "pink-blue," "lilac-pink," or "brown"—which they consider negative. I think that most of these colour reactions should really be regarded as positive, and that some of the "brown" colours may be the result of charring of organic matter by the sulphuric acid. The question of the identity or difference of tints can be decided by any worker by the simple method of comparing a paretic fluid with a protein solution of the same concentration.

There remains to be considered the recent paper of Piotrowski, who has found positive results with the "Boltz test" in cases of general paralysis, cerebral and meningeal syphilis, meningitis, cerebral degeneration, poliomyelitis, and in a few normal fluids. When one bears in mind the irregularities in the conditions of the test it seems that these results give no evidence against the view that the protein of the fluid is the reacting substance. Piotrowski mentions a negative result in a fluid with 0.025 to 0.035 per cent. protein, and positive results in seven cases of cerebral degeneration in which the "albumin" was "normal." In four out of ten of his cases of general paralysis the "Boltz test" was negative, but in these the "albumin" was below 0.035 per cent. Two cases of tuberculous meningitis with an "albumin" content of 0.044 and 0.025 gave a negative Boltz test, others gave positive results.

Summary.

The "Boltz test" is regarded as a protein reaction similar to, or identical with, the glyoxylic reaction; no information of diagnostic value is to be obtained from it, apart from its being a rough guide to the protein content of the fluid, which is better estimated by the usual methods.

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Memoranda:

MEDICAL, SURGICAL, OBSTETRICAL.

A FULL-TIME EXTRAUTERINE PREGNANCY.

The following case seems worthy of record on account of the difficulty of arriving at a correct diagnosis.

On May 20th, 1929, a married woman, aged 44, consulted me because of increasing swelling of the abdomen and general physical ill health. She had had eight children, of whom the last was born seven years ago. The labours had been normal. The periods were regular up to June 8th, 1928, and then ceased; so that to date she had had eleven and a half months' amenorrhoea. She thought she was pregnant, and engaged a midwife for March. She had a severe attack of pain in November, and another in January, which confined her to bed for a week each time. Since January she had not been conscious of foetal movements; she had not consulted a doctor.

The patient was heavy-eyed, sallow, toxic-looking, and rather emaciated. The abdomen had a tense, somewhat tender swelling reaching to the xiphisternum; its size was that of a large normal pregnancy. No foetal sounds were heard or parts palpated; a non-pregnant cervix of the uterus was felt by vaginal examination. A diagnosis was made of ovarian cyst with some adhesions. Operation was advised and the patient admitted to hospital.

Operation.—The operation was performed on May 24th under general anaesthesia. A subumbilical incision was made and subsequently enlarged. When the peritoneum was opened a cyst wall appeared with so many adhesions to the abdominal wall that malignancy was diagnosed, and preparations made to abandon the operation. Before doing so it was deemed wise to tap the cyst. Grumous fluid came away through the trocar and, finally, a finger was put in to feel for malignant nodules, and so confirm the diagnosis. To our surprise a foetal part was felt. The incision was then further enlarged, and a full-time macerated foetus was delivered. An attempt was made to remove the placenta, but this was found difficult to detach. Owing to the extreme thinness of what were supposed to be the uterine walls

it was considered wisest to remove the uterus. It was found to be adherent to the abdominal wall, transverse and ascending colon, omentum, and bladder, and a careful dissection was required to free it. To enable the cyst to be removed a portion of its wall had to be left attached to the transverse colon, and was subsequently removed by another dissection. The bowel had to be sutured, as submucous membrane had been exposed. Finally, on exploring the pelvis, it was seen that there was a small, non-pregnant uterus. The right broad ligament was clamped, and, leaving the right ovary behind, the uterus was removed supravaginally with the attached cyst. It was then observed that there was no left ovary or Fallopian tube, this being involved in the large cyst and attached as a broad band to the left upper part of the uterus. The specimen, when removed, was seen to consist of a small, non-pregnant uterus and, attached to it, a cyst, which was apparently formed from the left ovary and tube, and contained amnion and chorion, with portions of placenta.

Dr. E. Wordley (pathologist to the South Devon and East Cornwall Hospital) reported that the cyst wall consisted simply of fibrous tissue, there being no evidence that it was either muscular or ovarian.

The patient made a good recovery after the operation, and was discharged to a convalescent home at the end of three weeks. The injured bowel gave no trouble.

My thanks are due to Dr. Millicent Fox for administering the anaesthetic.

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TRAUMATIC BILATERAL PNEUMOTHORAX: A SIMPLE METHOD OF TREATMENT.

In view of the recent reports on cases of pneumothorax in the *Journal*, the following case appears worthy of note.

W. D., aged 23, single, was run over by a journey of full trams, while engaged at his work underground on June 17th, 1923. The accident occurred at about 11 a.m., and he was conveyed to the Aberdare and District General Hospital, where I saw him at 12.30 p.m. He was then in a condition of shock. His pulse was weak, rate 120, respirations rapid and shallow, colour bluish. He complained of pain all over the body, but principally in the region of the sternum and on either side of his spine.

Examination showed fractures of both clavicles and several ribs on both sides. There was subcutaneous surgical emphysema in both axillae and at the site of the fractured clavicles. The usual treatment of shock was instituted and a many-tailed bandage applied around the chest.

He was seen again one and a half hours later. His condition was truly remarkable. He was quite blue, respiration was practically absent, the pulse was imperceptible, and he was cold all over. Percussion note was tympanitic all over the chest. His neck, as such, had ceased to exist; on either side from the zygomatic arch to the lower border of the pectoralis major the subcutaneous tissues were enormously distended with air. The skin presented a uniformly convex surface, and he looked like some weird fish, all head and shoulders. The emphysema also extended over the ribs on either side towards the back.

It was evident that something would have to be done quickly as the man was dying from asphyxia. The emphysema was displaced by pressure from the lower part of the right axilla, the ribs defined, a puncture made through the skin with a scalpel, and an ordinary hydrocele trocar and cannula pushed through the intercostal space. On withdrawing the trocar air could be heard hissing out. His condition immediately improved. Respiration, pulse, and colour became better. After the first escape of air, during inspiration air could be heard entering the pleural cavity and leaving it during expiration. A simple method of further emptying the pleural cavity was adopted. During inspiration a finger was placed over the cannula and removed during expiration. In this way the lung was enabled to expand further, for at each expiratory effort air escaped from the cannula. After some twenty breaths the cannula was removed.

The patient's condition was now greatly improved. In half an hour the procedure was repeated on the left side of the chest.

The following day his condition was good; both lungs appeared to be fully expanded, and the superficial emphysema had considerably subsided. He made an uninterrupted recovery, and has been working underground ever since.

Subsequent x-ray examination revealed, besides the fracture of the clavicles, fractures of the fifth, sixth, seventh, and eighth ribs on the right side, and of the seventh, eighth, and ninth on the left, all being broken posteriorly near the angles.

This patient was shown at a clinical meeting of the South Wales and Monmouthshire Branch held at Aberdare in 1927.

The case is interesting for three reasons. First, the rarity of a bilateral traumatic pneumothorax with complete recovery. Secondly, the simple and dramatic way in which the condition was relieved. Thirdly, as to the nature of the internal injuries. I think that both lungs and pleura on each side must have been torn, and yet the patient hardly ever coughed during his illness and had no haemoptysis or melaena.

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