enable the proposed operation to be carried out or completed. With one exception, a case of haemorrhoids, these were all cases of operations above the level of Poupart's ligament. In the haemorrhoid case the analgesia stage only lasted for thirty minutes, and although the operation was almost finished the patient required a little chloroform at the end. The stovain in this case was not satisfactorily injected as there was a very poor flow of cerebro-spinal fluid. In the others of this class of partial failures the analgesia was good up to a certain level and the injection was well made; they were as follows:

1. D. R., aged 60. Inguinal colostomy.—The abdomen was opened without any pain, but any manipulation of the parietal peritoneum caused great pain, and he required to have a general anaesthetic to enable fixation of the colon in the wound to be made.

2. J. D., aged 61. Carcinoma of penis.—The stovain produced good analgesia to the level of the anterior superior spinous processes of the ilium. As in these cases of carcinoma of the penis I always remove the glands in both Scarpa's triangles, as well as in both iliac fossae, the analgesia in this patient was not sufficiently high for this latter part of the operation.

3. G. L., aged 36. Appendicitis.—Stovain produced complete analgesia as high as Poupart's ligament on each side, but no higher after twenty minutes.

4. M. K., aged 27. Appendicitis.—Analgesia developed to the level of first lumbar nerve, just short of the site of the incision.

5. J. B., aged 51. Right inguinal hernia.—Stovain produced good analgesia in the left side up to the umbilicus, but none at all in the right side of the middle line.

6. L. C., aged 38. Appendicitis.—Analgesia perfect on both sides to a point just below the site of the incision.

B. Complete failure to produce analgesia, of which there were 15 instances. In 6 of these patients the injection was not satisfactory, owing to a deficient flow of the cerebro-spinal fluid. I think there can be no doubt that it is absolutely essential for successful analgesia that the flow of cerebro-spinal fluid shall be free. It must run from the cannula, and about 5 or 8 c.cm. should be permitted to escape before the injection is made. These six cases were as follows:

Appendicitis	...	...	...	...	...	2
Hydrocele	...	...	...	...	...	1
Hernia, radical operation	...	...	...	...	...	1
Amputation of leg	...	...	...	...	...	1
Prostatectomy	...	...	...	...	...	1

In the last patient complete muscular paralysis of the lower limbs was caused, but no loss of sensation occurred after twenty-five minutes from the time the injection was made.

In the remaining 9 cases the injection of the solution was well carried out. There was no defect in the technique whatever, but the patients did not develop any analgesia at all. I can only suppose that this was due to some idiosyncrasy on their part towards the drug. Those patients were all males, whose ages ranged from 22 to 61. Only one of them received a second injection, which also failed, after being well injected, to produce any analgesia, though the second injection caused muscular paralysis of the lower limbs.

The after-effects of stovain have not been troublesome at all, so far as I have seen; in fact, I have been surprised that there has been so little after-discomfort. Headaches have been complained of by some patients, one or two have vomited a very little after the operation, but none of the patients have ever complained of the severe headaches so often seen after ether and chloroform, and the vomiting has been trivial to a degree as compared with what is often met with after these two anaesthetics. But a good many of the patients have complained greatly of pain in the wounds for the first hour or two after operation, very much more so than patients who have a general anaesthetic do, and I imagine this is due to the fact that these latter patients have their cerebral activity so dulled by the anaesthetic that they do not appreciate the irritation of the nerves of their wounds, whereas the stovain patients, who have their intellect unimpaired throughout the operation, are not only capable of appreciating any unusual sensations, but are on the look-out for them. None of the patients who got stovain injections had any trouble with the bladder function after it.

I have thought it might be worth while to publish these notes, for there is no doubt that in stovain we have a very excellent anaesthetic, although it may be a little

uncertain in its action, for the region comprising the lower limbs and lower part of the abdomen, and it will undoubtedly prove a great boon to many people who hold back from an operation simply in consequence of their fear of the general anaesthetic, their chief dread of an operation being the idea of the loss of consciousness inseparable from the use of chloroform, ether, etc. These patients deserve every consideration, and in stovain injected into the spinal fluid we have an agent which comes nearer towards supplying their want than by any other means.

THE CARE OF THE PATIENT DURING SERIOUS ABDOMINAL OPERATIONS.

By H. BELLAMY GARDNER, M.R.C.S., L.R.C.P.LOND.,
LATE INSTRUCTOR IN ANAESTHETICS AT CHARING CROSS HOSPITAL.

THOSE who undertake the care of the patient's general state in anaesthesia during difficult and dangerous abdominal operations should particularly consider the methods by which reserve force may be retained for the later hours of physiological readjustment when depressing factors and complications may be encountered. These methods are directed towards increase of vasomotor tone, maintenance of temperature, elimination of anoxaemic (asphyxial) factors, prevention of shock, arrest of and compensation for haemorrhage, mechanical circulatory considerations, and correct degree of anaesthesia.

In my experience a marked improvement of vascular tone is attained by the internal administration of liquor strychninae hydrochloratis *mv* three times a day for a week to patients about to undergo serious abdominal operations, for not only is the nervous system fortified against the event, but early signs of exhaustion are not then displayed during the surgical manipulations.

I also observe that strong purgation lowers the general blood pressure for a time, and consider it should be avoided on the night immediately preceding a serious operation.

The effect of rest in bed for two or three days previously, combined with the regulation of the diet and bowels and compliance with nursing discipline, assist materially in improving the tranquillity and in reducing the after-effects of anaesthesia.

In the next place a thin blanket is not enough covering for a patient during an operation, for lowering of temperature takes place from anaesthesia *per se* as well as from exposure of skin surfaces and of internal organs. As loss of bodily heat may turn the scale against even the most robust, woollen stockings, night garments and one doubled blanket to cover the chest and arms, with another double blanket to wrap up the legs and feet are required to maintain the temperature. A hot-water bed or tank covered with blankets beneath the patient is of distinct advantage during long operations, but hot bottles should not be used for anaesthetized patients, as they are very likely to burn the skin with which they may come in contact. Heated blankets are equally efficient and more easily applied.

Large surfaces of the body near the wound should not be exposed or covered with wet cloths, which produce rapid chilling of the skin by cooling and evaporation, and if these are to be used mackintosh and, if possible, blanket also should lie beneath them.

It must not be forgotten in this connexion that exposed intestines and other vascular organs produce a rapid loss of heat and should be covered when drawn out by a succession of warm sponges or wads of gauze. A patient always begins to flag when eviscerated bowel is allowed to cool.

It is not enough that a patient should continue breathing during a prolonged operation; but adequate oxygenation of the blood should be proceeding, for no more depressing factor can be at work than partial anoxaemia (asphyxia), both by exhausting the vitality of the nervous system and weakening the force of the heart.

The best method of ensuring adequate oxidation is by establishing oral respiration by means of a mouth prop between the teeth, and further in some cases the use of a small tongue clip to prevent the occlusion of the airway by this organ touching the pharyngeal wall.

Feeble respiration can be stimulated by friction of the lips with a towel under chloroform, and may also be

deepened by the addition of ether upon the mask or a change to the C_2E_2 mixture.

Shock or the exhaustion of the nervous centres, which is rapidly produced after a transient primary stimulation by traction, stretching or prolonged manipulation of certain highly sensitive structures such as the mesentery, the peritoneum within Douglas's pouch, and the pedicles of abdominal organs and tumours, can best be met by the use of ether during such stages.

In my opinion ether possesses a specific action in blunting and in some cases preventing the transmission of nerve stimuli more effectually than chloroform, and when used at particular stages of an operation which may be proceeding under chloroform protects the patient from the occurrence of the respiratory and circulatory shock which otherwise appears as the result of the operative measures.

When ether is contraindicated and the reflex effect of surgical stimuli disturbs the breathing so far as to interfere seriously with efficient oxygenation by causing laryngeal spasm, the hypodermic injection of morphine grain $\frac{1}{4}$ proves of considerable value in additionally narcotizing the peripheral nerves and allowing respiration to proceed unhampered by the surgical manipulations. Besides shock, lowering of general blood pressure, with feeble respiration due to anaemia of the medullary centres, may occur from haemorrhage alone. The anaesthetist should inform the surgeon that the loss of blood is affecting the patient when he first observes a change in the depth of respiration, other causes in his judgement being excluded, before blanching of the skin has definitely appeared.

Recovery of vascular tone and respiration is remarkably rapid from the moment of complete arrest of haemorrhage, and this is the most urgent and vitally important treatment. The injection of a pint and a half or more of hot saline solution into the rectum, with raising of the feet and lowering of the head, are next in value. A funnel, tubing, and silver nozzle for the transfusion of saline fluid into a vein of the arm should always be at hand in case of more severe haemorrhage.

Syncope due to the removal of the weight of fluid or tumours from the splanchnic area may be anticipated and prevented by the surgeon removing the tension slowly, and the anaesthetist lowering the patient's head at the same time.

After an operation conducted in either the Trendelenburg or the lithotomy position, if haemorrhage has occurred it is best not to let the patient down flat at its termination, but to keep the feet raised for some hours afterwards to prevent the supervention of cerebral anaemia before the blood pressure has returned to normal level.

In deep stages of anaesthesia the vasomotor mechanism is paralysed and whenever shock or haemorrhage begin to appear the anaesthesia should be lightened so that the vasomotor system may recover its activity and readjust the disturbed blood pressure.

These points being all carefully put into practice preserve the vitality of the patient in such a manner that a period of many hours in which the general state borders on collapse after abdominal operations is replaced by a condition of general warmth and good colour, rapid recovery of consciousness and normal circulation.

STERILITY AMONG X-RAY WORKERS.

By ALFRED C. JORDAN, M.D., B.C.CANTAB.,

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THE fact is now well-known that azoospermia is produced by exposure to *x* rays. What is not yet appreciated is the fact that a worker who has taken "every reasonable care" to avoid exposing himself unduly to their action becomes sterile after working daily for a year or so. By "reasonable care" I mean that he has had his *x*-ray tube enclosed in a protective box, has worn a protective apron, has conducted *x*-ray treatment with the tube in a protective shield, and has himself kept at a distance of a few yards from the tube.

Dr. Albers Schönberg, of Hamburg, has adopted the expedient of erecting a cabin, lined with sheet lead, in the middle of his skiagraphy room; within this cabin is the

switch-board from which he starts the current. There is a small window of lead-glass, through which he is able to observe the tube and the patient. As he takes all his skiagrams with the tube unshielded, no less complete measure would suffice to afford him and those working with him sufficient protection. Unfortunately, he is precluded by his method from carrying out a very important branch of the work—namely, the examination with the fluorescent screen. For surgical work this can, perhaps, be dispensed with and no great loss ensue; in the examination of the chest and stomach, however, the screen examination is of great importance, and it becomes necessary to devise other means of protecting the operator.

The tube-box which is ordinarily supplied in this country is far from efficient; the top has a quantity of red lead or white lead packed between wooden boards, and the sides are of lead-glass, or often of ordinary plate-glass. More often than not there is an area between the side and the top which is almost entirely unprotected. If a box of this description be carefully examined at close quarters with the screen while the tube is in action, it will be seen that quite an appreciable quantity of *x*-rays filters through the walls of the box.

The means which I suggest as probably sufficient are the following: The tube-box should be made entirely of wood, and should be completely lined on the outside with an efficient protective rubber material with the exception of an aperture at the top which is controlled by an adjustable diaphragm. A view of the tube may be obtained through a small lead-glass window covered with a flap of the protective material. The rubber material which truthfully answers the description of "protective" is manufactured by Messrs. Müller of Hamburg, and tested by Dr. Albers Schönberg, probably the most exacting man in Germany where the question of protection from *x* rays is concerned. The operator should always wear a protective apron reaching from the shoulders to below the knees, and, as these two means are not sufficient, he should also have an upright rectangular wooden screen, 3 ft. 3 in. in height and 2 ft. in width, lined on both faces with 3-lb. sheet lead, and should place it close to the couch between himself and the tube box. A larger screen (say 4 ft. square) should be supplied for use while *x*-ray treatment is in progress. The screens may be mounted on castors. Screens of the sort I describe are not in the operator's way to an uncomfortable extent. For treatment the tube should always be completely enclosed. Eventually I believe sheet metal shields and tube-boxes will be available, but this cannot well be before static machines have been so far improved and developed as to be used in place of induction coils, as is done with great success in Paris, in Dr. Sabouraud's treatment department.

I would urge those who are taking up *x*-ray work not to allow themselves to be influenced by the unsympathetic remarks of their colleagues, who perhaps consider them to be taking excessive precautions; surely their worst enemies would not desire them to injure themselves, did they appreciate the actual facts of the case.

I am not aware of any reliable data bearing on the interesting question of the possibility of recovery from sterility, once it has become complete; assuming the condition to be recognized early enough, say while there are still immobile spermatozoa, it would appear possible that two or three years of complete abstinence from *x*-ray work might result in some degree of recovery, but I do not see how a man could expect to recover otherwise unless he were to take such extreme measures of precaution as would preclude the possibility of his doing really useful work.

Considering the entirely undefended position of the testes, it is no matter for surprise that they should be affected by very small doses of *x* rays, provided the doses be repeated often enough. Wisdom suggests the advisability of inserting a small protective apron under the clothes as an additional measure. This expedient is in fairly general use, but it is merely an adjuvant, and cannot be relied upon in the absence of the other measures I have described.

MISS MARY ANN MELLOR DAVIDSON, of Higher Broughton, Salford, who died on May 17th, left £1,000 each to St. Mary's Hospital, Manchester; Manchester Royal Infirmary and Dispensary, and Stockport Infirmary.