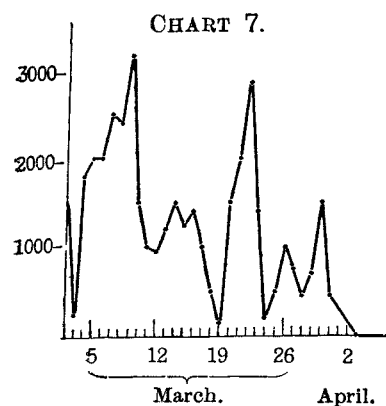


to the School of Tropical Medicine Hospital on Feb. 2nd, 1916. During the acute period of the disease nine motions



were passed daily. Before reaching England he had received two injections of emetine. On admission one or two stools were passed daily, and they were almost always bulky and hard in character. On March 29th treatment with bismuth subnitrate, one teaspoonful three times daily, was ordered. The lamblia cysts decreased in numbers, and had disappeared on April 3rd, after which the man was discharged. (See Chart 7.)

The Volume of Lamblia-infected Stools and the Possible Number of Parasites Therein.

The daily examination of this series of stools has led to the conclusion that probably there is a greater uniformity of distribution of lamblia cysts in a diarrhoeic stool than in a formed or hard one. The distribution of cysts in different parts of a stool, however, varies to some extent, but attempts were made to allow for this in the taking of the sample and in the making of the emulsion. As a rule, there appeared to be more parasites in a diarrhoeic stool than in one of firmer consistency.

Determinations were made of the volume in cubic centimetres of some of the stools of patients infected with lamblia. The diet in Cases 1 and 2 at first was milk and fish. Later a chicken diet was prescribed. The remaining five patients were given an ordinary mixed diet. It was found that the volume or bulk of a normal stool from a man fed on a mixed diet varied from 130 to 180 c.c. per day. Pathological stools may vary in volume from about 500 to 1200 c.c. One of the patients observed (Case 1), who is an example of pure lamblia, had bulky stools varying from 175 to 500 c.c., volumes near the latter figure being the more common. On a few occasions the volume of this patient's stool has reached 950 c.c. Another patient (Case 2) at first had stools that were about normal in volume, averaging 150 c.c., but latterly they have been smaller, averaging 50 c.c. In yet a third patient (Case 3) the bulk of the stool was often 180 to 200 c.c., but latterly the volume has fallen to an average of 125 c.c. The possible number of cysts in a bulky infected stool, such as that of Case 1 on Feb. 22nd, when the volume was 950 c.c. and the number of lamblia cysts per c.mm. was 15,200, is:

$$15,200 \times 1000 \times 950 = 14,440,000,000.$$

The possible number of cysts in an infected stool of average volume, such as that of Case 3 on a day of moderate infection—for example, on March 21st, when the volume was 180 c.c. and 1800 lamblia cysts were found in 1 c.mm., is:

$$1800 \times 1000 \times 180 = 324,000,000.$$

The possible number of lamblia cysts in an infected stool of small bulk on a day when the infection is relatively low, such as that of Case 2 on April 6th, when the volume was 50 c.c. and the number of lamblia cysts per c.mm. was 200, is:

$$200 \times 1000 \times 50 = 10,000,000.$$

The above examples are sufficient to indicate that the number of lamblia cysts contained in an infected stool is counted in millions, and that every endeavour should be made to reduce and, as far as possible, to eliminate the organisms.

General Observations.

Certain points of general interest may now be mentioned. Examination of a large number of stools has shown that uniformity of distribution of lamblia cysts in a diarrhoeic stool is more probable than in a formed or hard one. In general there are not so many parasites in a formed stool as in a diarrhoeic one. The motions of some of the cases of lamblia were constipated at times.

Relapses of cases of lamblia may occur. Also, certain workers have considered that lamblia is harmless and have given no treatment for it. In other cases men known to be heavily infected with lamblia cysts, but free from dysentery-producing bacilli, have been discharged from hospital. Both

these classes of men may act as reservoirs of lamblia, and the infective cysts of the parasite may be shed promiscuously through the land, especially in country districts where sanitary arrangements may be somewhat primitive. There is, then, danger of outbreaks of lamblia diarrhoea, especially among infants and younger children. Outbreaks of flagellate diarrhoea have in the past been reported in certain parts of South America and in Italy. Also cases of lamblia have been recorded by several French workers from investigations conducted by them in Tonkin and other parts of Indo-China, and the infestation of the patients' houses by rats and mice has been noted. This observation is not without interest, as such rodents harbour species of lamblia in their intestines.

The danger arising from the presence of apparently healthy carriers of amoebic dysentery in a community is now well recognised. It is a matter of regret that seemingly so little consideration has been given to the problem of the carriers of lamblia cysts, who may be a source of considerable trouble in the future.

From Charts 1 to 7 it will be seen that the numerical distribution of lamblia cysts in a patient's stools varies from day to day. Cysts result from the rounding of the pear-shaped, suctorial flagellate forms. The cysts themselves are very difficult to eliminate and destroy by means of drugs. Every effort, therefore, should be made to attack the flagellate forms of lamblia—that is, the precursors of the cysts. Probably when cysts are few in the stool of a person suffering from lamblia, there are numerous flagellates in the duodenum and other parts of the intestine of the patient, and it would be well to try medicaments at such periods. Thus, it might be hoped that the flagellate organisms would be killed before they encysted, and the formation of a new "crop" of cysts be thereby prevented.

Again, from a study of the charts it will be seen that casual examinations of stools made at irregular intervals will result in a fallacious impression being obtained. It is necessary that regular examinations should be conducted, and should be continued over several months if possible.

The periodicity in the appearance of the maximum number of lamblia cysts appears to vary in the different cases. In some of the cases there seems to be a period of about a fortnight between the maximal crops of cysts (see Charts 1, 2, 6, 7), while in other cases it is somewhat less. By daily examinations of the stools of two other (uncharted) cases of lamblia, periods of 14 and of 10 days were found.

In conclusion, I have pleasure in thanking Professor J. W. W. Stephens, Captain L. A. Morgan, R.A.M.C. (T.F.), and Captain E. E. Glynn, R.A.M.C. (T.F.), for affording me facilities for obtaining material at the School of Tropical Medicine Auxiliary Hospital, Liverpool, and the sisters at the hospital for their cordial coöperation in securing the retention of the patients' stools needed for examination.

SPINAL ANÆSTHESIA:

WITH REFERENCE TO ITS USE IN THE TRENDLENBURG POSITION AND FOR THE PREVENTION OF SHOCK.

By H. M. PAGE, F.R.C.S. ENG.,

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With a Note by HAROLD CHAPPLE, M.C. Cantab., F.R.C.S. Eng., *Obstetric Surgeon to Guy's Hospital, &c.*

FOR all ordinary uncomplicated cases inhalation anæsthesia as improved at the present day is still the method of choice. Ether, if not contra-indicated, after a preliminary injection of atropine with or without opium, is rightly preferred, given by means of Clover's apparatus, with the addition, if possible, of oxygen, or by the open method, when a warmed vapour should be blown to the patient if the administration is anything more than a short one, which warming can be very simply effected by coiling an extra long delivery tube in a small receptacle for hot water or by the use of a thermos flask, as in the apparatus designed by my colleague, Dr. F. E. Shipway. There are also special cases where ether is best given by the intratracheal method, by Crile's tubes, or the rectum. Warmed nitrous oxide and oxygen with or without the addition of some ether vapour may be the method to choose, if available. There is also the intravenous route, which may have advantages under certain circumstances, though there are few cases that,

in my opinion, cannot be better managed with one or other of the above-mentioned methods of using ether in conjunction with subcutaneous or, if necessary, intravenous administration of saline or glucose solution. Chloroform is required for some cases, and in the form of A.C.E. or C.E. mixture is of great use for induction. When it is advisable to use chloroform all through the administration, I consider that the percentage method, with the addition of a small quantity of oxygen, is the best method to employ.

There remain, however, many cases in which those who are familiar with its use will agree that great advantages can be obtained by the use of spinal anæsthesia. By this means either the whole or the greater part of the operative shock is done away with. (No form of general anæsthesia can prevent shock.) A more complete muscular relaxation is produced than by any other method of anæsthesia, thereby assisting the surgeon in his work, shortening the time of operative interference, and diminishing traumatism. The operations in which these advantages may be of special importance are those for acute abdominal conditions, especially if septic in nature; any prolonged abdominal procedure likely to be followed by shock; amputations; operations on the bones of the lower limbs, especially when the patient's vitality is lowered by exhaustion, sepsis, or hæmorrhage; and certain genito-urinary operations. At the present time there are many cases of injury to the bones of the lower limbs requiring plates, &c. Spinal anæsthesia is an immense help to the surgeon in all these cases owing to the complete muscular relaxation obtained, and in some will save life by preventing the very great shock often met with in difficult cases of fractured femur.

With regard to the risk of sepsis in spinal injection, a small amount of sterilised fluid sealed in a glass capsule is used, and the operation of injecting it within the theca after taking all ordinary aseptic precautions should be done without touching any part of the needle that comes in contact with the thecal membrane or the solution to be injected.

Though the position of spinal anæsthesia in surgery is now more or less generally accepted, and though there are many surgeons and gynaecologists who are familiar with the use of spinal injections with the Trendelenburg position, the fact that it can be used safely in this position is not generally recognised. Mr. Harold Chapple asked me to try spinal anæsthesia in connexion with the Trendelenburg position four years ago for certain selected pelvic operations. I have therefore ventured to report 70 cases in which the patient was put into the Trendelenburg position after intrathecal injection. I could have reported many more cases in which the patient was put in a slight incline with the head lower than the body without any trouble occurring, but I have only included here those put into the Trendelenburg position. When this position is used it is better to combine a general anæsthetic with the spinal injection, for the small quantity of ether or chloroform mixture required to keep the patient unconscious when there is no reflex disturbance has no necrotic effect on the tissues and practically has very little effect on the after-condition of the patient. If nitrous oxide and oxygen be used there is no effect at all in this respect. The administration of nitrous oxide and oxygen for prolonged periods is quite easy after either a spinal injection or in conjunction with satisfactory local infiltration with novocaine, as recommended by Crile. In this way mental shock and distress are prevented and the patient escapes the discomfort of lying upside down for a long period. The general anæsthetic is only given to produce a state of unconsciousness, not surgical anæsthesia. However, 12 of these cases were operated on successfully without any general anæsthetic being given. Novocaine, the Saccharine Corporation's 5 per cent. solution with adrenalin was used in the majority of the cases, the dose varying from 2½ c.c. to 3 c.c., seldom under 2¼ c.c. The boy, aged 3 with ruptured liver, was given 1 c.c. of the novocaine solution. Stovaine, Billion's 10 per cent. solution, generally 6/10 c.c., never more, sometimes 5/10 c.c., was used in the others. About 2 c.c. of spinal fluid were drawn into the syringe containing the stovaine and reinjected. I vary the dose according to the size, condition, and age of the patient, with some reference also to the size of the individual. Solutions to which glucose or other weight-giving substances have been added must not be used.

The injection is given with the patient lying on the side. Immediately after the injection the patient is turned on to the back and the thighs well flexed on the abdomen, this position is maintained for five minutes, after which the patient is got ready for the operation. The patient is put into the Trendelenburg position 15 minutes after the injection when novocaine has been used and 15 to 20 minutes after injection with stovaine, according to the rapidity with which the anæsthesia spreads upwards.

In the present series there was no case of surgical shock. In some cases there was a fall of blood pressure without quickening of pulse-rate, remedied immediately, if thought necessary, by raising the legs to a level with the rest of the inverted body; this loss of pressure which disappears when sensation and movement have returned to the legs, is, I believe, due to a mechanical vasomotor effect. Owing to the inverted position symptoms of general toxicity following absorption of the drug into the blood are practically absent.

Twelve cases were operated on without any general anæsthesia. The spinal anæsthesia in those cases, of course, was excellent. In the remaining 58 there was perfect anæsthesia and relaxation in 55. In several of these cases the operation was begun before any general anæsthetic was given; in none of them was the lid reflex abolished or the jaw relaxed by the small quantity of inhalation anæsthesia employed. In the three cases of partial failure a more or less deep inhalation anæsthesia was required. The surgeon experienced in the use of spinal anæsthesia is quite aware whether he is dealing with the complete flaccid relaxation due to intrathecal injection or the relaxation following a well administered general anæsthetic. There was no case of interference with respiration; no artificial respiration had to be done. No patient died on the table or before recovery from the paralysis. There have been no permanent sequelæ.

The Trendelenburg position was used after spinal injection in the following cases. "Recovered" in this list means that the patient recovered from the operation.

Cases in which the Trendelenburg Position was Used after Spinal Injection.

	No. of cases.	Re-covered.	Died.
Complete Wertheim's operation for carcinoma uteri	14	11	3
For carcinoma uteri	5	5	—
„ sarcoma uteri	1	1	—
„ fibroids	18	17	1
„ ectopic gestation	1	1	—
„ removal of tubes and appendix ...	4	4	—
„ „ tube and right ovary ...	2	2	—
„ inoperable carcinoma uteri (tying arteries)	4	4	—
„ growths in the bladder	4	3	1
„ ventral hernia	2	2	—
„ ovariectomy	3	3	—
„ ventral fixation	1	1	—
„ appendicectomy, curetting and fixing ovaries	1	1	—
„ large suppurating gland in mesentery	1	1	—
„ gastro-jejunoscopy	1	—	1
„ carcinoma of sigmoid	2	2	—
„ intestinal obstruction	4	2	2
„ adhesions, intestinal	1	1	—
„ ruptured liver	1	—	1
Totals	70	61	9

Particulars of the Nine Fatal Cases.

1. Wertheim's operation. Patient died suddenly from pulmonary embolism three weeks after the operation.
2. Wertheim's operation. Patient died from hæmorrhage on the day following the operation. Much blood lost both on the table and afterwards. This was not one of Mr. Chapple's cases.
3. Wertheim's operation. Very anæmic, cachectic woman, with some œdema. She seemed to recover well from the operation at first, but died five days after.
4. Death after hysterectomy for fibroids. The patient was an enormously stout woman. The surgeon said that but for the relaxation produced by the spinal injection he could not have operated at all on account of her obesity. She recovered very well from the operation, but died from pulmonary embolism on the twenty-fifth day when practically well.
5. A young man who had been allowed to bleed from a non-malignant growth of the bladder until he was quite

exsanguined, cold, and feeble to the last degree. The growth was removed suprapubically. He was not at all worse at the end of the operation. There was no hæmorrhage. He had lost too much blood to be able to recover, and died on the third day.

6. The patient, who died after gastro-jejuno-stomy, recovered perfectly from the spinal injection and immediate operative interference, but died on the sixth day from acute intestinal obstruction, demonstrated by post-mortem examination.

7. The patient, who died after anastomosis for obstruction, was 18 years of age. She had been operated on eight days before for acute obstruction, a tube being put into the ileum. She died three weeks after the operation for anastomosis, the determining cause being toxicity due to the extremely septic condition of the abdominal wound, which was present before the operation done under spinal anæsthesia.

8. The other patient suffering from obstruction, who died, was a woman aged 68. She had a transposed heart. According to the report of the physician her heart was in a diseased and failing condition, apart from the acute disease, and she could not take a general anæsthetic. She had an attack of hemiplegia seven days after the operation and died a few weeks later.

9. The patient, operated on for ruptured liver, was a boy aged 3. He was suffering from intense shock with extreme dyspnoea. Several ribs were broken and the lungs were injured; there was double pneumothorax. He was not appreciably affected by the abdominal exploration, and recovered completely from the spinal paralysis, but died some hours after from the condition of his chest.

I consider that the spinal injections had nothing to do with the result in any of the nine fatal cases, that Cases 2, 3, 5, and 7 had a better chance of life than if the operations had been done under general anæsthesia, and that Cases 4, 8, and 9 could only have been operated upon under spinal anæsthesia.

I should also like to report eight cases operated on under spinal anæsthesia in the Trendelenburg position at the West London Hospital by Dr. H. J. F. Simson. The anæsthetist was Dr. A. C. Sandston, of Christchurch, N.Z. The method used was the same as I have described. All the patients have recovered from their operation and there were no sequelæ and no trouble during the operations.

Note by Mr. HAROLD CHAPPLE.

During the last four years I have made use of spinal anæsthesia on many occasions in operations on the female pelvic organs, and am thoroughly in agreement with Mr. Page as to its great value. As he has said, ordinarily the usual inhalation methods skilfully given are perfectly satisfactory, but when surgical shock is anticipated a spinal anæsthetic followed by sufficient ether to render the patient unconscious has proved of very great benefit. For instance, the so-called Wertheim's operation for carcinoma of the cervix, which was formerly rather dreaded because of the frequent association of great shock, can now safely be performed if this method of anæsthesia be employed, and especially if normal saline be at the same time introduced into the axillæ after the method of Arbuthnot Lane. The attitude with which one approaches this operation is now entirely different and it is not at all unusual to send the patient back to bed after a complete removal of the affected parts and a dissection of the pelvic glands with a full pulse running at about 92 or thereabouts. From the surgeon's point of view the other great advantage it affords is the complete relaxation of the abdominal muscles. This is particularly noticeable in stout women, who frequently take ether badly, and the greater ease with which the pelvic organs can be attacked is very satisfactory.

The method of introduction is simple, and if the patient be kept in a suitable position for a few minutes the extreme Trendelenburg position can be adopted with perfect safety. We have had no trouble with it, except that on a few occasions the patient has complained of severe headache for a few hours. There have been no permanent ill-effects of any kind. The momentary discomfort associated with the introduction is a small price to pay for the great advantages to be gained in the almost complete absence of shock and the facility afforded by the complete abdominal relaxation.

BRIGHTON, ROYAL PAVILION HOSPITAL. — The Queen has presented the Royal Pavilion Hospital at Brighton with a building to be used as a school for the teaching of some occupation to limbless soldiers.

OBSERVATIONS ON THE TREATMENT OF ANAPHYLAXIS.¹

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AND

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THE causation of anaphylaxis is still a matter of doubt. Of the two chief theories, one regards the anaphylactic phenomenon as due to the union of two substances producing a poisonous combination which then acts on the sensitised cells, while the other theory assumes that it results from the liberation and direct action of the toxin within the sensitised cells. We do not think the cell sensitisation essential. All the theories may be true, for the symptoms are not always alike in different species of animals, and they are not even always the same in the same species.

In the human subject some kind of indefinable sensation that the patient cannot describe precedes the more objective symptoms—namely, flushing of face, general erythema, cyanosis, and unconsciousness—which are evidently of cardio-vascular origin. This premonition in itself rather points to a central nervous cause for the whole phenomenon, and this supposition underlies some of the experiments on treatment about to be described. Death is, we think, always the result of cardiac failure, although some believe that in the guinea-pig, in which animal the respiratory symptoms are often very prominent, spasm of the pulmonary muscle is more important. Our method of experiment, in the guinea-pig, is to inject the sensitising dose (generally 0.02 c.c.) subcutaneously and the toxic dose (1 c.c. or more) into a vein of the ear. By this means we appear to obtain a larger percentage of positive results than many observers. We are able to confirm the observation that different strains of guinea-pig vary in sensitiveness and have noted that all-tan coloured guinea-pigs are especially susceptible. In other animals a disturbance of the respiratory rhythm may also be seen, even in minor anaphylactic attacks, and it may, in man, make artificial respiration necessary. Nevertheless, as the result of experiments on the excised rabbit's heart,² we believe that the anaphylactic phenomenon (a) is due mainly to a toxic combination of horse serum and patient's or animal's serum and (b) is dangerous chiefly on account of the effect on the central nervous system and the cardiac muscle.

We have accordingly been led to investigate some possible remedies or prophylactics.

The problem may be attacked in two ways: (1) By modification of the serum, so as to eliminate the toxic element; or (2) by treatment of the patient, either before or after the onset of symptoms.

1. *Modification of the Serum.*

This method has been attempted by several manufacturers of antitoxic sera, so far with but little success. There is no doubt that different samples of horse serum, as tested on the excised rabbit's heart, vary much in toxicity, and, further, that the amount of toxic substance diminishes after the first week of keeping. It is partly on this account that the sera from several horses are mixed and kept a little while before being issued for sale, although the accidents which happen with commercial sera show that these precautions are insufficient. Filtration through a porcelain candle will remove a very large fraction of the toxin, but unfortunately also of the other essential elements. The candles used commercially for filtering antitoxic sera also allow the anaphylatoxin to pass through.

Pasteurisation of the serum and the attempt to eliminate the toxic element by precipitation methods are both unable to make the serum innocuous. This is not surprising when we remember how very resistant the sensitising molecule is to heat and many powerful chemical substances, and the toxic molecule, although weakened, is not destroyed by the moderate heat which it is possible to apply to antitoxic sera.

¹ The expenses of this investigation were defrayed in part by a grant from the Medical Research Committee.

² Journal of Physiology, vol. I., 1916, p. xiii.