By the Stomach.

In the next two experiments 25 c.cm. of chloroform in oil were administered by the stomach on two successive days. In both experiments a distinct increase in the total nitrogen excreted was observed, and in both there was a distinct fall in the nitrogen in urea, a rise in the nitrogen in ammonia and in uric acid, no marked change in the proportion of nitrogen in creatinin, and a very marked rise in the nitrogen not in these combinations. This "remainder nitrogen" may be taken as probably chiefly nitrogen in amino-acids, and it is of interest to observe that its chief rise preceded the chief rise of ammonia nitrogen. The proportion of oxidized sulphur showed a fall. In both experiments proteins, granular cells, and tube casts were present in the urine, and in one experiment jaundice was present.

Hypodermically.

In the next two experiments 10 c.cm. of chloroform were given hypodermically on two successive doses. No marked rise in the total nitrogen excretion was found. The proportion of urea nitrogen fell markedly in the first experiment, but only to a small extent in the second. The ammonia nitrogen showed a rise, the proportion of uric acid nitrogen was increased, but the proportion of creatinin nitrogen was not markedly altered. The nitrogen not in these combinations rose markedly in the experiment in which the urea nitrogen was decreased. The sulphur was estimated in only one experiment, and the oxidized sulphur showed a marked decrease.

Proteins and granular cells were present in the urine.

Assumption and Elimination in the Blood.

Is this difference in the mode of action of chloroform administered by these different channels merely the result of difference of dose, or do some other factors play a part?

To answer this question the assumption and elimination of chloroform by the blood when it is administered by different channels, was studied in conjunction with Miss Dorothy Lindsay. For this investigation rabbits were used, and the chloroform in the blood was determined by Nicloux's method. It was found that, generally speaking, when chloroform is inhaled the amount in the blood rapidly rises to something like 40 mg. per 100 c.cm., and that it is rapidly eliminated, so that at the end of three hours it has largely disappeared. Several cases showing a marked divergence from this rule were observed. It was found that, if the rabbits were kept in a small cage after the administration, the elimination of chloroform took place much more slowly, and that at the end of two hours there might still be as much as 24 mg. of chloroform present. The observations of Tissot and of Nicloux showing that there is no fixation of chloroform in the liver were confirmed.

When, on the other hand, chloroform is given by the mouth or hypodermically in doses of 1 c.cm., the amount in the blood slowly rises to reach about 22 mg. at the end of five hours, and then slowly falls. The elimination thus takes as long as six hours. The amount of chloroform in the liver is as great as, or greater than, the amount in the blood.

The difference between the effects of the administration of chloroform by inhalation on the one hand, and by the stomach or hypodermically on the other, is not, then, due to difference in dose, but to its rapid elimination after inhalation, and to its slow elimination after the latter modes of administration.

The greater effect produced in these experiments by the administration by the stomach as compared with the administration hypodermically is probably a result of the difference in dose—50 c.cm. as against 10 c.cm.—for upon rabbits we find that it is equally toxic when given by the mouth and when given hypodermically, and that the course of accumulation in the blood and elimination from the blood is about the same.

The rarity of late chloroform poisoning after its inhalation seems to be due to rapid elimination, and the absence of fixation in liver tissue. But the occurrence of so many cases of slow elimination in rabbits seems to show how, when this occurs from any cause in the human subject, the same fixation may take place, and the metabolic and renal changes characterizing late chloroform poisoning may ensue.

A NOTE ON THE ADMINISTRATION OF ETHER BY THE OPEN METHOD.

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When testing the principles of ether anaesthesia last summer I removed the small bag from the Clover's inhaler and allowed the patient to breathe to and fro without it. The disadvantage of this method is that half the ether is wasted and the purity of the surrounding air is vitiated; the cooling of the inhaler is also excessive. Messrs. Barth and Co., therefore, made me a small valve box for introduction between the inhaler and the facepiece, and so arranged as to allow inspiration through the inhaler, but to direct the expiration into the air without passing back through the inhaler. The valves were of rubber, and the condensation of water on the metal due to the cooling caused by the ether vapour was excessive, so that the valves stuck and were inefficient. The next step was to interpose between the facepiece and the inhaler one of Barth's aseptic 3-way gas stopcocks, patent 1902, in which the valves are of mica seated on ring knife edges. The piece was adapted by means of a reducing collar. The water of condensation caused no sticking of the valves, and flowed off readily through the expiratory one, which, with this method, is the most dependent part of the apparatus.

The induction and maintenance of anaesthesia in this way is very simple. The small bag, with gas connexion, being attached to the ether inhaler, the valve pointer being turned to "air" and the patient's head being on its side, preferably the right, the facepiece is applied and gas admitted, the pointer is gradually turned to "valves," and the gas in the bag continuously replenished. The proceeding, in fact, precisely resembles the ordinary method with the large bag, except that the valve chamber is placed between the facepiece and the inhaler, instead of between the bag and the inhaler, and that the small bag is used throughout. The induction is the same, and needs no description. When the patient is fully under ether and the gas has been disconnected, the pointer being at this stage usually at "no valves," and the patient rebreathing from the small bag, the latter is removed, the pointer turned to "valves," and the inhaler rotated on its stem so as to increase the percentage of ether vapour. The patient continues to inspire fresh air laden with ether vapour through the inhaler, and to expire through the valve, the passage of the expiration through the inhaler being prevented. Should he at any time show signs of returning consciousness, all that is necessary is to reapply the small bag, turn the pointer to "no valves," and to decrease the percentage of ether on the inhaler. When he has now rebreathed "four and one" or "five and one" for two or three minutes, the sequence may be repeated.

There seems to be no doubt that there is, on the whole, less cyanosis, less secretion of mucus, and less oozing of the tissues by this method, but the anaesthesia almost always tends to become light, as is evidenced by the advent of shallow, occasionally thoracic, breathing, lateral movements of the eye, and the contracted (2.5 mm.) pupil. Perhaps this would be obviated by using an inhaler which presents a greater evaporating surface for the ether. At no time, however, is the oozing of blood less than with anaesthesia maintained with chloroform. The advantages of the method are:

1. Some attempt at measurement is introduced and undoubtedly much less ether is used than would be required to produce the same effects by pouring it on lint. The inhaler is kept upright. Ether is given by the open method, but the ether is kept in a closed chamber so far as waste by evaporation is concerned.

2. Apparatus at present on the market can be used, thus reducing the amount of apparatus that need be carried. Messrs. Barth and Co. will supply a reducing collar for the necessary adaptation, or the proximal limb of the valve chamber can be itself adapted, whereby the distance from the lower border of the inhaler to the centre of the valve chamber is reduced to 1½ in. In such case, however, the fitting to the large bag has to become an inside instead of an outside fitting, a matter of no disadvantage, or a collar may be used for this. The whole stopcock may be boiled without injury.

3. The advantages claimed for ether by the open method are all present, though these do not seem to be greater than those of maintaining the anaesthesia with chloroform. The patient may be readily anaesthetized more deeply should this be necessary. The initial induction is as at present practised, except that the small bag only need be carried. The use of the valves as an adjunct to the "small bag method" of gas and ether administration automatically avoids any rebreathing during induction. It is customary to avoid this when valves are not employed by removing the lower part of the facepiece during expiration.

The disadvantages of the method are that the anaesthesia tends to be light, that there *is* oozing of blood, but it is now red instead of bluish, that the patient is kept on ether for an increased time, often much to his discomfort afterwards, and that the purity of the surrounding air is vitiated.

On the whole the administration of ether by the open method seems to have its uses in a small number of cases, chiefly in very anaemic patients, for short operations, and in those who readily become cyanosed.

ON RECTAL DRAINAGE IN CASES OF PELVIC ABSCESS DUE TO APPENDICITIS.

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IN the June number of the *Annals of Surgery*, received in London, July 3rd, I find a short paper by Dr. Archibald MacLaren, Professor of Clinical Surgery in the University of Minnesota, on Pelvic Abscess with Special Reference to Rectal Drainage. I was myself about to publish a short paper on this very point, and notwithstanding the appearance of Dr. MacLaren's paper I think it may be of service to emphasize still further the value of rectal drainage in the pelvic abscesses resulting from appendicitis. I have advocated and practised this method of evacuating pelvic abscesses for several years, but I believe I am right in saying that it is a method rarely adopted by English surgeons—indeed I have heard of its being characterized as "not surgery." It is well known that in the days before appendicitis and appendix abscesses were understood and treated by operation cases occasionally recovered after the spontaneous evacuation of an abscess through the vagina or the rectum, and the same fortunate event from time to time occurs nowadays. Nature's method of cure is often a good one to follow and the subject under consideration is a good instance in point.

Pelvic abscesses in connexion with appendicitis may be arranged in two groups:

1. An appendix abscess has formed above the true pelvis in the iliac fossa, and has been opened through the anterior abdominal wall. At the time of the operation no collection of pus can be detected in the pelvis by rectal or vaginal examination. The temperature falls, and all goes well for a few days. The temperature then goes up again, and the pulse increases in frequency. The drainage of the abscess already opened appears to be quite satisfactory, and consequently a further examination of the pelvis by rectal or vaginal examination is made, and the relapse is explained by the presence of a collection of pus in the basin of the pelvis.

2. The illness has begun in the manner characteristic of appendicitis. The temperature continues high and the pulse rapid, and so perhaps a week goes by. No mass is felt by abdominal palpation, but as the case is not progressing satisfactorily a surgeon is called in, and his routine rectal examination discovers a pelvic swelling bulging the anterior rectal wall, either alone or in association with resistance or swelling behind the right rectus muscle.

In the first group the adhesions of the bowels intervening between the first abscess and the collection of pus in the pelvis have become so firm and the separation of the coils of intestine from one another so indistinct that the attempt to open the pelvic collection through the abscess cavity already opened would be attended with grave risk of injury to the intestine. The difficulties just mentioned have been met by operating in the left linea semilunaris. This plan involves a second abdominal incision, and the risks attendant upon evacuating an abscess through the abdominal cavity, protected though it may be by gauze packing. It is in these cases that Dr. MacLaren has opened the pelvic abscess through the rectum. I have several times done the same thing, and always with success. I have operated thus in females as well as in males. I have selected the rectal route in preference to the vaginal in females, because in my cases the abscess has bulged more towards the rectum than the vagina, and it has appeared that a rectal opening would be more dependent than a vaginal one. With regard to cases in the second group, Dr. MacLaren writes:

> There is another type which I have not operated upon—namely, the man who is desperately sick and who presents a decided fullness in the cul-de-sac. In such a case I will, on my first opportunity, simply open the cul-de-sac and drain, and not make an anterior incision at all.

I have recently dealt with a case of this type precisely in the way advocated by Dr. MacLaren, and I propose to give a short account of the case in order to illustrate my method of operating, which is very similar to that employed by Dr. MacLaren:

G. O., a man aged 26, was admitted to University College Hospital on June 16th, 1908. His illness began nearly three weeks before his admission with severe abdominal pain and sickness. The pain was mostly central at first, but on admission it was worst on the left side below the level of the umbilicus. The lower part of the abdomen was distended, and did not move much during respiration. There was well-marked tenderness all over the lower part of the abdomen, and a distinct mass could be felt coming up from the pelvis, especially on the left side. By rectal examination the pelvis was found to be occupied by a large mass which bulged into the rectum, especially on its anterior and left lateral aspects. The swelling was very tender, and the most prominent part of it, which was about 3½ in. from the anus, was soft. The temperature was 101.4° F., and the pulse 88.

Rectal drainage was decided upon. The patient was anaesthetized with chloroform, and placed in the lithotomy position with the pelvis well raised and rotated forwards. The sphincter ani was well stretched, and the anus was held widely open by three retractors, one on either side and one behind. The bulging swelling was thus completely displayed. A trocar was pushed into it, and pus found. The mucous membrane was divided longitudinally with scissors for 2 in., and the other structures were split and stretched by means of polypus forceps introduced through the trocar puncture. About a pint of stinking pus was evacuated. The opening into the recto-vesical pouch was maintained by means of a tube an inch in length and an inch in diameter, with a flange at each end. One flange was passed into the abscess and the other remained in the rectum. The tube was left in position for eight days, and the abscess cavity was irrigated daily through the tube, and after its removal the irrigation was continued through the wound for three days more. The temperature fell to normal a few hours after the operation and the patient made an uninterrupted and rapid recovery.

If this case had been dealt with by an abdominal incision it would have been necessary to have made it free enough to allow of the introduction of abundant gauze packings in order to protect the rest of the abdomen from infection during the evacuation of the pus. There would have been some risk of infection of the peritoneal cavity; but, putting this at a minimum, the use of the tube and the almost certain infection of the abdominal wound would have been followed by a weak scar, which would probably have been on the left side, and hence at an unsuitable place for the subsequent appendectomy.

In dealing with a well-localized appendix abscess in any situation, it is, in my opinion, unwise to do more than is absolutely necessary for the efficient evacuation and drainage of the abscess. The appendix should not in these cases be removed at the time the abscess is drained, for its complete removal involves the breaking down of limiting adhesions and the risk of peritoneal infection. Holding this view, I am very averse from removal of the appendix in the original operation for pelvic abscess when this is done through an abdominal incision; and so I am not deterred from using the rectal route on account of the impossibility of removing the appendix through it.

Gynaecologists constantly use the vaginal route for evacuating pelvic abscesses, and I believe that surgeons would be wise in adopting the vaginal or rectal route in females and the rectal route in males for the evacuation of large appendix abscesses which are apparently confined to the pelvic cavity.