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Neurosurgical Procedures for Relief of Pain

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INDEX

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I. NEUROSURGICAL PROCEDURES FOR THE RELIEF OF PAIN

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INTRODUCTION

The purpose of this report is to outline the various surgical methods of relieving intractable pain, and to present the results obtained by these procedures. The data have been collected from the Neurosurgical Service at the University Hospitals and at the Veterans' Administration Hospital. Indications, methods of procedure, and results are included. The follow-up material was obtained either by recalling the patient for direct examination or by a questionnaire.

The relief of pain is one of the physician's primary responsibilities. The most logical treatment of any pain is to remove its cause; but, not uncommonly, this is impossible. In such instances some measure must be taken solely to affect the pain. In patients with chronic intractable pain, surgical interruption of the pain pathways may be necessary. In this presentation, interruptions of the pain pathways at various points from their peripheral endings to the cerebral cortex are considered.

ANATOMY AND PHYSIOLOGY OF PAIN CONDUCTION

Painful impulses are received at naked nerve terminals which are specific for that sensation, and are scattered throughout the skin. They are carried through myelinated and non-myelinated fibers of various sizes, either (1) directly to the posterior root ganglia of somatic nerves, or (2) indirectly in sympathetic nerve trunks, through the sympathetic ganglia then, via the white rami communicantes, to the posterior root ganglia.

Sensory nerve fibers have been classified according to their size, and also according to the speed with which they conduct impulses. The latter is measured by oscillographic recordings of action potentials from a nerve trunk during the transmission of afferent impulses. Gasser and Erlanger[8] found that these two classifications, anatomical and physiological, correspond. The large myelinated fibers, ranging up to 20 micra in diameter, conduct at speeds up to 100 meters a second. They have been designated as belonging to Class A. Class B fibers are also myelinated but are smaller, being less than 3 micra in diameter, and conduct impulses at a rate of 3 to 14 meters per second. Class C fibers are unmyelinated and conduct at less than 2 meters per second. The demonstration of the existence of both fast and slow pain sensation is easily made with the application of a single appropriate stimulus. When such a stimulus is applied, there are felt two distinct flashes of pain, one coming almost at once, and the other after a discernible delay. The second may be more intense and prolonged. Gordon and Whitteridge[9] have been able to correlate the reception of impulses from fast and slow pain with changes of the alpha rhythm of the electroencephalogram. Bright pricking pain appears to be carried in the thick rapidly conducting myelinated fibers. Burning pain, felt in the skin, is carried in the fibers of smaller size which conduct more slowly. Aching pains in the muscles, bones, and viscera are carried mainly in sympathetic chains, presumably by both myelinated and unmyelinated fibers of varying size. Burning pain can be induced, as shown by Förster[32], by stimulation of the cut peripheral end of a sensory nerve if the innervation of adjacent areas is intact. The mechanism of this phenomenon has not been explained, but it may depend upon the liberation of some substance at the terminals of the cut nerve which in turn stimulates terminals of adjacent nerves. The cell bodies of <u>all</u> sensory nerves are found in the posterior root ganglia. From there, dendrites of neurons which subserve pain, enter the cord along the posterior lateral sulcus and penetrate the gray matter in the region of the posterior horn. Here the impulses switch to a second neuron, whose cell body is in the posterior horn, and are promptly transferred to the opposite side of the cord via the anterior commissure to the

lateral spino-thalamic tract, and then up the cord to the lateral nucleus of the thalamus. Some phylogenetically older fibers appear to travel in the spino-tectal tracts to end in the roof muclei of the mesencephalon. Those impulses, which travel to the thalamus, are relayed by neurons located in the thalamo-cortical radiation, and go to the postcentral area of the cerebral cortex, where the arrangement is such that those fibers from the medial portion of the thalamic nucleus (that is the cephalic parts of the body) end in the lower part of the postcentral gyrus. Those from the lateral portion of the thalamic nucleus (from the caudal parts of the body), end in the paracentral region, and those from the middle parts end in the intermediate region. Here, connections are made with the highest integrative levels for the interpretation of the painful sensation and doubtless the formation of the individual's reaction to it.

Appropriate noxious stimuli applied to any body structure equipped with pain endings may give rise to the sensation of pain. Whether or not pain occurs depends upon the integrity of the pathways mentioned, the nature of the stimulus, its intensity, and the individual's pain threshold. The nerves, which subserve pain, continue to conduct the sensation as long as the stimulus is applied. Thus, for painful stimuli no true adaptation occurs as it does for touch.

Deep pains characteristically spread to be felt in areas other than those stimulated. The spread may involve deep or superficial pathways or both. This effect has been called referred pain. It is attributed to the spread of excitation in the neuro-axis to other portions of the same segment, or to segments adjacent to those into which the noxious impulses are conducted. This gives rise to pain experienced in parts innervated by deep and superficial branches of the affected segments and to a variety of motor effects. In general, the more intense the noxious stimulation, the more widespread is the area of reference. The central spread of excitation also appears to give rise to a stage in which sensory impulses coming in over the segment at their usual threshold values seem more intense and more persistent than they otherwise would. For example, noxious stimulation of an area of referred pain is often productive of more discomfort than stimular stimulation of an uninvolved region. Its actual threshold for continuous pain, however, is not altered. This phenomenon is included in the term hyperalgesia. Such hyperalgesia follows noxious stimulation of either superficial or deep structures, and is usually spoken of as local tenderness. In an area of skin involved in a process of referred pain, not only do pain sensations arising from noxious stimulation appear intensified, but so do all sensations arising from other sensory stimuli. An example of this central reinforcement of sensory impulses, other than those subserving pain, is illustrated by the intensification of a light stimulus in an eye whose conjunctiva is painful because of the presence of a cinder (Wolff and Wolf[32]). This example also establishes that the effects of a central spread of excitation may involve not only the segmental levels but also the suprasegmental, including the cerebral cortex. In fact, the hyperalgesia and hyperesthesia due to accentuation of the effects of sensory impulses arising in the tissues of a segment involved in a process of referred pain may constitute the principal element of discomfort from a given visceral disease. A number of investigators have observed that local anesthetization of the superficial tissues by procaine, greatly reduces the patient's discomfort by blocking impulses arising in the skin. Undoubtedly there are other factors involved in this phenomenon of referred pain. Procainization of these superficial tissues is capable of blocking stimuli arising in the anesthetic area but not of interrupting the central spread of excitation within the cord. Wolff and Wolf[32] demonstrated that when a tooth is stimulated causing headache, there also is a superficial and deep hyperalgesia of the temporal region of the head. Infiltration of procaine into the hyperalgesia skin and underlying soft tissues reduces but does not eliminate the headache, although it may

produce local analgesia. They then demonstrated that all headache, however, can be eliminated by local infiltration of procaine about the tooth. It is therefore, evident that when pain results from the persistance of the primary visceral or deep noxious stimulation, its intensity may be modified by either superficial or deep procaine infiltration or both, but it is not entirely eliminated until the primary afferent impulses end either spontaneously or are surgically or chemically blocked at their source. Blocking agents, with few exceptions, are temporary. It is for this reason that surgical procedures need be instituted for permanent relief. The site of surgical severance is influenced by both the site of origin and the character of the pain.

ABLATION OF HYPERALGESIA AREAS

The ablation of receptors in the skin is rarely, if ever, indicated, but can be accomplished by excision of the involved segment of skin[1]. Simple undercutting has also been used. Our experience with these procedures is limited to five patients suffering from post herpetic neuralgia. The painful skin was excised. In no patient was complete relief obtained, but two had much improvement, two, some improvement, and in one there was no relief.

PROCEDURES ON PERIPHERAL NERVES

Section and other local procedures on the peripheral nerve are indicated only when the lesion clearly and exclusively affects a single nerve. Such sections of peripheral nerves, most of which are mixed, produce an undesired motor loss in addition to loss of all sensory modalities. Then, too, a severed nerve is very prone to develop a painful neuroma (Lhermitte and Puech[17]). Excision of the neuroma leads only too often to recurrence. In this series there were 26 patients who had excisions of painful neuromas, in several of these patients repeated excisions were performed. The ultimate outcome in 16 was total failure, in six there was some relief obtained, and in four the relief was complete.

Recently, a new method of treating painful neuromas has been tried here. This technique consists of leaving the neuroma in situ but twice sectioning and suturing the nerve several centimeters proximal to the neuroma. Theoretically, when the regenerating fibers reach the distal anastomosis, they are blocked within the neurolemmal sheaths, making neuroma formation improbable. This has been attempted in two patients with a good result in one. They are included in the above totals; both had at least one previous failure of simple neuroma excision.

Neurolysis is the procedure of freeing up a nerve from surrounding adhesions. Since pain can arise from incompletely divided or scarred nerves, it is not uncommon to explore these traumatized areas. If, at the time of exploration, the nerve is found to be incompletely severed and important motor function is retained, one hesitates to destroy this function. Hence, the nerve is simply freed from scar as well as possible, i.e., a neurolysis is done. In this series there were six patients on whom neurolysis were performed. One patient obtained total relief, four partial, and one, no relief.

Neurotomy is the sectioning of a peripheral nerve. In six patients in this series, an attempt was made to relieve pain by division of a peripheral nerve. These are listed below:

Divided Nerve	Pathological Lesion	Result
Ninth intercostal	Post-thoracotomy neuritis.	Partial relief
Ulnar	Pain in traumatically amputated 5th digit.	Temporary relief
Obturator	Legge-Perthes disease.	No relief
Lateral femoral cutaneous	Post-traumatic neuritis.	Temporary relief
Digital	Pain in traumatically amputated 5th digit.	Relieved
Pudendal	Post-prostatectomy neuritis.	Relieved

Rhizotomy: The sensory and motor components of a nerve become separated as ventral and dorsal roots within the spinal canal. Hence, dorsal rhizotomy is a logical operation but has the undesirable effect of destroying all sensory modalities. Posterior rhizotomy of all the nerves to an extremity renders the limb useless. Furthermore, the primary sensory area of one dorsal root is so invaded by fibers from adjacent roots, that section of a single root produces little or no demonstrable sensory loss. Foerster's[4] extensive experience proved that two or even three roots above, below the primary area must be divided. Even a small lesion may involve the primary sensory areas of several roots; thus an operation for complete pain relief may become prohibitively extensive. Posterior spinal rhizotomy is applied today for the relief of pain in the neck, thorax, in an already useless limb, and in cases of primary nerve root involvement as in very localized disease of the spine[6,21]. The increasing employment of high cervical cordotomy is limiting the use of rhizotomy even more.

DORSAL RHIZOTOMY

Relief	Vertebral Disease	Phantom and Stump Pain	Traumatic Neuritis	Cancer	Neuritis Cause Unknown
Good	1	1	2	5	1
Fair	3	0	1	3	0
Poor	4	4	0	1	1
Total	8	5	3	9	2

THORACIC CORDOTOMY

Pain fibers (the axons of dorsal root cells) enter the spinal cord through the lateral division of the dorsal root and ascend a short distance (about two segments) in the dorsolateral tract of Lissauer to synapse in the substantia gelantinosa Rolandi. The neurons of the second order cross almost immediately through the ventral commissure and gather as a more or less compact, discrete bundle of ascending fibers (the lateral spinothalamic tract) in the anterior half of the lateral funiculus. As the lateral spinothalamic tract ascends, fibers from each higher segment are added to its ventromedial border so that in the cervical region the most posterior fibers are from the sacral segments with lumbar, thoracic, and cervical forming successive anterior layers. This arrangement means that an incision of the tract which misses the more posterior fibers will leave intact some sacral innervation, or if not carried sufficiently anterior, the upper level of denervation will be several segments below the level of incision (Hyndman & Van Epps[13]).

Section of the lateral spinothalamic tract[26] is one of the most popular and effective operations for the relief of pain[30]. The operation must be performed several vertebral levels above the upper limits of pain[15,30]. Except in the cervical regions, the spinal cord and vertebral levels do not correspond because the spinal cord is shorter than the vertebral column. For example, the second thoracic spinal cord segment is opposite the first thoracic vertebral segment and the fifth sacral spinal segment is opposite the second lumbar vertebral segment. At least two segments are required for incoming pain fibers to be gathered into the lateral spinothalamic tract. For these reasons, a cordotomy for pain relief seldom is done below the upper thoracic (vertebral) levels.

This series includes 75 patients who had as the primary operation unilateral

high thoracic cordotomy. In 56 of these, there was ultimately complete or nearly complete relief of pain in the original site--in 5 patients it was necessary to repeat the operation because the spinothalamic tract section was incomplete with unsatisfactory loss of pain sensation. In 13 patients severe pain later developed on the other side. Five of these had cordotomies done in the uncut side and obtained complete pain relief.

UNILATERAL THORACIC CORDOTOMY

Complete Relief of Pain

Cause of Pain	NO.
Cancer	40
Phantom Limb Pain	3
Post-exploration for Herniated Intervertebral Disc	1
Ischemic Neuritis	1
Paget's Disease of the Spine	1
TOTAL	46

UNILATERAL THORACIC CORDOTOMY

Partial Refief of Pain

Cause of Pain	NO.
Cancer	7
Phantom Limb	2
TOTAL	9

UNILATERAL THORACIC CORDOTOMY

Little or No Relief of Pain

Cause of Pain	NO.
Cancer	6
Phantom Limb	1
Tahetic	1
Post Herpetic	1
TOTAL	9

Two of the patients with cancer who obtained no relief were redone as high cervical incisions and are included also in the summary of that procedure.

In 74 patients, primary bilateral high thoracic cordotomy was done. Seven of these patients died in the hospital, not necessarily from the operation but from the advanced stages of the cancer. Three of them may be attributed to surgical shock superimposed on their poor general condition. Of the remaining four one had a cerebrovascular accident several days postoperatively and the other three expired from pneumonia. Interestingly, these patients with pneumonia all had rather extensive pulmonary metastases.

BILATERAL THORACIC CORDOTOMY

Good Results

Cause Pain	NO.
Cancer	47
Cauda equina injury	2
Phantom limb pain	1
Chronic interstitial neuritis	1
TOTAL	51

In one of these one side was recut twice before an adequate level was obtained and, in another, one side was recut.

BILATERAL THORACIC CORDOTOMY

Fair Results

Cause of Pain	NO.
Cancer	11
Tuberculous Cystitis	1
TOTAL	12

One of these patients had one side recut once.

BILATERAL THORACIC CORDOTOMY

Poor Results

Cause of Pain	NO.
Cancer	4
TOTAL	4

Sacral sparing and inadequate levels were conspicuous causes of failure[14,31]. In some records the cause of failure was not obvious. In a few, pain persisted despite an apparently adequate level.

CERVICAL CORDOTOMY

Following the standard procedure of high thoracic cordotomy a sensory level usually is obtained up to the level of the umbilicus (T_{10}). Consequently this procedure is inadequate to accomplish relief of pain in regions cephalad to the lower abdomen. Pain arising from midabdominal structures cannot be relieved with thoracic cordotomy. Many surgeons, Foerster[5] and Stookey[27] among the first, have performed cordotomies in the high cervical levels for relief of pain located between the lower abdomen and neck. This operation has only recently been generally accepted. Interference with the motor fibers to the diaphragm and intercostal muscles occurs if the cut is not too deep[22].

Unilateral high cervical cordotomy was undertaken initially in 26 patients. There were no deaths in this series.

HIGH CERVICAL CORDOTOMY

Complete Relief

Cause of Pain	NO.
Cancer	20
Tabetic	2
Phamton Limb	1
TOTAL	23

HIGH CERVICAL CORDOTOMY

Incomplete Relief

Cause of Pain	NO.
Tabetic	1
Phantom Limb	1
TOTAL	2

The patient with phantom limb pain who had incomplete relief of pain actually had an inadequate cord section, i.e., analgesia was complete to the C_7 level but incomplete between C_7 and C_4. This can only be a criticism of the way the procedure was performed.

Ten of the 26 patients with unilateral high cervical cordotomies developed pain on the opposite side. Three of the ten had cordotomies done to relieve this pain. In one, a high thoracic section was made and in two the section was in the high cervical region.

One of these two died of respiratory failure the day after surgery.

Primary bilateral high cervical cordotomy was performed in 6 cancer patients with 3 good results and 3 deaths. Two deaths were due to cardiac arrest after the dura was opened and before the incisions in the cord were made. Obviously they were extremely poor surgical risks and it is felt that they cannot truly be called deaths specific to the procedure. The other death was due to respiratory failure three days after surgery. The patient had had an adrenalectomy previously for his extensive metastases.

High cervical cordotomy to affect the side of maximum or most rostral pain was combined with contralateral high thoracic cordotomy in 11 patients. There were 2 postoperative deaths, one from pneumonia and one from combined operative trauma and debilitation due to cancer. Of these 9 survivors good relief was obtained in 7, of whom 6 had cancer and 1 was a tabetic.

In one patient the thoracic cut was repeated.

High cervical cordotomy on one side with contralateral mid-cervical cordotomy was done in only 2 patients, both had cancer pain and were relieved.

The physiological result obtained in the adequate operation is a complete loss of pain and temperature sensation beginning about four segments below the spinal segment incised. Touch, sensation, position sense and proprioception are intact. Other sequelae which may be considered complications are found on occasion[31]. Motor strength on the side of the incision may be lessened but seldom is there any permanent loss. Motor function of the bladder is often impaired but relatively normal function is nearly always recovered in those who do not have contributing factors such as benign prostatic hypertrophy or malignancy involving the bladder or its nerves. Transurethral resection has been necessary in some of our patients and a few have been discharged with indwelling catheters. In high cervical cordotomies, the bladder complications have occurred more frequently than with thoracic cordotomies[31], probably due to greater cancer involvement in the former. Fecal incontinence has seldom been noted[31].

All these patients should be told that the protective function of pain is absent, but occasionally, despite emphatic warnings, patients have injured themselves without realization of injury or else have neglected an injury because it is not painful.

In bilateral cordotomy, postural hypotension presumably on the basis of interruption of sympathetic fibers has been an occasional problem.

High cervical cordotomy, if too extensively performed, may interrupt the motor fibers to the diaphragm[31]. Three of the postoperative deaths in this group, in addition to the patient discussed above, were due to respiratory complications on the side of the high cervical cut. Two other patients had atelectasis which responded to treatment.

Follow-up to determine the longer term results of pain relief in terminal cancer patients has proved a problem to us as it has to previous reporters on the subject. Certainly, some patients may have developed recurrence of pain after they passed from our observation. In others death followed in a few weeks and recurrence of pain might have resulted, had there been a longer survival. Cordotomy has not been done unless there is a probable survival of at least 3 months. In evaluation of the results here reported it is considered good if the operations relieved the preoperative pain since this was the objective of the operation. Most patients with malignancy of the torso should have a bilateral operation at the outset because of the high incidence of postoperative pain on the other side--23 of 101 in our series.

High cervical cordotomy has made it possible to offer relief to a previously unrelieved group of patients. It has been particularly effective in patients with malignant infiltration of the brachial plexus. It appears to be the most effective measure against phantom limb and tabetic pain. It has almost entirely replaced dorsal root rhizotomy except for pain in the upper four cervical segments.

It would also seem that there is less variation in the levels obtained in the high cervical operation than in the high thoracic. Probably, the lateral spinothalamic tract is more consistent in its anatomical structure and position at this level (Kahn)[14].

MEDULLARY AND MESENCEPHALIC TRACTOTOMY

Interruption of the lateral spinothalamic tract at various levels in the brain stem has been reported sporadically. They are technically very difficult operations. Our series includes two incisions at the medullary level and one in the mesencephalon. Poor levels were obtained in the first two and the third resulted in a postoperative mortality.

Speigel and Wycis[33] have continued clinical studies with a human stereotaxic

machine. Utilizing predetermined coordinates an insulated needle is passed through a trephine opening so that its unshielded tip lies in the desired tract or nucleus, which is then destroyed by electrocoagulation. They have attacked the spinothalamic and trigeminal tracts in the mesencephalon and also the sensory nuclei of the thalamus. This is a most interesting operation. If their coordinates are valid, it is a theoretically effective method, but their published reports are too preliminary to evaluate.

LOBOTOMY

A more philosophical approach to pain relief may be used. The pure sensory impression of pain is believed to reach the level of consciousness in the thalamus. The unpleasantness associated with the sensation of pain and not found with the other sensations such as touch and position is considered to be a matter of psychic interpretation dependent on the connection of the thalamus with the frontal lobes. This has led to the application of such operations as lobotomy[7,18] and topectomy[20] (in which these connections are destroyed) for the relief of pain. In an ideal result the patient would be apparently intact mentally and completely aware of the sensation of pain; his ability to suffer from the sensation of pain would be removed. Too often an operation, adequate for the relief of suffering causes such profound psychic changes that the valadity of the operation for pain relief has been challenged by many leading neurosurgeons [11,28]. Unilateral lobotomy[23] and topectomy[20] are reported to be effective without such severe mental changes.

We have had 6 patients with primary unilateral lobotomy or topectomy. In none were there any great mental changes. Two patients were relieved, two were improved, and two were failures. One of the failures had good relief with minor mental changes when the lobotomy was made bilateral.

The results of 11 other patients who had bilateral lobotomies are tabulated below:

7 Cancer Patients:

- 2 Postoperative deaths
- 2 Relieved with few mental changes
- 2 Relieved with definite mental changes
- 2 Relieved with severe mental changes

1 Thalamic pain relieved with moderate mental changes

1 Pain in traumatic paraplegia relieved with definite mental changes

1 Arthritis with excellent results

1 Phantom limb pain--a complete failure in pain relief with moderate mental changes.

The role of the parietal sensory cortex in the perception of pain is undetermined. Scattered reports can be found of its removal to relieve pain with varying results[3,12]. One[16] of the most recent reports emphasizes operation under local anesthesia with electrical stimulation to locate a cortical area which reproduces the pain. These authors believe that in patients with chronic pain states, cortical representation in the parietal sensory cortex is present.

SYMPATHECTOMY

Visceral pain eventually reaches the lateral spinothalamic tracts but it must traverse the sympathetic pathways first and enters at a higher cord level. Certain forms of pain can therefore be relieved by sympathectomy or splanchnicectomy or both. The pain associated with Sudek's atrophy (sometimes called reflex sympathetic dystrophy), renal stones, the shoulder hand syndrome, chronic pancreatitis, cholecystitis, carcinoma limited to the viscera, and the pain of causalgia and angina pectoris have been reported to be relieved by removal of the proper sympathetic tissue[29]. It is probably imappropriate in cancer because early spread to somatically innervated structures can be anticipated.

Our patients are tabulated:

Chronic pancreatitis	3 Complete relief
Chronic pancreatitis	3 incomplete relief
Post-herpetic pain	1 incomplete relief, 1 failure
Phantom limb and amputation stump pain	1 complete, 3 incomplete, 3 failures
Painful peripheral nerve injuries	2 complete, 3 incomplete, 2 failures
Angina	2 complete, 1 incomplete, 1 failure in a very neurotic individual
Ischemic neuritis	2 complete
Pain of unknown etiology (preoperative temporary response to procaine sympathetic blocks)	3 failures

TRIGEMINAL RHIZOTOMY AND TRACTOTOMY

The relief of pain in the face and neck poses special problems. If limited to the distribution of the trigeminal nerve, the sensory root can be sectioned using the technique developed for the relief of trigeminal neuralgia. This may be done by either the temporal[25] or suboccipital routes[2]. Another point of attack is the descending sensory tract of the trigiminal nerve which follows the peculiar course of passing caudad from the pons into the medulla and upper cervical spinal cord before it passes to the opposite side to ascend to the thalamus[24]. It is a compact tract conveniently located for surgical attack but involves a more difficult exposure and its section is often complicated by incomplete relief and the presence of incoordination[19].

Pain deep in the pharynx can be relieved by intracranial glossopharyngeal section[10].

Pain limited to neck structures can conveniently be relieved by posterior root section, a relatively innocuous procedure in this location[10].

However, painful lesions are seldom limited to only one of the nerves supplying the head and neck and combined procedures can be done such as spinal 5th tractotomy and glossopharyngeal root section to which may be added cervical dorsal rhizotomy[10].

Procedure	Pathology	Result
Alcoholic injection of the gasserian ganglion	2 Cancer	1 complete, 1 partial
IXth nerve rhizotomy	1 Cancer	Partial
Vth nerve rhizotomy	1 Cancer	Prolonged relief
Vth nerve rhizotomy and dorsal cervical rhizotomy	1 post-herpetic pain	Failure
Descending Vth tractotomy	2 atypical facial pain. 2 Cancer	2 Failures 2 Relieved
Descending Vth tractotomy and dorsal cervical rhizotomy	7 Cancers	6 Relieved--2 died 10 days postoperatively 1 partially relieved
Descending Vth tractotomy IXth nerve rhizotomy and dorsal cervical rhizotomy	11 Cancers	2 postoperative deaths 7 complete relieved 1 partial relieved 1 relieved, except for pain in the ear
Descending Vth tractotomy IXth and Xth nerve rhizotomy and dorsal cervical rhizotomy	2 Cancers	Both relieved but died before discharged from the hospital

Certain patients in the terminal phase of malignancy may suffer such terrible pain that rather destructive procedures which have a low mortality may be employed. We prefer to reserve prefrontal lobotomy for such cases. Only when mental changes such as severe depression accompany the pain does lobotomy in the good risk patient become indicated. Recently, infiltration of the frontal lobes with procaine has been suggested as an adequate and safer substitute for surgical incision of the frontal lobes. This has been performed in one patient here with relief for the last six weeks of his life.

Destruction of the spinal cord with alcohol injection can be used in the already bedridden terminal patient. In this series were two patients in whom such injections were made. Very satisfactory relief was obtained in both.

SUMMARY

The neurosurgical procedures available for the relief of pain have been discussed and our experiences with them presented.

Most patients with intractable organic pain can be relieved by the properly selected and executed operation. An increased morbidity and mortality is to be expected from operation on debilitated cancer patients. The necessity of differentiation between the organic and neurotic elements in the patient's complaints is emphasized. Failure to do so will lead to a poor result in the latter group even though a perfect operation is performed.

The relief of phantom limb pain, post herpetic pain, tabetic pain, and the painful traumatized peripheral nerve are all difficult to relieve. This may be related to presence of direct injury to nervous structures common to each lesion. High cervical cordotomy appears to offer the greatest chance of relief.

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II. MEDICAL SCHOOL NEWS

Coming Events

February 16-18	Continuation Course in Recent Advances in Diagnosis for Internists
February 17	Phi Delta Epsilon Lecture; "Iron Metabolism and Iron Deficiency Anemia"; Dr. Carl V. Moore, Professor, Department of Medicine, Washington University School of Medicine, St. Louis, Missouri; Owre Amphitheater; 8:00 p.m.
March 2-4	Continuation Course in Clinical Dietetics
March 26	Special Lecture; "Trace Elements in Biochemistry and Medicine"; Dr. Burt L. Vallee; Peter Bent Brigham Hospital, Boston, Massachusetts; Owre Amphitheater; 4:00 p.m.
April 6-11	Continuation Course in Proctology for General Physicians
April 16-18	Continuation Course in Gynecology for Specialists

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Faculty News

Dr. Donald W. Hastings, Professor and Head, Department of Psychiatry and Neurology, and Director, Division of Psychiatry, will attend an Aero-Medical meeting in Paris on February 23-25. This meeting will be held under the auspices of the Advisory Group for Aeronautical Research and Development which is a part of the N.A.T.O. Dr. Hastings is Chairman of the Aero-Medical Panel of the U.S.A.F. Scientific Advisory Board. He will present a paper entitled "Psychiatric Selection of Combat Flying Personnel."

Several members of our Medical School faculty participated in the Health Day Program which was held at the Radisson Hotel on February 6. Several hundred lay persons attended this conference. Dr. Gaylord Anderson, Director, School of Public Health, discussed poliomyelitis, and Dr. Wesley W. Spink, Professor of Medicine, spoke on the use of antibiotics. Dr. Reynold Jensen gave the group some interesting comments about psychiatry.

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FACULTY PROFILE

Investigator - Scholar

Followed by a host of eager medical students, interns, and fellows, a well-fed, black-haired man in a long white coat enters the patient's room. With stethoscope dangling from his pocket, he approaches the bedside listening all the while to the student present the patient's history. Then, affixing the ear pieces to his ears, he applies the stethoscope to the patient's precordium. Withdrawing the instrument almost as rapidly as a child removes his finger from a hot stove, he turns to the assembled group and exclaims, "Wow!"

This chain of events indicates that the patient in question undoubtedly has a loud heart murmur. It also allows us to identify the man making ward rounds as Dr. Wesley W. Spink, Professor of Medicine at the University of Minnesota Medical School and internationally recognized authority in the field of infectious diseases. The "Wow!" will be followed by an exceedingly capable discussion of the clinical problem, certain suggestions with regard to therapy, and perhaps also by an embarrassing question or two directed to the house staff, should they have made some oversight.

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Wesley Spink was born in Duluth in 1904 and graduated from the Duluth High School. After receiving his B.A. degree from Carleton College in Northfield, he attended Harvard Medical School, receiving his M.D. in 1932. He held the Proctor Scholarship at Harvard in 1932-33, and following this served his internship on the Harvard Medical Service at Boston City Hospital. From 1934 to 1937 he was a resident physician in medicine at the Thorndike Memorial Laboratory, Boston City Hospital. He returned to his home state in 1937, joining the faculty of the University of Minnesota Medical School as Assistant Professor of Medicine in 1937. He became an Associate Professor in 1941 and Professor in 1946.

During World War II, he served as Consultant to the Secretary of War on Epidemic Diseases and as a member of the Commission on Hemolytic Streptococcic Diseases. He is probably most widely known for his work with brucellosis. He was President of the Third Inter-American Congress on Brucellosis, Washington, D.C., in 1950, and currently is Chairman of the Committee on Brucellosis of the National Research Council and Director of the Brucellosis Research Center of the United States for the World Health Organization and Food and Agricultural Organization of the United Nations. His standing as a world authority on brucellosis has resulted in extensive travel. In 1948 at the invitation of the government of Mexico, he conducted investigations in Mexico City on the therapy of brucellosis. In 1951 he visited Brucellosis Research Centers in Great Britain, France, Italy, and Yugoslavia as an Expert Consultant for World Health Organization and Food and Agricultural Organization of the United Nations, and last fall visited Spain in a similar capacity at the request of the Spanish government. An indication of his enthusiastic approach to his work is given by the fact that he and Mrs. Spink, who accompanied him on his European trips, spent many long hours last year studying Spanish in order that his trip to Spain could be most profitable to him and to those he visited.

His leadership in the field of medical research has been recognized in many ways. He has been President of the American Society for Clinical Investigation and of the Central Society for Clinical Research and is a member of the Committee on Research of the American Medical Association. Precise organization characterizes his investigative activities. Working closely with the other members of his research team, he carefully outlines their problems for them and supervises them at every phase of their work.

An able clinician and teacher, he is apt to be mildly confusing to the uninitiated on ward rounds due to his habit of thinking aloud. Those who are accustomed to this, however, will find in his final statement concerning a given problem a considered opinion based on extensive experience, wide knowledge, and sound judgment. Many of his former students well remember the day he saw a woman patient with right upper quadrant pain and a history of a previous cholecystectomy. With some sixth sense, he placed the stethoscope on the upper abdomen of the patient, heard a bruit, and announced "This lady has an aneurysm of the hepatic artery." Two days later the patient died suddenly. Autopsy revealed an aneurysm of the hepatic artery.

A prolific writer, over 150 articles of his have been published in medical journals. In 1941 his monograph, "Sylfonamides and Related Compounds in General Practice," was published and received wide recognition. He serves on the editorial board of the Journal of Clinical Investigation and of the Journal of Laboratory and Clinical Medicine.

He is Governor for the State of Minnesota for the American College of Physicians and a member of the Phi Beta Kappa and Alpha Omega Alpha. In 1950 Carleton College awarded him an honorary Doctor of Science degree. Although engaged in academic medicine, he has always been acutely aware of the problems of the practicing physician.

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He was a member of the House of Delegates of the Minnesota State Medical Association in 1952, and, of course, he is currently the Secretary-Treasurer of the Minnesota Medical Foundation.

He and Mrs. Spink have two youngsters with whom he manages to spend much time despite the pressure of his many activities and duties. Daily he walks from his home in Prospect Park to the Hospital, returning by the same means at night. He has been known to refuse a ride from a passing colleague in -10 degrees weather. His colleagues suspect that each journey from Hospital to home results in at least one new research project. When asked what his hobbies are, he replied, "None." This is not true. His hobby, as well as his profession, is medicine. His career can be summed up best with one word--Wow!

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III. UNIVERSITY OF MINNESOTA MEDICAL SCHOOL
WEEKLY CALENDAR OF EVENTS

Physicians Welcome

February 16 - 21, 1953

Monday, February 16

Medical School and University Hospitals

9:00 - 9:50 Roentgenology-Medicine Conference; L. G. Rigler, C. J. Watson and Staff; Todd Amphitheater, U. H.

9:00 - 10:50 Obstetrics and Gynecology Conference; J. L. McKelvey and Staff; W-612, U. H.

10:00 - 12:00 Neurology Rounds; A. B. Baker and Staff; Station 50, U. H.

11:30 - Tumor Conference; Doctors Kremen, Moore, and Stenstrom; Todd Amphitheater, U. H.

11:30 - 12:30 Physical Medicine Staff Seminar; Dynamic Splinting of Upper Extremity Disabilities; J. P. Engel; Heart Hospital Auditorium.

12:15 - Obstetrics and Gynecology Journal Club; Staff Dining Room, U. H.

12:30 - 1:30 Physiology Seminar; Diet and Blood Cholesterol; Ancel Keys; 214 Millard Hall.

1:30 - 2:30 Pediatric-Neurological Rounds; R. Jensen, A. B. Baker and Staff; U. H.

4:00 - Pediatric Seminar; Hearing Disabilities in Children; Lawrence R. Boies; Sixth Floor West, U. H.

4:00 - 5:30 Seminar on Fluid and Electrolyte Balance; Gerald T. Evans; Todd Amphitheater, U. H.

4:30 - ECG Reading Conference; James C. Dahl, et al; Staff Room, Heart Hospital.

4:30 - Public Health Seminar; 15 Owre Hall.

4:30 - 6:00 Physiology 114A and Cancer Biology 140 -- Research Conference on Cancer, Nutrition, and Endocrinology; Drs. Visscher, Bittner, and King; 129 Millard Hall.

5:00 - 6:00 Urology-Roentgenology Conference; C. D. Creevy, O. J. Baggenstoss, and Staff; Eustis Amphitheater.

Minneapolis General Hospital

9:30 - Pediatric Rounds; Eldon Berglund; Newborn Nursery, Station C.

10:30 - 12:00 Tuberculosis and Contagion Rounds; Thomas Lowry; Station M.

11:00 - Pediatric Rounds; Erling Platou; Station K.

12:30 - Surgery Grand Rounds; Dr. Zierold; Sta. A.

1:00 - X-ray Conference; Classroom, 4th Floor.

2:00 - Pediatric Rounds; Robert A. Ulstrom; Stations I and J.

Monday, February 16 (Cont.)

Ancker Hospital

8:30 - 10:00 Chest Disease Conference.

1:00 - 2:00 Medical Grand Rounds.

Veterans Administration Hospital

8:00 - 9:00 Neuroradiology Conference; J. Jorgens, R. C. Gray; 2nd Floor Annex.

9:00 - G. I. Rounds; R. V. Ebert, J. A. Wilson, Norman Shrifter; Bldg. I.

11:30 - X-ray Conference; J. Jorgens; Conference Room, Bldg. I.

2:00 - Psychosomatic Rounds; Bldg. 5.

Tuesday, February 17

Medical School and University Hospitals

9:00 - 9:50 Roentgenology-Pediatric Conference; L. G. Rigler, I. McQuarrie and Staff; Eustis Amphitheater, U. H.

9:00 - 12:00 Cardiovascular Rounds; Station 30, U. H.

12:30 - 1:20 Pathology Conference; Autopsies; J. R. Dawson and Staff; 102 I.A.

12:30 - 1:30 Physiology 114D -- Current Literature Seminar; 129 Millard Hall.

4:00 - 5:00 Pediatric Rounds on Wards; I. McQuarrie and Staff; U. H.

4:30 - 5:30 Clinical-Medical-Pathological Conference; Todd Amphitheater, U. H.

4:30 - ECG Reading Conference; James C. Dahl, et al; Staff Room, Heart Hospital.

5:00 - 6:00 X-ray Conference; Presentation of Cases from General Hospital; Drs. Lipschultz and Blank; Eustis Amphitheater, U. H.

*8:00 p.m. Phi Delta Epsilon Lecture; "Iron Metabolism and Iron Deficiency Anemia"; Dr. Carl V. Moore, Professor, Department of Medicine, Washington University School of Medicine, St. Louis, Missouri; Owre Amphitheater.

Ancker Hospital

8:00 - 9:00 Fracture Conference; Auditorium.

8:30 - 9:30 Medical-Roentgenology Conference; Auditorium.

1:00 - 2:30 X-ray - Surgery Conference; Auditorium.

Minneapolis General Hospital

10:00 - Pediatric Rounds; Spencer F. Brown; Stations I and J.

10:30 - 12:00 Medicine Rounds; Thomas Lowry and Staff; Station F.

12:30 - Grand Rounds; Fractures; Sta. A; Willard White, et al.

12:30 - Neuroroentgenology Conference; C. Lipschultz, J. C. Michael and Staff.

12:30 - EKG Conference; Boyd Thomes and Staff; 302 Harrington Hall.

1:00 - Tumor Clinic; Drs. Eder, Cal, and Lipschultz.

1:00 - Neurology Grand Rounds; J. C. Michael and Staff.

Tuesday, February 17 (Cont.)

Veterans Administration Hospital

7:30 - Anesthesiology Conference; Conference Room, Bldg. I.

8:30 - Infectious Disease Rounds; Dr. Hall.

8:30 - Surgery Staff Seminar; Surgical Treatment of Hypersplenism; Sol Center; Medical Conference Room, Bldg. I.

9:00 - Liver Rounds; Drs. Nesbitt and MacDonald.

9:30 - Surgery-Pathology Conference; Conference Room, Bldg. I.

10:30 - Surgery Tumor Conference; L. J. Hay, J. Jorgens; Conference Room, Bldg. I.

1:00 - Review of Pathology, Pulmonary Tuberculosis; Conference Room, Bldg. I.

1:30 - Combined Medical-Surgical Chest Conference; Conference Room, Bldg. I.

2:00 - 2:50 Dermatology and Syphilology Conference; H. E. Michelson and Staff; Bldg. III.

3:30 - 4:20 Autopsy Conference; E. T. Bell and Donald Gleason; Conference Room, Bldg. I.

Wednesday, February 18

Medical School and University Hospitals

8:00 - 9:00 Roentgenology-Surgical-Pathological Conference; Paul Lober and L. G. Rigler; Todd Amphitheater, U. H.

11:00 - 12:00 Pathology-Medicine-Surgery Conference; Surgery Case; O. H. Wangensteen, C. J. Watson and Staff; Todd Amphitheater, U. H.

12:30 - 1:30 Radioisotope Seminar; 12 Owre Hall.

1:30 - 3:00 Physiology 114B -- Circulatory and Renal System Problems Seminar; Dr. M. B. Visscher, et al; 214 Millard Hall.

4:00 - 5:30 Physiology 114C -- Permeability and Metabolism Seminar; Nathan Lifson; 214 Millard Hall.

4:30 - ECG Reading Conference; James C. Dahl, et al; Staff Room, Heart Hospital.

5:00 - 5:50 Urology-Pathological Conference; C. D. Creevy and Staff; Eustis Amphitheater, U. H.

8:00 - 10:00 Dermatological-Pathology Conference; Review of Histopathology Section; R. Goltz; Todd Amphitheater, U. H.

Ancker Hospital

8:30 - 9:30 Clinico-Pathological Conference; Auditorium.

2:00 - 4:00 Medical Ward Rounds;

3:30 - 4:30 Journal Club; Surgery Office.

Minneapolis General Hospital

9:30 - Pediatric Rounds; Max Seham; Stations I and J.

Wednesday, February 18 (Cont.)

Minneapolis General Hospital (Cont.)

10:30 - 12:00 Medicine Rounds; Thomas Lowry and Staff; Station D.

11:00 - Pediatric Seminar; Arnold Anderson; Classroom, Station I.

11:00 - Pediatric Rounds; Erling S. Platou; Station K.

12:00 - Surgery-Physiology Conference; Dr. Zierold, Dr. E. B. Brown; Classroom.

12:15 - Pediatrics Staff Meeting; Classroom, Station I.

1:30 - Visiting Pediatric Staff Case Presentation; Station I, Classroom.

Veterans Administration Hospital

8:30 - 10:00 Orthopedic X-ray Conference; E. T. Evans and Staff; Conference Room; Bldg. I.

8:30 - 12:00 Neurology Rehabilitation and Case Conference; A. B. Baker.

2:30 - 4:00 Psychosomatic Rounds; C. K. Aldrich; Conference Room, Bldg. I.

4:00 - Combined Medical-Surgical Conference; Conference Room, Bldg. I.

7:00 p.m. Lectures in Basic Science of Orthopedics; Conference Room, Bldg. I.

Thursday, February 19

Medical School and University Hospitals

8:00 - 9:00 Vascular Rounds; Davitt Felder and Staff Members from the Departments of Medicine, Surgery, Physical Medicine, and Dermatology; Heart Hospital Amphitheater.

9:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; E-221, U. H.

11:00 - 12:00 Cancer Clinic; K. Stenstrom and A. Kremen; Todd Amphitheater, U. H.

12:30 - Physiological Chemistry Seminar; Theoretical Treatment of Metabolic Pathways; C. Jardetzky; 214 Millard Hall.

1:30 - 4:00 Cardiology X-ray Conference; Heart Hospital Theatre.

4:00 - 5:00 Physiology-Surgery Conference; Todd Amphitheater, U. H.

4:30 - 5:20 Ophthalmology Ward Rounds; Erling W. Hansen and Staff; E-534, U. H.

4:30 - ECG Reading Conference; James C. Dahl, et al; Staff Room, Heart Hospital.

5:00 - 6:00 Radiology Seminar; Heart Size; Joseph Jorgens; Eustis Amphitheater, U. H.

7:30 - 9:30 Pediatric Cardiology Conference and Journal Club; Review of Current Literature 1st hour and Review of Patients 2nd hour; 206 Temporary West Hospital.

Ancker Hospital

4:00 - Medical-Pathological Conference; Auditorium.

Minneapolis General Hospital

9:30 - Neurology Rounds; Heinz Bruhl; Station I.

Thursday, February 19 (Cont.)

Minneapolis General Hospital (Cont.)

10:00 - Pediatric Rounds; Spencer F. Brown; Station K.

10:00 - Psychiatry Grand Rounds; J. C. Michael and Staff; Sta. H.

1:00 - Fracture - X-ray Conference; Dr. Zierold; Classroom.

1:00 - House Staff Conference; Station I.

2:00 - 4:00 Infectious Disease Rounds; Classroom.

4:00 - 5:00 Infectious Disease Conference; Wesley W. Spink; Classroom.

Veterans Administration Hospital

8:00 - Surgery Ward Rounds; Lyle Hay and Staff; Ward 11.

8:00 - Surgery Grand Rounds; Conference Room, Bldg. I.

11:00 - Surgery-Roentgen Conference; J. Jorgens; Conference Room, Bldg. I.

Friday, February 20

Medical School and University Hospitals

8:00 - 10:00 Neurology Grand Rounds; A. B. Baker and Staff; Station 50, U. H.

9:00 - 9:50 Medicine Grand Rounds; C. J. Watson and Staff; Todd Amphitheater, U. H.

10:30 - 11:50 Medicine Rounds; C. J. Watson and Staff; Todd Amphitheater, U. H.

10:30 - 11:50 Otolaryngology Case Studies; L. R. Boies and Staff; Out-Patient Department, U. H.

11:45 - 12:50 University of Minnesota Hospitals Staff Meeting; Diet and Incidence of Heart Disease; Ancel Keys; Powell Hall Amphitheater.

1:00 - 2:50 Neurosurgery-Roentgenology Conference; W. T. Peyton, Harold O. Peterson and Staff; Todd Amphitheater, U. H.

3:00 - 4:00 Neuropathological Conference; E. Tichy; Todd Amphitheater, U. H.

4:00 - 5:00 Physiology 124 -- Seminar in Neurophysiology; Ernst Gelhorn; 113 Owre Hall.

4:30 - ECG Reading Conference; James C. Dahl, et al; Staff Room, Heart Hospital.

5:00 - Urology Seminar and X-ray Conference; Eustis Amphitheater, U. H.

Ancker Hospital

1:00 - 3:00 Pathology-Surgery Conference; Auditorium.

Minneapolis General Hospital

9:30 - Pediatric Rounds; Wallace Lueck; Station J.

10:30 - Pediatric Surgery Conference; Oswald Wyatt, Tague Chisholm; Station I. Classroom.

12:00 - Surgery-Pathology Conference; Dr. Zierold, Dr. Coe; Classroom.

Friday, February 20 (Cont.)

Minneapolis General Hospital (Cont.)

1:00 - 3:00 Clinical Medical Conference; Thomas Lowry; Classroom, Station M.

1:15 - X-ray Conference; Oscar Lipschultz; Classroom, Main Bldg.

2:00 - Pediatric Rounds; Robert Ulstrom; Stations I and J.

Veterans Administration Hospital

1:00 - Pathology Slide Conference; E. T. Bell; Conference Room, Bldg. I.

10:30 - 11:20 Medicine Grand Rounds; Conference Room, Bldg. I.

Saturday, February 21

Medical School and University Hospitals

7:45 - 8:50 Orthopedic X-ray Conference; W. H. Cole and Staff; M-109, U. H.

9:00 - 10:00 Infertility Conference; Louis L. Friedman, David I. Seibel, and Obstetrics Staff; Station 54.

9:00 - 10:30 Pediatric Grand Rounds; I. McQuarrie and Staff; Eustis Amphitheater.

9:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; Heart Hospital Amphitheater.

9:15 - 10:00 Surgery-Roentgenology Conference; L. G. Rigler, J. Friedman, Owen H. Wangensteen and Staff; Todd Amphitheater, U. H.

10:00 - 11:30 Surgery Conference; Todd Amphitheater, U. H.

10:00 - 12:50 Obstetrics and Gynecology Grand Rounds; J. L. McKelvey and Staff; Station 44, U. H.

11:30 - Anatomy Seminar; Histopathology of Certain Experimental Renal Lesions; Dennis J. Kane; 226 Institute of Anatomy.

Ancker Hospital

8:30 - 9:30 Surgery Conference; Auditorium.

Minneapolis General Hospital

11:00 - 12:00 Medical - X-ray Conference; O. Lipschultz, Thomas Lowry, and Staff; Main Classroom.

Veterans Administration Hospital

8:00 - Proctology Rounds; W. C. Bernstein and Staff; Bldg. III.

8:30 - 11:15 Hematology Rounds; Drs. Hagen, Goldish, and Aufderheide.
11:15 - 12:00 Morphology . . . . . Dr. Aufderheide.

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* Indicates special meeting. All other meetings occur regularly each week at the same time on the same day. Meeting place may vary from week to week for some conferences.