REFRESHER COURSE FOR GENERAL PRACTITIONERS

THE SURGICAL RELIEF OF PAIN*

BY

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Remembering that pain is but a symptom and its biological purpose for the most part protective, we must seek to allay its cause. This may, however, be unknown or imperfectly understood, as in trigeminal neuralgia, or well known but no longer within the range of effective local treatment, as in myocardial ischaemia or inoperable malignant disease. In such cases our efforts must be wholly directed to relieving the symptom of pain. Surgical methods for its relief will usually be considered only after lesser measures in the form of anodynes have failed or for any reason are no longer advisable.

Pain may be relieved or abolished by :

- (1) Removing its source, thereby eliminating the noxious impulses which are giving rise to it—for example, the pain of appendicitis by appendectomy, of gallstones or renal colic by getting rid of the offending calculi.
- (2) The administration of anaesthetics—for example, in tetanic spasms—or analgesic drugs—for example, morphine in cardiac infarction.
- (3) The interruption of the pathways of the painful impulses in order to abolish or modify their effects on the sensorium, either before they reach it or in the brain itself, by operations such as neurotomy, rhizotomy, chordotomy, medullary or mesencephalic tractotomy, or frontal lobotomy.
- (4) Increasing the blood supply to the painful part so as to reduce or abolish the pain of ischaemia.

We should also remember that irradiation will sometimes diminish the pain of malignant disease, though for a time it may make the patient feel very ill.

To employ surgical measures for the relief of pain in those cases in which it is not possible or feasible to attack the lesion which is its source, it is necessary to know the course taken by the painful impulses in the nervous system and those sites where they may be interrupted, either by sectioning or coagulation or by the injection of chemical substances such as procaine, alcohol, or phenol.

The Course of Pain Impulses

Pain impulses enter the posterior root ganglia of the spinal cord from spinal nerves and are passed into the cord by way of the central processes of these ganglia. In the substantia gelatinosa of Rolando they ramify in relation to cell bodies of secondary neurones, the axons of which cross in the anterior commissure over the course of a few segments and as a crossed tract (spino-thalamic) pass upwards in an antero-lateral position in the cord. After traversing the medulla and the brain stem these fibres end in cells in nuclei in the thalamus, whence they are connected by other neurones with the sensori-motor, orbito-frontal, and probably other parts of the cerebral cortex. Pain impulses also traverse certain parts of the sympathetic nervous system.

The passage of pain impulses may thus be interrupted at any of the following sites: (1) the nerves conveying them; (2) the posterior spinal root or roots; (3) the pain tract in the spinal cord; (4) the pain tract in the medulla; (5) the pain tract in the brain stem; or (6) the cortico-thalamic fibres in the frontal lobe.

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What Surgery Can Offer

Division of Nerves.—This is not often performed. In Buerger's disease the nerves to the foot have been severed in the hope of relieving the pain, but the operation is rarely effective. In certain cases of supraorbital neuralgia relief is sometimes obtained if the nerve is injected or divided as it leaves the supraorbital notch or foramen.

Posterior Root Section (Foerster's Operation).—This is effective in cases of localized root pain such as may be due to spinal arachnoiditis. It is not feasible to denervate completely the sensory part of a limb, for a painful condition in it, by dividing all the posterior roots of the plexus by which it is innervated. If this is done the limb becomes useless, since knowledge of its presence and position is lost to the patient. This operation of posterior rhizotomy, therefore, has only limited use, with the great exception, however, of the trigeminal nerve in facial neuralgia.

Posterior-root section of the Gasserian (trigeminal) ganglion is a most satisfactory operation for relieving the intense pain of major trigeminal neuralgia. The sensory (posterior) root is divided proximal to the ganglion, either by approaching it, as is the usual practice, by a temporal route or else through the posterior fossa of the skull. The division of the trigeminal root may be partial and selective, so that in cases in which there is no pain in the distribution of the ophthalmic division the medial part of the root, which contains the ophthalmic fibres, may be left intact and sensation thereby preserved in the cornea.

When divided, a sensory root, in contradistinction to a dendron—for example, a peripheral nerve or peripheral part of the trigeminal—does not regenerate, so that such divisions are permanent and the relief of pain is permanent.

Chordotomy.—The pain tract in the spinal cord may be divided by a cross-section of the antero-lateral area of that part of the spinal cord in which it lies or by a longitudinal section designed to cut the crossing fibres in the commissure. The latter operation is rarely practised, and antero-lateral chordotomy, performed a few segments higher than the level below which the pain is to be abolished, is the operation of choice (Figs. 1 and 2). It is employed for conditions such as an inoperable malignant disease. The result of the

FIG. 1.—Chordotomy. The section (black area) avoids the important crossed pyramidal motor tract.

FIG. 2.—Chordotomy. The cord is rotated by gentle traction on a slip of the dentate ligament and the section made in front of the plane of attachment of the ligament.

operation is to abolish pain and temperature sensations on the opposite side of the body below the section, light touch and the proprioceptive sensations being retained. There is a tendency for the level of analgesia to "fade," and recently emphasis has been laid on the necessity to be more radical in the section than had previously been thought to be necessary. The site and distribution of the pain determines whether the section is to be made on the opposite side of the cord alone or whether the operation is to be a bilateral one.

Dorsal Chordotomy for Painful Phantom Limbs.—In patients over 4 years of age amputation of a limb produces a phantom hand or foot which lasts for a varying time and then fades and disappears. In some cases (probably about 7%) pain, which may be intense, persists in the phantom member, which seems to the patient to be in a distorted posture, the pain being described as cramping, squeezing, or twisting in character. Various operations have been performed in an attempt to abolish this pain—for example, sympathectomy, rhizotomy, antero-lateral chordotomy, and even excision of part of the parietal cerebral cortex—without much success in most cases. A recent operation which has given relief and appears more promising is the division at an appropriate level in the spinal cord of the dorsal columns (tracts of Goll and Burdach) concerned with posture.

Medullary Tractotomy.—The incision is made in the brain stem between the origin of the vagal roots and the inferior olive; the indications are the same as for chordotomy, with the addition of trigeminal neuralgia, since the descending root of the trigeminal nerve can be divided at this level (Fig. 3). This is not the most popular operation for

FIG. 3.—Medullary tractotomy. The section is made between the origin of the vagal roots and the inferior olive.

trigeminal fibres, is superficial and its division produces hemi-analgesia. Queer sensations (dysaesthesia) are reported, however, as occurring later in some cases, and as sensory disturbances of this type do not follow more caudal sections—for example, chordotomy and medullary tractotomy—the mesencephalic operation is not often performed.

Prefrontal Leucotomy.—Ablation or section of the frontal lobes lessens or abolishes stress and thereby the intensity of pain, but produces changes in personality. The operation does not abolish the perception of pain but relieves the suffering from it so that the patient may regard it lightly or even humorously. This operation raises the question whether the surgeon has the moral right to produce irreversible changes in those structures which constitute the matrix of the mind and so alter the personality of a fellow being, but this is perhaps less debatable if the patient suffers from inoperable malignant disease. Recent work, however, has made this question less significant by showing that pain may be relieved by far less extensive operations on the frontal lobes than their removal or transection by the usual type of lobotomy. The section need only be confined to the medial ventral quadrant of the lobe, with the result that the appropriate cortical connexions of the thalamus are severed, while the lateral parts of the

lobe which constitute the neopallium and are primarily concerned with learning, memory, and intellectual functions are left intact. Realization that the area in which interruption is essential for the relief of pain is thus restricted anatomically is an important advance, and still further progress has been made by the use of an insulated needle-electrode to coagulate a barrier of cerebral tissue in the area concerned* instead of dividing it through a cortical incision. Whether this limited orbito-frontal leucotomy relieves pain by relieving anxiety and tension or by severing visceral afferent cortico-thalamic fibres is disputable, but the fact that pain can be so relieved is definite. Pain which is associated with undue mental stress or other emotional factors is the type for the relief of which these operations on the frontal part of the brain are particularly effective.

Sympathectomy.—In painful conditions due to ischaemia, in which improvement in blood supply by relaxing the arterioles can be brought about by sympathectomy, this operation may be indicated. Thus in early cases of thromboangiitis and of arteriosclerosis in which there is associated vasospasm causing claudication, lumbar ganglionectomy may give welcome relief. In cases of causalgia after peripheral nerve injury or following amputation—for example, of a digit—sympathectomy may also be palliative. The operation has also been successful in certain cases of dysmenorrhoea, the sympathetic fibres in front of the sacral promontory and constituting the nerve of Latarjet or the Frankenhauser plexus being divided (the Cotte operation). Cervico-thoracic sympathectomy has also been employed with success in cases of angina pectoris.

Other methods of relieving pain, such as the intrathecal injection of alcohol or radiotherapy in malignant disease, need only be mentioned here. It will be seen that we have ample resources to enable us, when other measures fail or are contraindicated, to relieve pain by surgical methods. For this reason, and also because it is our duty to preserve and not take life, no case can be made for introducing legislation for euthanasia.

"And that must end us; that must be our cure,—
To be no more. Sad cure! for who would lose,
Though full of pain, this intellectual being,
Those thoughts that wander through eternity."

Paradise Lost, Book 2, lines 145-8.

Of the foregoing operations for the relief of pain the most successful and most often practised are root section for trigeminal neuralgia, sympathectomy for vascular insufficiency, and antero-lateral cordotomy for intractable pain in malignant disease.

Indications for Surgery

Whether to employ analgesic drugs or surgical methods must be determined by the state of the patient and the condition from which he suffers. The decision will be influenced by his probable length of life, and generally speaking it may be said that if this is likely to be short morphine and its allies are indicated, while if it is likely to be prolonged surgical methods may better be employed.

When pain is purely psychological in type caution is necessary and operations should be avoided. The numbness which follows the analgesia produced by operation in such cases may be as great a source of complaint as the original pain, and as the numbness cannot be relieved the last state of the patient is worse than the first. One type of case which may come into this category is the young adult, usually a woman, with pain in the face. We should hesitate to diagnose true trigeminal neuralgia in patients under 50 who do not have recurrent attacks confined strictly to the field of distribution of one or more branches of the trigeminal nerve.

Finally, let us not forget that the ideal, though not always practicable, treatment of pain by surgical methods is to find the cause and remove it.

*E. G. Grantham, *J. Neurosurg.*, 1951, 8, 405.

Conclusion

When faced with a patient with persistent and intractable pain, for whom the continued administration of analgesic drugs is for any reason undesirable, the practitioner may do well to consider surgical treatment. This may comprise the severance of nerves or nerve roots or the pain pathways in the central nervous system, or their interruption or destruction by the injection of chemical substances such as procaine, alcohol, and phenol, or by electro-coagulation. If the patient's suffering is likely to be prolonged and the pain intense, and if the cause cannot be eradicated at its source, and addiction to morphine or its derivatives is an undesirable alternative, a good case may be made for employing surgical methods.

I am much indebted to my colleague Mr. Cecil Lewis, F.R.C.S., for the drawings.

Next Refresher Course Article.—"Glandular Fever," by Sir Henry Tidy.

THE CONTROL OF NEW REMEDIES*

BY

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I have chosen "The Control of New Remedies" as the subject of my address because of an uneasy feeling that when new and powerful remedies are evolved the restrictions upon their use in the early stages may often seem unreasonable and even irritating to practitioners eager to give their patients the best treatment possible, and this in spite of the explanatory notices we put in the medical press.

Now, new remedies are of many different kinds and need control for many different reasons, ranging from the really dangerous untried remedy which must be carefully evaluated before doctors are in a position to use it safely to the harmless nostrum which may waste the private resources of the patient or the public resources of the Exchequer or postpone efficient treatment of some fatal disease until it is too late.

I propose to discuss first the control of those remedies usually known as "biologicals," and such control may be divided into three categories: (1) control of importation; (2) control of manufacture for sale; (3) control of distribution.

1. Control of Importation

The Government Departments primarily concerned with this form of control are H.M. Customs and Excise and the Board of Trade, but they depend on the Ministry of Health for expert advice where medical remedies are concerned. This is especially so in the case of those remedies which may be considered "therapeutic substances" within the meaning of the Therapeutic Substances Act of 1925—that is, substances "the purity or potency of which cannot be adequately tested by chemical means." These are the substances usually known as "biologicals," many of which are covered by the generic names of vaccine, toxin, antitoxin, antigen, but which include other substances specifically named in the schedule to the Act, such as insulin, surgical ligatures and sutures, the arsphenobenzene compounds, penicillin, blood products, etc. I will not go into the details of this Act and the necessarily complicated regulations made under it, which came into force in 1927, and which I have administered since 1928, but I would merely ask you to note that, though it provides a most valuable safeguard against the importation of dangerous or useless preparations of such substances, there are many others which, at any

rate at first, are not caught by this net, either because they are of a kind to which the Act does not apply or because they are not mentioned, either individually or generically, in the Schedule to the Act. In such cases we have to consider whether the substance should be added to the Schedule if suitable, and whether on medical grounds we can recommend its admission to this country. Such advice is often difficult to give. For example, the antibiotics are being developed in a continuous stream, mostly in the United States, and the issue of each new one is accompanied by glowing claims for its effectiveness in a number of different infections. But we have to determine, in the first place, whether it is worthy of serious attention, and whether it is of sufficient importance to merit all the labour involved in devising a schedule to the Therapeutic Substances Regulations, laying down what tests for potency, toxicity, pyrogenicity, etc., it must pass. Even when we decide we must take it seriously it may still be a long time before satisfactory tests of this kind can be devised to safeguard the patient. In this task, however, the Medical Research Council gives us invaluable aid, though it cannot, of course, be expected to carry out such expensive and laborious investigations in the case of every remedy for which value is claimed.

I would here draw attention to some relevant considerations. First, we are often faced with applications to import a quantity of some new remedy "for research purposes." Obviously our pharmaceutical manufacturers, some of whom maintain research establishments of very high class, should not be hampered in their investigation of new remedies from abroad (on which they may often improve), but it must be remembered that "research" may mean something very far short of scientific investigation, and that the free distribution of new remedies to doctors is a well-established method of "creating a market," the customers in which may not be as discriminating as we would wish. The foreign manufacturers, moreover, well know that the new remedy, on the development of which they have perhaps spent vast sums of money, may be superseded in a short time by a superior rival, so they have got to recoup themselves as quickly as possible.

Of course, dollar expenditure has to be taken into consideration in making decisions (in 1951 we spent over \$187,000, or nearly £67,000, on cortisone, and over \$582,000, or more than £208,000, on A.C.T.H. and this year we shall be spending more), but fortunately this is an aspect on which the medical side of the Ministry is not expected to tender advice. I must, however, say a word about "free gifts," as this is a question with important medical bearings, and I will take cortisone as best illustrating my points. The importation of free gifts of medical remedies is usually permitted, though H.M. Customs can forbid it if they choose. Many kind persons in the United States, both medical and lay, have sent free gifts of cortisone to doctors here for use in particular cases, or direct to the patients themselves, and you may reasonably ask, "Why not?" Well, there is one very important consideration in such cases, apart from the danger of administration to the patient without proper control—namely, the starting of a treatment which cannot be maintained. I have received many, and often pathetic, appeals for cortisone for the treatment of patients with rheumatoid arthritis who have been greatly benefited by the injection of "free gift cortisone," the supply of which has failed. Usually I have been forced to refuse the request, though I knew that the last state of the patient would be worse than the first, because our limited supplies of cortisone—all that the manufacturers have been able to let us have—must, in fairness to the general body of patients and in order to obtain reliable information about its best method of use, be distributed to the 56 centres now holding it, where there are experienced physicians and adequate laboratory facilities.

And what of applications to import cortisone against dollar payments? Well, there are two cogent objections to allowing such applications. The first is that this means "jumping the queue," and that it would be unfair in prin-

*An address delivered to the Nottingham Medico-Chirurgical Society and the Nottingham Branch of the British Medical Association on February 27.