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PART I.

ORIGINAL COMMUNICATIONS.

ART. XIV.—*Local Anæsthesia in Minor Surgery.*^a By
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YOUR President was good enough some months ago to invite me to make a communication to this Association before the end of the Session. The difficulty of choosing a subject was great, for although I have had as much as my share of interesting surgical cases, the Association has already been well supplied with material of that sort, and pathological specimens, however interesting a communication they may afford, appeal only to a limited number of the members. In selecting as a general subject Local Anæsthesia I thought of the chemical, anatomical, therapeutical, medical, and surgical problems involved, and that a free discussion on these various subjects might be of mutual interest. Roughly speaking, I have performed about two hundred operations without the aid of a general anæsthetic, including the radical cure of hernia, hydrocele, varicocele, amputations of fingers and toes, removal of numerous non-malignant and

^a A paper read before the Dublin University Biological Association.

malignant tumours, large numbers of varicose veins, and almost every operation which comes under the category of minor surgery. The general results of these experiences, combined with a sketch of the scientific aspect of the question, I propose to bring before you in this paper.

The manner of employing local anæsthesia can be divided into two great classes—the Infiltration and the Regional methods. Of these two, the infiltration is by far the more commonly used, being simple and requiring no special anatomical knowledge of the sensory nerves. Against the infiltration method it may be said that the operation is prolonged, and the results as regards pain more uncertain than when a general anæsthesia or the regional method is employed. The advocates of the infiltration method are notably Schleich and Kocher. It consists in the infiltration of the tissues, layer by layer, with a solution of a local anæsthetic, injecting first into the cutis, producing a blanched and œdematised wheal, or, since the introduction of adrenalin, the needle may be passed subcutaneously, and the vitality of the skin consequently not interfered with. As the operation proceeds, layer by layer is infiltrated, bearing in mind that nerves, periosteum, and parietal peritoneum are extremely sensitive; tendons, muscles, and fasciæ, on the other hand, can be divided with impunity. It is not quite correct to say that infiltration of the tissues produces local anæsthesia, analgesia is the proper term, because though no pain is felt, the patient can often say when a knife or when a scissors is being used, and so sensation is not completely lost. This effect is produced by deadening of the superficial nerve endings. I will pass over, for the present, the various drugs employed and the details of technique. Meantime, the subject of the second method—regional anæsthesia—can be summarily dealt with. By regional anæsthesia, Corning and Oberst, who advocated it, meant the direct introduction of an anæsthetising fluid into the great nerve trunks. This

produces a physiological nerve block arresting afferent and efferent impulses. The method requires an accurate anatomical knowledge of the course and distribution of the sensory nerves, and, in addition, infiltration of the tissues must be employed in order to expose and inject the nerve. For these reasons the method is troublesome; but, if employed, produces the most perfect anæsthesia. Crile amputated the leg by injecting cocaïn into the great sciatic and anterior crural nerves, and the same operator removed the arm and portion of the shoulder girdle by injection of the brachial nerve trunks (Struthers). The physiological block, to which I have alluded, not only prevents pain, but is supposed to diminish or obliterate shock, on the supposition that the latter is caused by stimuli or impressions conveyed along sensory or mixed nerves, especially when the patient is under a general anæsthetic. On these grounds some enthusiasts, when employing a general anæsthetic, injected the large nerve trunks with cocaïn in order to prevent the passage of these stimuli and impressions, and so diminish shock. It is necessary, when carrying out the regional method of local anæsthesia, to use a stronger solution than is required for infiltration work, to wait a longer time for the action of the drug to be produced, and, as mentioned before, to have a good anatomical knowledge of the distribution of the nerves. Braun, of Leipzig, reached a compromise between the Infiltration and Regional Methods by his discovery that the use of an injection deeply *in the region of the nerve* produces an anæsthesia as complete as if the nerve itself had been infiltrated. The success of this method largely depended upon the introduction and addition of suprarenal extracts to the drugs employed. The operation became more bloodless, less toxic, and the anæsthesia more complete. Adrenalin, in fact, produces the same result as described by Schleich and Corning, when these workers adopted the use of a tourniquet. A tourniquet applied above the site of injection also renders the operation more bloodless, less toxic, and more

anæsthetic. I may here allude to a most recent and novel method of producing local anæsthesia introduced by Bier, of Berlin.

Here is the procedure he adopts, say, for an operation of excision of the knee :—

The leg is elevated to empty it of blood, a tourniquet is applied above and below the site of operation, a large vein, like the internal saphenous, is isolated between the tourniquets and divided. The nozzle of a syringe is introduced into the distal portion of the vein, and a local anæsthetic is injected. The fluid can neither go above nor below the region to be operated upon, being limited by the tourniquet, and is driven into the venous radicles, anæsthetising the adjacent nerves. A sufficient time is allowed to elapse and the operation is commenced. Complete excision of the knee may be painlessly performed, but before closing the wounds he again inserts a syringe into the original opening of the vein, and injects saline solution, the fluid pouring out through all the divided veins in the operation area like water from the rose of a watering can.

I may now pass on and mention some of the various drugs employed—Cocain, eucain β , tropa-cocain, stovain, and novocain. These are the best known. The last drug I personally have used combined with adrenalin, to the exclusion of the others, since its introduction. Cocain is still very largely employed, but it cannot be sterilised efficiently without destroying its properties. Its toxic disadvantages are well known; but in its favour it may be said that it is more diffusible amongst the tissues, consequently more immediate in its action, and it has the additional advantage over all, except novocain—it is a vaso-constrictor.

In my early experiences I have had three cases of cocain poisoning, though dilute solutions and non-poisonous doses were employed. One case is worth mentioning. The urethra was injected with about one drachm of a one per cent. solution while endeavouring

to relieve acute retention of urine. Not half a minute had elapsed when the patient showed signs of mental excitement, complained of cold, perspired profusely, and went into a state of delirium, with tonic spasms. The administration of stimulants was begun, and the case ended in recovery. Simon recorded a similar case, one of sexual neurasthenia, in which he used less than one grain of cocaïn to anæsthetise the urethra. There was a fatal result. If cocaïn is used, one-half per cent., or a much greater dilution, is sufficient for infiltration work. One per cent. should be the maximum strength even for regional anæsthesia. Patients will tolerate between two and three grains introduced in dilute solutions, but this amount must be looked upon as dangerous. As regards eucaïn, it has the disadvantage of being a vaso-dilator. It produces an analgesia only after an interval of about fifteen or twenty minutes; but it can be boiled, and is practically non-toxic in doses of from 2 to 6 grains. With stovain and tropa-cocaïn I have had no experience. Novocaïn, by the aid of which I have performed about two-thirds of the operations alluded to, has, in a word, all the advantages and none of the disadvantages of cocaïn. The solution I use has been until recently made by dissolving the commercial novocaïn adrenalin tablet in 7 drachms (25 c.c.) normal saline solution. This makes a one-half per cent. solution. Lately half this strength has been found adequate, and the tablet dissolved in 14 drachms. Three tablets—that is to say, 42 drachms of a quarter per cent. solution—can be used with impunity; but such an amount is never required. Novocaïn may be prescribed and kept for use in solution, a few drops of adrenalin being added after the former has been boiled, care being taken to wipe the rim of the neck of the adrenalin bottle with some carbolic lotion, lest some infective organisms be carried into the novocaïn solution. I have referred to the great use of adrenalin. It enables the regional method to be adopted without actually exposing the nerve, and since its introduction the infiltration

method can be employed successfully by injecting under the skin instead of into the skin—an obvious advantage. Curiously enough, against the opinion of all other writers, Schleich held that the fluids used for local anæsthesia should not be isotonic with the tissues, and should be cold. The reverse is really the case. In order to prevent irritation and lowering of the vitality of the tissues and consequent sloughing, the solutions used should be isotonic and injected at about body heat. Isotonic fluids do not swell the tissues or withdraw water. In this connection the freezing-point of body fluids has been ascertained, and a solution of cocaïn, eucain, or novocaïn, should approximate them in this respect. It has been found that these drugs, dissolved in .75 or .8 saline solution make the required isotonic fluid. For practical purposes the familiar normal saline, one drachm to the pint, is sufficiently accurate. The effects of injection of fluids into the skin may be exemplified as follow:—1. Three or four c.c.'s of any fluid produce an endermic wheal; the sensibility of the wheal varies according to the substance injected. 2. Normal salt solution produces an endermic wheal painlessly, but the sensibility remains unaltered. 3. Water, on the other hand, produces pain when injected, but in a few seconds complete anæsthesia supervenes. 4. A one in 10,000 isotonic solution of cocaïn produces painlessly an insensitive wheal. (Struthers.)

It is impossible to enter into a logical controversy on local *versus* general anæsthesia. Neither should be employed to the exclusion of the other. The disposition and wish of the patient and the nature of the operation, combined with personal experience, must guide every operator. Some argue that general anæsthetics are nearly always preferable on the grounds that the patient knows or sees what is going on, and to an untrained mind the paraphernalia of aseptic technique, the sight of instruments and blood, is more distressing than the experience of taking ether or chloroform. These points are undoubtedly worthy

of consideration, but you will find patients to whom a general anæsthetic is repugnant, especially amongst medical men; you will meet cases where you dare not give ether or chloroform on account of the age or general condition of the patient, and, provided you are not dealing with a hyper-sensitive or hysterical individual, local anæsthesia will be the method of choice. The preparation and the operation take longer, but the patient can go straight from the operating theatre to eat a good dinner, envied by his vomiting friend who is recovering from the effects of ether, and possibly already has developed chest complications.

In my own list of cases I can produce only one of abdominal section, though I would have no hesitation in opening the abdomen under a local anæsthetic whenever the occasion should arise.

To relieve an intestinal obstruction in desperate cases by the insertion of a Paul tube, or to drain the abdomen in cases of ruptured appendix or gastric ulcer when the patient is apparently moribund, local anæsthesia is not only the method of choice but unquestionably should always be employed.

With regard to abdominal sensitiveness, organs innervated by the vagus and sympathetic nerves—that is to say, kidneys, bladder, stomach, gall-bladder, intestines, mesentery, &c., all, in fact, below the level of the inferior laryngeal nerve—have no nerve apparatus for the perception of pain, touch, heat, or cold. This seems a sweeping statement, and a question at once arises, how do diseases of abdominal organs occasionally produce such intense pain? The answer is not far to seek, for pathological conditions produce mechanical, chemical, or inflammatory—that is to say, bacillary or toxic—irritation of the cerebro-spinal nerves, through which pain is transmitted. The sensitiveness of the parietal peritoneum is probably due to twigs from the intercostal lumbar and sacral nerves ramifying in the sub-serous coat. The secret of success in abdominal operations is to anæsthetise the abdominal

wall well and not to tear or pull the parietal peritoneum. In these, as in all operations, do not ask the patient if you are hurting him—questions suggest uncertainty and produce imaginary pain. The use of sharp instruments must always be a substitute for tearing and pulling or blunt dissection of any kind.

As the effects of a local anæsthetic begin to wear off in from one to three hours, a reactionary pain sometimes sets in. It may be defined as increased sensibility of sensory nerves due to congestion following anæmia of the part. Schleich added a little morphin to his solutions to diminish reactionary pain, but any effect it may have is general, and the same as is given hypodermically afterwards—a necessity which in my experience has never arisen. Some say that this reactionary pain is no worse than ordinary wound pain, and does not occur if the fluids used are isotonic. In my cases there has always been a little after-pain, whether I used isotonic fluids with or without adrenalin or whether I employed a tourniquet or not. It is always bearable, and, as far as I can see, no worse than the pain one sees after every-day operations. Reactionary shock has also been described; but this, like the pain, may be “a false creation” of the mind of enthusiastic workers. Spinal anæsthesia does not come within the scope of the paper. I have seen it many times employed on the Continent, and also by Barker in London, and I believe the method has a distinct but limited sphere of usefulness.

ILLUSTRATIVE CASES.

I.—P. R., aged seventy years; operated upon in November, 1907, for combined hernia and hydrocele. Bassini's operation and excision of the tunica vaginalis.

Usual skin incision after subdermal infiltration of the tissues, with $\frac{1}{2}$ per cent. isotonic novocaïn solution.

Region of external abdominal ring well injected with fluid, and needle passed under the aponeurosis into the internal oblique and transversalis muscles.

One syringe of fluid injected into and around the cord, and about a drachm into the interior of the hernial sac.

The operation was painless, the old man conversing on general topics during the various manipulations.

II.—F. D., aged twenty-eight; operated upon October 10, 1908. Their skin grafts removed from thigh to cover a large ulcer on the leg. Six square inches of the skin on the thigh were anaesthetised by endermal injection of novocaïn, and the skin was shaved off with a razor to the tops of the papillæ and nerve endings. The operation was quite painless.

III.—J. D., operated upon 5th September, 1908. Machinery accident. Finger amputated by Regional Method while the patient sat on a chair and described the accident.

IV.—E. B., aged sixty; operated upon September, 1908. Ruptured quadriceps extensor tendon. Subdermal infiltration of the tissues transversely across the site of injury. Tendon sutured with silk. Some pain was felt when passing the needle through the periosteum of the patella.

V.—E. G., operated upon November, 1908. Needle embedded for some weeks deeply in relation to carpo-metacarpal joints. Removed painlessly after some difficulty by means of subdermal novocaïn infiltration.

VI.—D. R., operated upon April, 1909. Varicocele removed. Novocaïn injected under the skin for about three inches in the region of the external abdominal ring. Cord hooked up and operation completed in the usual way. No pain whatever was felt. During operation a drachm of solution was injected into the spermatic cord.

VII.—E. B., operated upon September, 1908. Hammer toe rectified under regional anaesthesia. One per cent. novocaïn solution injected into region of digital nerves. Tourniquet employed. Toe swelled distal to tourniquet as fluid injected. Ellipse of skin bearing the corn removed. Excision of head of proximal phalanx. No sensation of pain during operation.

VIII.—A. D., operated upon November, 1908. Varicose veins. Infiltration of subcutaneous tissues superficial to vein in different portions of the leg. Anaesthesia complete.

IX.—Cellulitis of neck.

X.—Epithelioma of lip.