

the cause, providing this is done before the development of adenomata or cysts. Glands containing these will subside as a whole, but the adenomata or cysts are left. The administration of iodine may cause a slight diminution in their size, but they have not disappeared even after eighteen months' treatment. Cysts and adenomata should be treated along the usual surgical lines.

The symptoms of excessive secretion at first rapidly diminish after removal of the cause, and then more slowly *pari passu* with the diminution in the size of the gland. Any excitement will for the moment bring these symptoms again into evidence. If the disease has progressed so far that the various organs have become degenerated, only partial recovery can be made. The patient may be left with a dilated heart, permanent albuminuria or glycosuria, or with some weakness of the nervous system, either central, peripheral, or sympathetic, leading to feeble mentality, paralysis of a nerve, or some vasomotor disturbance. These require appropriate treatment.

#### Acute Exophthalmic Goitre.

These cases arise from the effect of a toxæmia acting on a gland that is already hypertrophied and has led to hyperthyroidism or typical exophthalmic goitre. The added stimulus gives rise to an acute exacerbation which may rapidly lead to death. Treatment is a matter of difficulty, as the five cases quoted show. Medicinal measures may prove unavailing, removal of the toxæmia may be impracticable, and any attempt to remove a portion of the gland may prove fatal.

CASE IV.—A. L., male, 30, developed an acute *catarrhalis* infection before involution was complete from exophthalmic goitre and died in a few weeks despite all medical remedies.

CASE V.—F. H., male, 30. An extension of a *catarrhalis* infection on exophthalmic goitre caused death in five days despite medical remedies.

CASE XXII.—S. L., female, 28. Developed an acute *catarrhalis* infection on medium type exophthalmic goitre and went rapidly down hill. An attempt to remove half the thyroid under Crile's anaesthesia proved fatal.

CASE XXIII.—V. D., female, 25. Developed acute exophthalmic goitre on endemic goitre and teeth infection. She lost 26 lb. in weight, but recovered under medicinal treatment after appearing moriturus for some weeks. She now exhibits the combination of myxoedema and degeneration of various organs from exophthalmic goitre.

CASE XXIV.—M. R., female, 51. An acute exophthalmic goitre developed from the effect of acute *catarrhalis* on exophthalmic goitre from chronic *catarrhalis* and teeth infection. Recovery after partial thyroidectomy under Crile's anaesthesia.

Such cases can only be treated on their own merits.

#### CONCLUSIONS AND SUMMARY.

Endemic goitre is caused by the toxins from the atypical forms of *B. coli*. The mutants are usually conveyed by water. They become indigenous in the intestine, and different mutants of *B. coli* are to be found in the faeces of cases of endemic goitre. The mutants are but rarely present in the faeces of normal individuals or in the faeces of individuals goitrous from other causes. It is possible to conceive circumstances which place the *B. coli* under abnormal conditions in the intestine itself, and lead to mutation and the temporary appearance of mutants in the faeces of normal individuals.

The mutants set up an apyrexial toxæmia, which stimulates the thyroid, so leading to a colloid hyperplasia and eventually to enlargement of the gland.

The whole process can be imitated in the laboratory, and endemic goitre induced in guinea-pigs by feeding with small doses of the mutants.

The supervention of a fresh toxæmia whilst the gland is in a hyperactive state causes a complete hyperplasia, with absorption of colloid and signs of hyperthyroidism up to a condition of exophthalmic goitre. This is dependent on the intensity and duration of the fresh toxæmia.

Endemic goitre is preventable by the avoidance of water contamination and by the sterilization of contaminated water.

It can be cured by the administration of intestinal antiseptics, the gland returns to normal, providing no degeneration has taken place. The gland as a whole involutes to normal, but the adenomata or cysts are left.

A condition similar to endemic goitre can be caused by other toxæmias capable of inducing a colloid hyperplasia.

#### Exophthalmic Goitre.

Exophthalmic goitre is due to a combination of toxæmias of an intensity sufficient to cause a hyperplasia with absorption of the colloid material. One acts during a period sufficient to give rise to a complete hyperplasia associated perhaps with slightly marked signs of hyperthyroidism without necessarily any glandular enlargement. The supervention of another infection stimulates the gland, which usually enlarges, and the signs of hyperthyroidism become very evident; the case develops into one of typical exophthalmic goitre. A nervous shock may lead to the diagnosis by suddenly bringing into evidence the symptoms of hyperthyroidism, especially those connected with the nervous system.

The severity and duration of exophthalmic goitre is dependent on the intensity and duration of the toxæmias. If they be of short duration the disease will disappear in a few months.

Exophthalmic goitre can be prevented by the detection of the early cases of hyperthyroidism and the consequent removal of the basal toxæmia.

Exophthalmic goitre can be cured if the causatory agents be removed before degeneration has occurred either in the gland or in those organs that are affected by the hypersecretion.

When degeneration has taken place in the thyroid, removal of the toxæmias causes involution to take place only in the hypertrophied portion; the adenomata and cysts are left. These require appropriate surgical treatment, as they to a certain extent keep up the symptoms of thyroid excess. Surgical treatment without removal of the cause is followed by recurrence unless so much of the gland substance has been removed that hypersecretion is impossible. Degeneration in the other organs partially recovers after involution of the thyroid; appropriate treatment is necessary for those that remain. Acute cases of exophthalmic goitre may present themselves in which surgical treatment is the only means of saving them, though the risk of death under the anaesthetic perhaps precludes operation.

As our knowledge of toxæmia is limited, so necessarily must be that of exophthalmic goitre.

The bacteriological work was done in the Westminster Hospital Laboratory, and I am much indebted to Dr. Braxton Hicks and Mr. Chopping for the care which they have taken over the work. I am also much indebted to Mr. Spencer for giving me the opportunity of making observations on clinical material.

#### REFERENCES.

- <sup>1</sup> Hack, *Deut. med. Woch.*, 1889, p. 434. <sup>2</sup> Semon, *Clin. Soc. Journ.*, vol. xxii, p. 234. <sup>3</sup> Scanes Spicer, *ibid.*, vol. xxviii, p. 265. <sup>4</sup> Dufour, *Lyon méd.*, cxx, No. 14. <sup>5</sup> McCarrison, *Ind. Journ. Med. Research*, vol. iii. <sup>6</sup> Houston, Annual Report Local Government Board, 1904-5. <sup>7</sup> Whipple, *Technology Quart.*, xvi, 18. <sup>8</sup> Horrocks, *Journ. Hygiene*, xii, 195. <sup>9</sup> Clemesha, *Bacteriology of Surface Waters in the Tropics*, 1912. <sup>10</sup> Eyre, *Lancet*, 1904, vol. i, p. 648. <sup>11</sup> Müller, *Archiv. Anatomie und Physiol.*, Suppl., 1906, p. 411. <sup>12</sup> Farrant, *Proc. Roy. Soc. Med.*, 1914, vol. vii.

## ANOCI-ASSOCIATION IN THE PREVENTION OF SHOCK AND POST-OPERATIVE DISCOMFORTS:

### AN EXPERIENCE OF 143 CASES.

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CRILE'S theory of shock is that it is due to the exhaustion of the vasomotor centres in the medulla and cord, the most important factors in the production of surgical shock being fear, pain, and anaesthetic poisoning. In operations done by ordinary methods these three factors are not sufficiently eliminated, and the operation is followed by a fall in blood pressure and definite changes in the cells of the central nervous system.

Ether and chloroform prevent feeling and movement, but they do not prevent the reception of stimuli and the discharge of nervous energy. Theoretically, nitrous oxide

should diminish shock, for it acts by preventing oxidization, and presumably oxidization is a process in the fatigue changes of the nerve cells. Experiments showed that an equal injury produces three times as much change in the nerve cells under ether as under nitrous oxide.

Exhaustion can be produced by injury, sleeplessness, and fear. Tearing produces far more shock than clean cutting, and rough handling and strong traction on peritoneal-covered viscera is especially liable to produce shock, which can be avoided by gentle manipulation.

Stimulants, such as strychnine and alcohol, produce exhaustion changes in brain cells; it is therefore as rational to treat the exhaustion of strychnine poisoning with trauma as to treat the exhaustion of trauma with strychnine. To advise the use of stimulants for the treatment of shock is as foolish as to advise a man who is almost bankrupt to increase his expenditure. Morphine and other sedatives are conservative of energy, and are therefore of use against shock.

Crile's principle is to prevent the consumption of the stored energy of the brain cells before, during, and after surgical operations by preventing the brain from receiving painful and disquieting stimuli. He calls this anoci-association, meaning the exclusion of all harmful associations or stimuli.

Two other theories of shock are those of Yandell Henderson and of Rendle Short. Yandell Henderson believes that painful stimuli reflexly induce deep breathing, so that the carbon dioxide in the blood is reduced below the normal (acapnia). When the painful stimuli cease, this reflex cause of deep breathing is no longer present, and the normal stimulus produced by carbon dioxide is so diminished that respiration becomes very shallow, and the absorption of oxygen is insufficient. Although this may be a factor in shock, an experiment of Crile's shows that its importance cannot be great. Two dogs,

A and B, were taken, and it was arranged so that the blood of A circulated through the brain of B, and conversely. A was injured and its brain cells showed typical shock changes, while the brain cells of B remained normal. Rendle Short, moreover, found by experiment that acapnia was not present in five cases of surgical shock observed by him. Rendle Short's theory is that reflex contraction of the arteries follows stimulation of pressor nerve fibres; plasma is consequently squeezed from the capillaries with resulting oligæmia.

The merits of these theories do not affect the present question, because Crile's practical suggestions for prevention of shock serve in all, as the authors of the acapnia and oligæmia theories both put painful stimuli as the first link in the chain of events, and this link is broken by anoci-association.

In September, 1913, Gray<sup>1</sup> of Aberdeen described his technique of giving omopon before an operation, and using local anaesthesia with novocain, ether being only used when required to keep the patient quiet. The method is on the same lines as Crile's, but it does not cut off noci-associations so thoroughly.

Chaldecott and Bryan<sup>2</sup> obtained extremely satisfactory results in twelve severe operations. Gas and oxygen were used; they had less post-operative vomiting than in our cases, but apparently more trouble when the peritoneum was handled.

We believe that Sir Berkeley Moynihan was the first surgeon to use Crile's methods of anoci-association in this country, and his opinion of their importance may be gauged from his remarks in his Address in Surgery at the Annual Meeting of the British Medical Association at Brighton (1913), when he ranked the work of Crile and its

effects on surgery with the discoveries of Lister and Morton.<sup>3</sup>

In our work from July 19th, 1913, to April 30th, 1914, we have followed Crile's methods of anoci-association as closely as possible.

*List of Operations Performed.*

Appendicectomy ...	57	Amputations through thigh	2
Prostatectomy ...	5	Radical cure, hernia	10
Gastro-enterostomy ...	5	Strangulated hernia	2
Hysterectomy ...	7	Exploration of kidney	1
Perforated duodenal ulcer	3	Castration	1
Colostomy ...	4	Hallux valgus	1
Gall stones ...	6	Radical cure, hydrocele	3
Explorations of abdomen...	4	Radical cure, varicocele	2
Ovariectomy and appendix	4	Perineorrhaphy	1
Ventrifixation ...	2	Glands in neck	2
Nephropexy ...	2	Removal of semilunar cartilage	1
Excision of knee ...	1	Plating and wiring operations for fractures	8
Amputations of breast	4		
Thyroidectomy ...	5		

After the preliminary injection of scopolamine  $\frac{1}{10}$  grain and morphine  $\frac{1}{4}$  grain (average doses) one hour before operation, unconsciousness is in most cases induced and maintained by ether given by the open method. In a few early cases the anaesthetist had such a prejudice in favour of chloroform that he could not resist giving it during a part of the operation. Very little inhalation anaesthetic is usually required, generally about one third of the usual

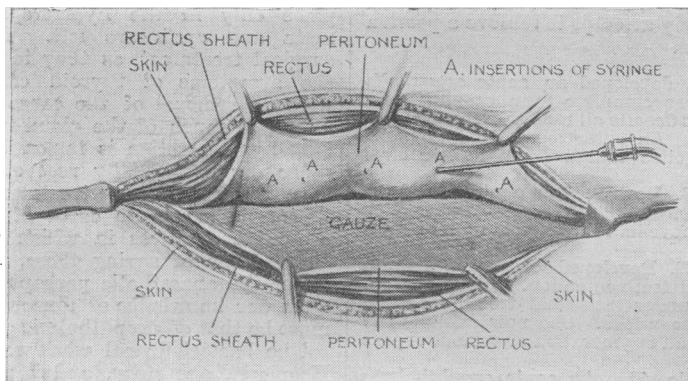
amount, and the patient sleeps comfortably without giving any anxiety. When unconsciousness has been produced, the skin is infiltrated with a 1 in 400 solution of novocain; during the incision the deeper layers are treated in the same way as they are exposed.

If the infiltration is thorough no stimuli reach the brain, and the lightest possible ether administration is needed, sufficient only to keep the patient quietly asleep, for the cut does not wake him.

In other words, the infiltration anaesthesia, aided by the scopolamine and morphine, should be sufficient by itself to cut off all impressions of physical pain, the inhalation anaesthetic being solely used to eliminate mental anxiety, and in such quantity only as is sufficient to keep the patient from knowing that an operation is proceeding, and oblivious to any distressing sights or sounds.

In abdominal operations, after the peritoneal cavity has been opened, a wet gauze pad is packed into the incision and the peritoneal edges are everted and freely injected with a solution of quinine hydrochloride and urea (5 per cent. of each in normal saline), large blebs being formed all round the peritoneal incision. An area should be infiltrated which will generously include all the parts which will subsequently be traversed by stitches. One or two ounces of the solution, according to the length of the incision, are used at this stage.

In spite of the lightness of the ether anaesthesia, there is no rigidity of the abdominal wall and no trouble with extrusion of the viscera, and the hand can gently explore the abdomen with ease. It is a great advantage to operate on patients under such favourable circumstances. Throughout the longest operation the patient's condition rarely gives the least anxiety to either anaesthetist or surgeon, the only difficulty for the anaesthetist being to keep his very light anaesthetic even. Patients have often moved and occasionally talked during the operation; one young lady woke up while the rectus sheath was being stitched and said, "Was it the appendix?" She added that she felt quite comfortable, and a little more ether sent her to sleep again. One marked advantage of the method is the uniform ease with which the peritoneum is sewn up. It



This figure is to show the method of injecting the peritoneum. It is held up by forceps, and the needle is inserted very obliquely just under the surface, the only difficult part of the technique.

pulls up easily, and the intestines fall back into the abdomen; usually no packing is required.

The injection, of course, adds to the duration of the operation, but, when once accustomed to it, it can rarely add more than five, or at the most ten, minutes. Part of this time is regained by the ease of operating, and in any case it is of no consequence, for the patient's condition is improved by it. There has been, however, one exception to this: An elderly woman of very poor fibre, weakened by six months of haemorrhage, needed panhysterectomy. The anaesthetist was, for some reason, unable to keep the airway clear, and from the start she took the anaesthetic badly. She was deeply cyanosed and strained all through the operation, which was long and difficult. She suffered severely from shock and never picked up, dying on the fourth day. She was the only patient that suffered any degree of shock.

When the operation is over, there is a quick and comfortable recovery; usually no pain at all is complained of, sickness is reduced to a minimum, and the patient usually sleeps well from the first night onwards.

Another marked effect, probably due to the scopolamine, is that, though patients may talk sensibly just before and soon after the operation, they frequently have no recollection of what has happened during most of that day when questioned afterwards, and it is a great advantage to have no unpleasant memories.

Ward and Home Sisters, who started by being sceptical, are now quite convinced of the advantages of anoci-association, and declare that such patients are no trouble after operation.

In two amputations through the thigh in old people, in addition to the usual novocain infiltration, the sciatic nerve was injected with quinine and urea, and there was no shock and practically no after-pain.

One girl of 17 years had a large one-sided goitre, which caused great pain and dyspnoea. The operation for removal was conducted without the slightest anxiety, and recovery was normal and rapid. The patient was subsequently operated upon by another surgeon for enucleation of the tonsils, and died under the anaesthetic. At the *post-mortem* examination status lymphaticus was found. It seems possible that it was anoci-association which saved her from disaster on the occasion of the first operation.

We have had no trouble in the healing of wounds, but there is no doubt that the infiltration must increase the chances of sepsis; and the method should therefore not be used unless the surgeon is sure of himself and his surroundings. Crile has pointed out that it is inadmissible to infiltrate tissues which are the seat of either acute inflammation or cancer.

The comfort of the patient and his pleased surprise at the absence of discomfort would repay the trouble entailed, even if the operation mortality were not lowered. Crile's mortality has diminished from 40 to 8 per 1,000 since he has used anoci-association.

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<sup>1</sup> *Lancet*, September, 1913. <sup>2</sup> *Ibid.*, September 6th, 1913. <sup>3</sup> BRITISH MEDICAL JOURNAL, July 26th, 1913, p. 169.

## RADICAL CURE OF INGUINAL HERNIA.

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It is not with any desire for innovation that I wish to invite attention to a method which I have lately devised, for I feel certain that any surgeon, like myself, who has performed a thousand hernial operations, must frequently have been struck by the difficulty of preventing the fibres of the inner shelf of Poupart's ligament splitting when inserting the necessary approximation sutures. It is obvious that such splitting must act detrimentally by weakening the first and principal line of defence. In order to avoid it I have tried various forms of needles, but found little difference in result, except that on two occasions, when using sharp curved ones, I wounded the external iliac vein (Chopart amputation of the foot followed in one, no penalty in the other).

The operation which I am about to describe has for its object the elimination of such "regrettable incidents," and

the fulfilment of the anatomical conditions which form the basis of such thorough procedures as that of Halsted and Bassini.

As to the skin incision, I should recommend every one not to forget Mr. Lockwood's advice, that in order to find the correct line it is essential to begin by invaginating the scrotum with the finger into the external ring. I have seen this elementary precaution often omitted, the inguinal canal missed altogether, and a fumbling excision made into the femoral region. I employ a long incision, extending from the level of the pubic spine to a point about one inch below and internal to the anterior superior iliac spine. The superficial epigastric and superior external pudic vessels are seized with forceps, divided between, and ligated, and the aponeurosis of the external oblique thoroughly exposed. The intercolumnar fibres of the external ring are then snipped with scissors, and with the handle of the scalpel the aponeurosis is split, parallel to its fibres, to the upper limit of the incision. The divided aponeurotic "leaves" are next seized on each side by pressure forceps, which act as tractors, and considerably facilitate the thorough separation of the former, by blunt dissector, from the underlying structures. I wish to lay

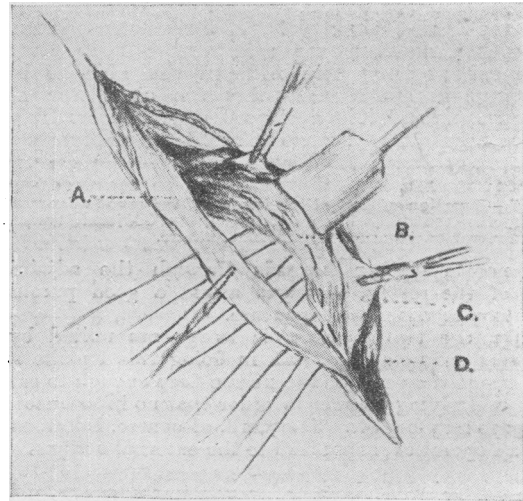


Fig. 1.—A, Poupart's ligament. B, Conjoined tendon. C, Aponeurosis of the external oblique. D, Cord retracted inwards and lying superficial to external oblique.

particular stress on the necessity of thoroughly executing this manoeuvre at this stage in order to prevent subsequent anatomical obfuscation, and the avoidance of what I have occasionally witnessed in clinics—the suturing of something to anything.

Once the inner shelf of Poupart is brought into clear perspective, and the fibres of Gimbernat can be readily felt, on the outer side, and the conjoint tendon with the rectus sheath exposed, on the inner, it becomes a very simple matter to free and isolate the cord, and to distinguish, separate, incise, and remove the hernial sac, and to suture the opening flush with the peritoneal cavity.

This completed, the cord is raised up and placed well out of range of injury behind the two tractor forceps attached to the edge of the internal leaf of the divided aponeurosis (Fig. 1).

I now come to the principal part in this operation. The external leaf is drawn firmly downwards and outwards by tractor forceps until the inner shelf of Poupart's ligament comes well into view. Taking this exposed shelf as level, a curved hernia needle is passed from without inwards right through the reflected aponeurosis—the lower one embracing in transit some fibres of Gimbernat's ligament (Fig. 2)—passed across the floor of Hesselbach's triangle, and made to emerge through the substance of the conjoint tendon. The needle is now threaded with strong catgut, one end grasped by an assistant, and the needle withdrawn. The unthreaded needle is again similarly introduced about half an inch above the former, and a mattress suture completed. Three more similar ones are inserted through the above level, and sufficient room is left at the upper angle for the passage of the cord (Fig. 1).