

THE ANTERIOR APPROACH FOR REMOVAL OF RUPTURED CERVICAL DISKS*

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IN THE surgical treatment of ruptured lumbar intervertebral disks, the operation of vertebral-body fusion following subtotal removal of the disk with partial laminectomy has been employed since 1943.² This operation has been performed on over 600 patients and in the writer's experience has proven to be superior to any other operative procedure employed for relief of pain in the back and leg caused by ruptured lumbar disks. The high percentage of permanent cures, the rapid rate of spinal fusion, short period of hospitalization and convalescence, and the early ability of the patient to return to heavy work are the factors upon which these conclusions were drawn.⁴

The poor results obtained in the treatment of disease of intervertebral disks in the cervical region, both from conservative therapy and surgical treatment, has been the concern of surgeons for many years. In an attempt to overcome some of these problems encountered with ruptured cervical disks, the methods used in the treatment of lumbar disks were considered.³ If the symptomatic lesion of the cervical disk not demonstrated by a myelogram could be identified by diskography and if the pathological joint could be treated surgically by an interbody fusion as is done for lumbar disks, the results from the treatment should be greatly improved. These criteria have been realized by an anterior approach to the cervical disk.

The technical difficulties encountered in the operations currently in use to expose and remove a ruptured cervical disk and/or the osteophytes on the margins of the vertebral bodies may be one reason for the poor results obtained by surgical treatment. The obstacles are primarily anatomical. A comparison between the conventional cervical and lumbar disk operations from a technical standpoint probably explains the excellent results obtained in treating the lumbar disk compared to the poor results for the cervical lesion. The surgical approach to the lumbar disks through the spinal canal is facilitated by the retractability of the long lumbar nerve roots and the dural sac which contains only the cauda equina and cerebrospinal fluid. This approach for performing lumbar vertebral-body fusion is greatly facilitated by use of special self-retaining retractors designed for this operation. With these instruments both the spinal canal and the intervertebral space are

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widely exposed and the danger of injury to structures of the nervous system is minimized. In the cervical region, the protruded intervertebral disk is concealed beneath the large, short, cervical nerve root and/or the spinal cord. The surgical approach used by most surgeons for removal of the disk consists of a complete laminectomy, hemilaminectomy or a facetectomy. The operation is more difficult if the disk has herniated in a dorsolateral position lying entirely beneath the nerve root. There is always danger of injury to the nerve root in obtaining an exposure through the solid bone that overlies it. A Hudson drill or an electrically driven burr is employed for this purpose, as described by Frykholm.⁶ The nerve root is also surrounded by large epidural veins, the removal of which may pose a considerable problem in hemostasis before the nerve root can be sufficiently freed and retracted to expose the disk. If the herniated disk or bony osteophytes protrude near the midline, they are exposed by a complete laminectomy. The lesion is removed either by a transdural approach with retraction of the spinal cord,¹ or extradurally working blindly beneath the cord as described by Mayfield.⁷ These operative procedures are long and difficult and are frequently fraught with considerable danger and complications. Injury to the nerve root by retraction or hemorrhage may result in serious neurological deficit in the upper extremities. The midline lesions are notorious for the universally poor results obtained by attacking them through the spinal canal.¹⁰

The anterior approach to the intervertebral disk was suggested while the technique of diskography for lesions of cervical disks was being developed.⁵ The radiographic visualization of the intervertebral disk by injecting a radio-opaque solution into the disk has long been used to demonstrate the pathological anatomy of the interior of lumbar disks. Lumbar diskography is performed by inserting the needle through the dural sac and into the disk from its posterior surface. The same approach would be impossible for the cervical intervertebral disks since the needle would pass through the spinal cord. The technique of cervical diskography by inserting the needle into the anterior surface of the disk between the carotid sheath and trachea was first performed by Dr. Exum Walker of Atlanta, Georgia and has proven to be a safe, technically simple and yet very valuable diagnostic procedure.⁸

The ease with which the cervical disk could be entered from its anterior surface led to experiments carried out on cadavers to develop a method of removing the disk by this route. A modification of the Wiltberger instruments used in the interbody fusion for the lumbar spine was employed.⁹ Wiltberger modified the writer's original operation for interbody fusion of the lumbar spine by designing an instrument which drills a round hole in the intervertebral space into which is inserted a prefit cylindrical dowel of bone. The use of this instrument was found to be an excellent method of exposing the cervical intervertebral disk through the vertebral body (Fig. 1). Accordingly, the instrument was redesigned for this purpose, with an appropriate guard and an adjustable depth gauge. This was necessary to prevent the drill from going too deep, plunging into the spinal canal and damaging the

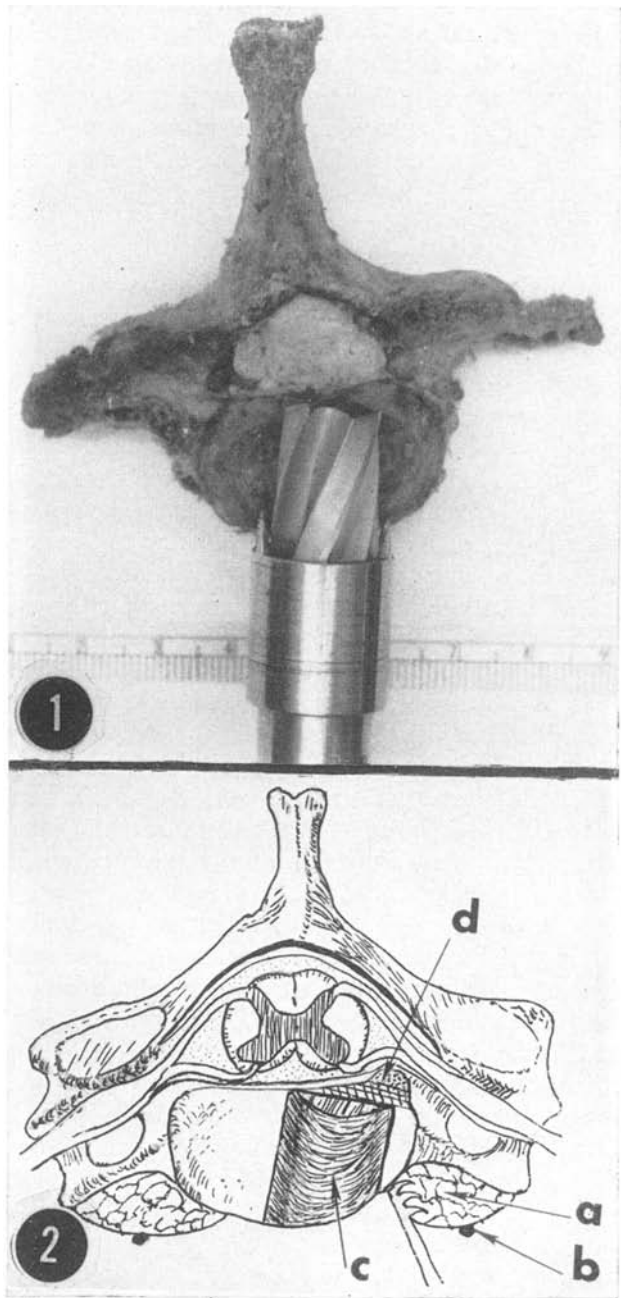


FIG. 1. (1) Photograph of 6th cervical vertebra with drill and guard superimposed on vertebral body. Note width of drill hole compared to spinal canal (actual size).

(2) Drawing to show: (a) longus colli muscle retracted from vertebral body, (b) sympathetic chain, (c) drill hole directed diagonally toward (d) unilateral disk protrusion or osteophyte.

spinal cord. The operation was carried out on several cadavers until the correct instruments had been designed and the technical details of the procedure were perfected. In the past year and a half, 61 patients have been operated upon by this method. This preliminary report will include our first 47 consecutive cases which have been followed from 6 to 18 months postoperative. Several lessons have been learned with this brief experience, through major and minor complications. These are expected, however, in developing a new surgical procedure. This communication will describe the operative technique for removal of ruptured cervical disks and osteophytes by the anterior approach which we have developed and a brief statistical review of the first 47 patients.

OPERATIVE TECHNIQUE

The anesthesia used in the early cases was intravenous Pentothal Sodium with local infiltration in the skin of the neck. An endotracheal tube was used routinely. It was thought that strong retraction of the trachea would induce respiratory difficulties from laryngeal spasm. However, we soon had an opportunity to try the operation on a stoic individual using only novocain in the skin. He suffered no ill effects from the procedure and we were able to stimulate the exposed disk and obtain from the patient valuable objective information as to radiation and location of pain. The operations are now done under local anesthesia with varying amounts of preoperative medication, barbiturates, atropine and an analgesic, depending on the individual patient's needs.

The patient is placed in the supine position with the head turned to the left. The neck is extended over a sand bag to give solid support to the cervical spine. Prior to making the incision, it is necessary to localize by roentgenography the intervertebral space to be operated upon. It is not difficult to make a mistake and choose the wrong disk, as the intervertebral disks all look alike on their anterior surface when exposed at operation. This mistake occurred in the beginning in one patient and led to the following method of preoperative localization. The technique of cervical diskography is employed (Fig. 3B).⁵ Digital pressure is made between the carotid sheath and trachea, pressing the finger tips firmly against the anterior surface of the vertebral bodies. A #20 needle is inserted through the skin and down to the bone. Short jabs are made up and down the spine until the intervertebral space is encountered. The needle is then pressed slightly into the disk and a lateral roentgenogram is obtained. If the film demonstrates the needle in the disk to be operated upon, usually C5-6, 0.3 cc. of methylene blue dye is injected into the disk as a marker.

The incision in the skin, 4 to 5 cm. long, is made transversely in one of the natural lines or folds of the neck. The incision extends from the midline to the anterior border of the sternocleidomastoid muscle. For the C5-6 disk, the incision is usually located at the level of the cricoid cartilage. It may be made above or below this level depending upon the disk to be removed, although, as a rule, three disks can easily be exposed through this incision. It is not necessary to extend the incision farther lateral for good exposure. If the incision is made too long, a small sensory nerve (superior cervical), which supplies the skin over the angle of the jaw, may be severed and the patient may complain of numbness in this area after the operation. The skin is dissected subcutaneously and retracted vertically. The platysma muscle is

split longitudinally. Care is taken not to cut this muscle transversely, which assures a much better cosmetic result. The plane of cleavage between the carotid sheath and the lateral border of the thyroid and larynx is easily determined, and the areolar tissue is separated with a blunt pair of scissors down to the anterior surface of the vertebral bodies. Two retractors are used: a superficial self-retaining retractor separates the skin and muscles and soft tissues in a vertical direction, and deep retractor blades are inserted temporarily in the line of cleavage to retract the carotid on one side and the trachea and esophagus on the other. The areolar tissue is cleaned from the anterior surface of the disk. The disk to be removed is identified by the blue dye. The longus colli muscle is cauterized along its medial border on both sides and stripped from the disk and the adjacent margins of the vertebra. The deep retractor blades are inserted into the edge of this muscle on each side. Because the longus colli muscles are firmly attached to the vertebral bodies, strong retraction can be made on them, giving a wide exposure of the disk without applying pressure to the carotid artery or the trachea and esophagus.

The position of the drill hole to be made in the vertebral bodies adjacent to the pathological disk depends upon the site of the suspected disk rupture and/or the osteophytes on the posterior margins of the vertebral bodies as determined clinically. If the symptoms and the cervical diskogram have demonstrated the lesion to be entirely unilateral, the drill hole is placed to that side of the midline. The hole can be placed considerably lateral for excellent exposure of the unilateral protruded disks causing brachial neuralgia and neurological signs in one upper extremity (Fig. 3D). If the lesion, either a disk protrusion or large osteophytes, has been demonstrated by roentgen ray and myelography to occupy a central position, then the drill hole is placed in the midline.

The special instrument for preparing the opening in the bone was designed primarily to prevent injury to the structures within the spinal canal. It consists of a drill and guard which can be used with any Hudson cranial-drill handle (Fig. 2). The guard permits the hole to be drilled to any desired depth. The adjustable screw on the guard allows the drill to advance to within a millimeter of the anterior wall of the spinal canal without fear of injury or damage to structures beyond this point. The guard has small sharp points which are secured to the bodies of the vertebra on each side of the disk by a few light taps of the hammer (Fig. 2a). An assistant holds the guard firmly with two hands, the drill is placed inside the guard and the drilling is carried out. The drill and guard are removed two or three times before the desired depth of the hole is reached. This is done to determine the depth and direction of the hole and adjust the length of the guard accordingly, and to remove the soft tissue of the disk. The drill does not remove the soft tissue completely, particularly the cartilaginous plates. The interspace is cleaned out between drillings by using a small sharp curette and a small disk rongeur.

Excessive bleeding from walls of the trephine hole is arrested by rubbing the bleeding bony surface with the bone dust removed by the drill. Bone wax is used in the bottom of the hole but not on the side walls as it would interfere with fusion of the bone graft. The drilling is cautiously continued downward 1 mm. at a time until the bone at the bottom of the hole has a uniform appearance of cortical rather than cancellous bone. This indicates that the cortex of the posterior surface of the vertebral body has been reached. Active bleeding in the bone from subcortical arterioles may occur at this level. This is arrested with bone wax. Removal of the fragments of ruptured disk and the osteophytes on the posterior margins of the vertebral bodies

is then accomplished by using a small, sharp mastoid curette. The bony tissue can be gently separated from the posterior longitudinal ligaments and scooped out in small nibbles, using the upper margin of the drill hole as a fulcrum. A fine pointed, cutting type of disk rongeur will aid in removing soft disk tissue. The curetting process can be carried out on the side of the lesion until the entire posterior and posterolateral margins of the adjacent vertebral bodies have been removed together with the intervening disk. One does not encounter during this procedure vessels of any magnitude. Bleeding from a few small capillaries in the ligament is easily arrested with Gelfoam and thrombin. If the electric cautery is used, it should be

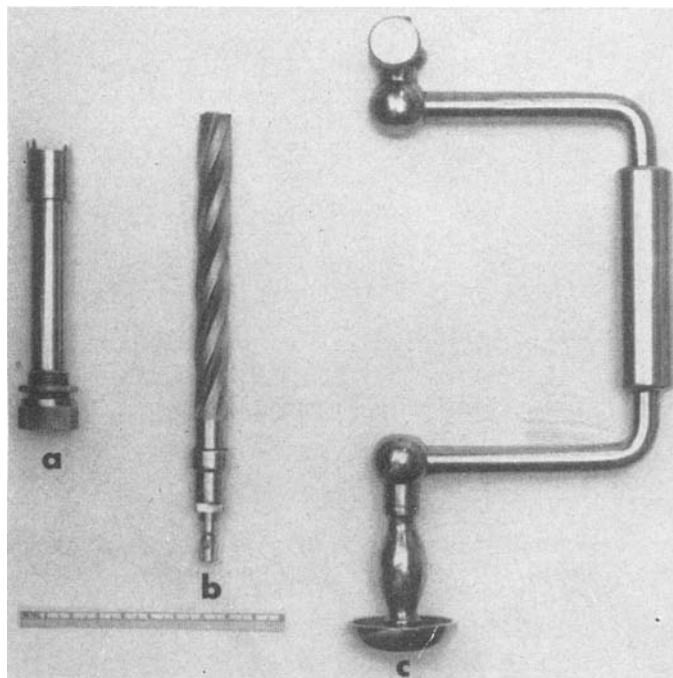


FIG. 2. Instruments used for making the anterior opening into the spinal canal through the intervertebral space. (a) The guard with adjustable screw and lock to vary its length. (b) The twist drill, $\frac{1}{2}$ inch in diameter. (c) Hudson cranial-drill handle.

placed at a low setting because stimulation is transmitted directly to the underlying dura mater and nerve root, and jerking of the arm or body may result.

After the margins of the vertebra and lateral recesses are cleaned of all bone and loose disk fragments, the posterior longitudinal ligament and the posterior fibers of the annulus fibrosus form the covering of the bottom of the drill hole. By careful use of the curette this ligament and its attachments to the vertebra are left intact so that a blind hole results. As stated above, the dura mater and nerve roots and epidural vessels are seldom visualized unless there has been a traumatic rent in the ligament with herniation of the disk material into the spinal canal.

When all bleeding points from bone and ligament are completely arrested by packing the hole with Gelfoam and thrombin, and the hole is dry, the precut dowel of bone is trimmed and placed in the hole and tapped firmly into place with a punch

and hammer. The dowel is carefully measured so that it is slightly shorter than the depth of the drill hole. The dowel is wedge-shaped and 1 mm. or so wider than the hole. By extending the head slightly, a few firm taps on the dowel impact it tightly into the hole. Any oozing from the bone is arrested with bone wax pressed into the groove between the graft and the drill hole.

The bone graft used to fill the drill hole for fusion of the adjacent vertebral bodies is obtained either from the patient or a bone bank. A special instrument, the dowel cutter, removes a cork-like graft by drilling a hole through the patient's anterior-superior ilium. The bone graft can be removed through a 4-cm. incision in the skin prior to the cervical operation. The bone graft was obtained in this manner in only one of our patients, however; in all the others grafts from the bone bank were used. The dowels were made from an ilium removed from a fresh cadaver under sterile conditions, and preserved in blood plasma (for cultures) and frozen.

A small rubber-tissue drain is placed routinely in one corner of the wound down to the vertebra to drain off any blood or serum which may possibly ooze from the bone. A small postoperative hematoma in the wound, although not a serious complication, may cause pain in the shoulder and difficulty in swallowing, and delay healing of the skin. The deep structures of the wound are permitted to fall together and the platysma muscle, subcutaneous layer and the skin are closed in layers with fine silk on an atraumatic needle.

Convalescence from this operation is surprisingly uneventful. Within 24 hours, the patient has recovered from his anesthesia and is able to be up and about. Since no muscles have been incised by the operation, the patient is relatively free of pain. The neck can be moved about freely without limitation or discomfort. A cervical collar or brace was used in the early cases, but this was discontinued. The normal attitude of flexion of the head without a cervical brace is beneficial since flexion compresses the anterior surface of the vertebral body and impacts the bone graft and the vertebral bodies tighter together. This is conducive to early vascularization and fusion. The rubber-tissue drain and sutures are removed in 24 to 48 hours and the patients as a rule are anxious and ready to leave the hospital within 3 or 4 days after the operation. Follow-up roentgenograms of the cervical spine have shown radiographic vascularization of the bone grafts and early fusion of the vertebral bodies within a period of 6 to 8 weeks (Figs. 3C and 4B)!

SUMMARY OF 47 CASES

Within 1 year after this operation was devised, 47 patients were operated upon by this method. There were 29 males and 18 females. Their ages ranged from 33 to 74 years. Half of the patients (24, or 51 per cent) were in the 4th decade. There were 8 patients in their 30's (17 per cent), 12 in their 50's (25.5 per cent) and 2 patients in their 60's (4.2 per cent). One patient was 73 years old. The over-all average age was 46.3 years. Two-thirds (32) of the patients could recall a specific injury to which they attributed their symptoms, whereas 15 patients gave no history of injury of the neck.

The patients were divided into two groups according to symptoms: (a) those with pain only in the neck, shoulder and arm, and (b) those with pain

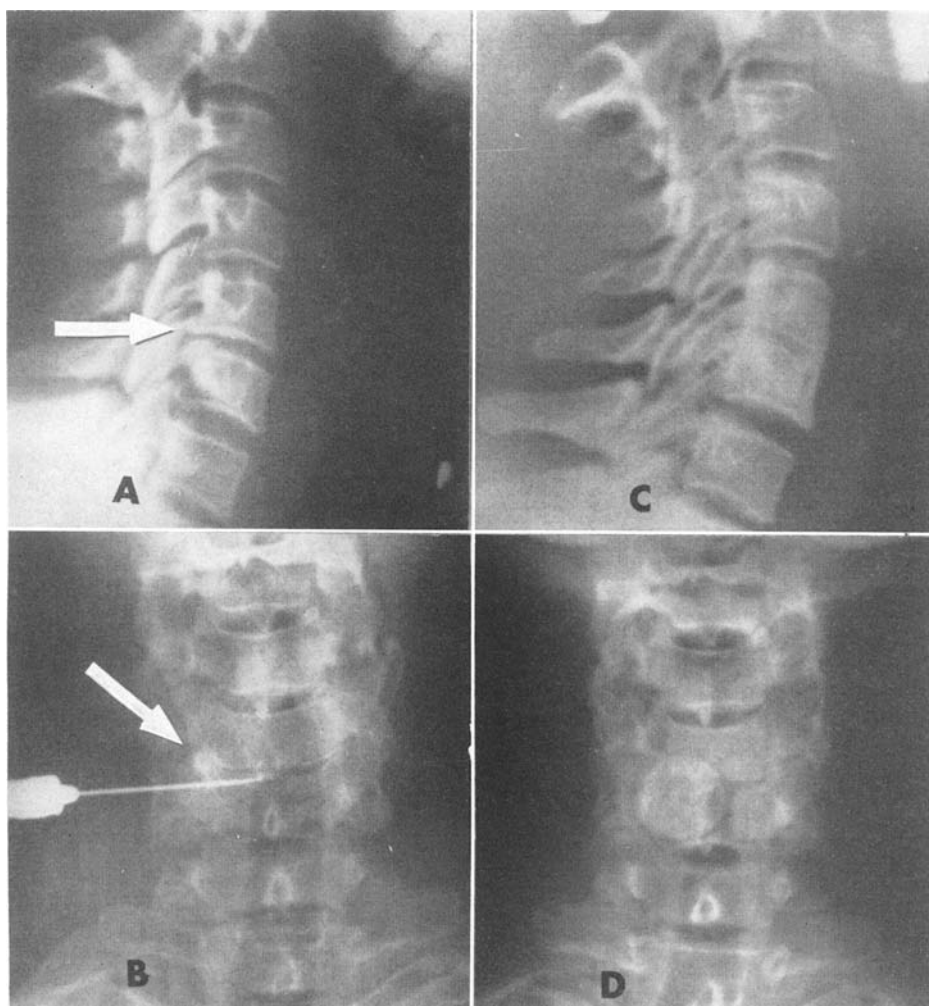


FIG. 3. Case 1. Nurse, aged 46. Pain in neck and shoulder, 8 months. Right brachial neuralgia, 5 months.

(A) Preoperative roentgenogram. Degenerated disk at C5-6 with posterior osteophytes (arrow).

(B) Cervical diskogram showing unilateral protrusion of disk (arrow).

(C) Postoperative film. Disk and marginal osteophytes have been removed and vertebral bodies have been fused. Patient cured.

(D) Anteroposterior film to demonstrate size and location of bone graft (dowel). In this case it was placed off center for removal of unilateral protrusion of disk.

radiating into the forearm, hand and fingers. All 47 patients complained of pain in the neck, shoulder and/or upper arm, and 27 of these had accompanying pain extending into the forearm and hand. There were 20 patients who had no pain or symptoms in the upper extremity indicating nerve-root involvement. All patients whose complaints included pain in the forearm and/or hand with numbness and tingling of the fingers were shown on ex-

amination to have abnormal neurological findings including weakness of the grip, diminution of reflexes and alteration in subjective sensation over the involved dermatome. There were 28 patients with positive neurological findings in the upper extremities and 4 with severe involvement of the pyramidal tract.

Preoperative roentgenograms of the cervical spine disclosed only 6 of the 47 patients to have normal-appearing intervertebral spaces without evidence of osteophyte formation; 3 of these had straightening or reversal of the lordotic cervical curve. In the 41 cases in which there was radiological evidence of degeneration of the cervical disks (Fig. 4A), 47 pathological

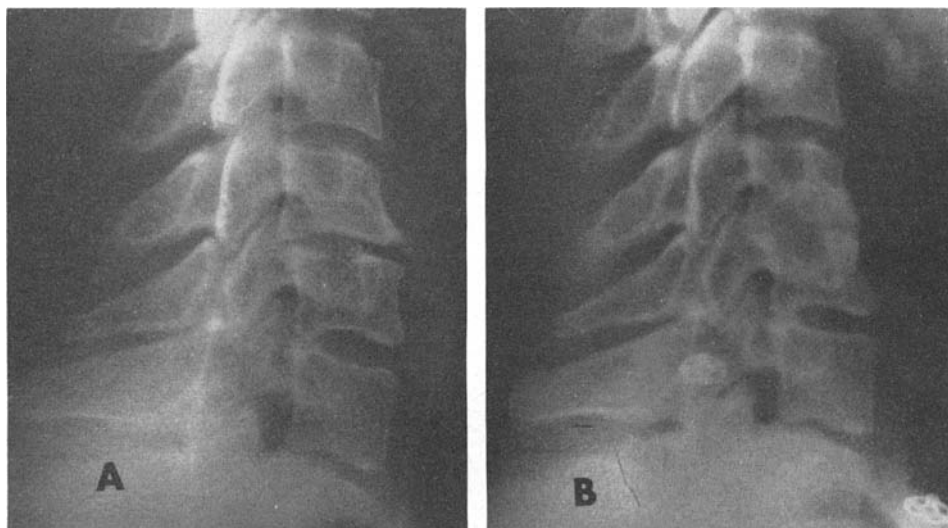


FIG. 4. *Case 2.* Catholic nun, aged 49. "Unbearable" pain at base of neck and shoulders, 3 years.

(A) Preoperative roentgenogram. Severely degenerated disk (cervical spondylosis) limited to a single joint, C5-6.

(B) Postoperative film, 2 months after removal of disk and vertebral-body fusion. Pain completely relieved. (This was the first patient operated upon by this method, before technique for removing posterior osteophytes was developed.)

disks were removed. Twelve of these were considered to be mildly degenerated, 16 moderately and 21 severely degenerated. In the latter group, almost complete obliteration of the intervertebral space with extensive osteophyte formation, either anterior or posterior or both, was present in each case. There appeared to be no relationship, however, between the degenerative changes in the cervical spine, a history of injury and the duration of symptoms. Of the 29 patients with either moderate or marked evidence of degeneration of the cervical disks, 19 gave a specific history of injury to which they attributed their symptoms. In 14 of the 19 patients, the symptoms were of short duration, less than 1 year, whereas the changes in the spine must have been present for a much longer period. Diskograms were performed on all 47 patients and 14 had an additional cervical myelogram.

The pathological disk was demonstrated at the C5-6 level in 31 instances, C6-7 in 9, C4-5 in 4, and C3-4 in 1 patient. Double lesions (two adjacent disks) were found in 6 patients.

The operation for removal of the pathological cervical disks was performed by the anterior approach on 46 patients, and on 1 patient by the posterior approach through a hemilaminectomy. All patients had anterior fusions of the vertebral bodies following removal of the disks. The pathological disk was removed at the C3-4 level in 1 patient (2 per cent). Single lesions were found at C4-5 in 3 patients (6.3 per cent), at C5-6 in 28 patients (59.0 per cent), and at C6-7 in 8 patients (17 per cent). Double disks were operated upon at C4-5, C5-6 levels in 3 patients (6.3 per cent) and 3 others had C5-6, C6-7 lesions (6.3 per cent). In the oldest patient (73-year-old woman) the C4-5 and C5-6 disks were removed and the vertebral bodies were fused. The youngest patient (33-year-old male) had a double fusion (C3-4 and C5-6). This patient had a very short thick neck and because of an error in identifying the correct level, the C3-4 disk was mistakenly operated upon. The error was discovered by roentgenograms 2 days later when the patient still complained of pain in his neck and shoulder. He was returned to the operating room and the correct disk (C5-6) was removed and the vertebral bodies were fused, relieving his pain.

The morbidity and discomfort resulting from this operation is minimal. About the only complaint offered is difficulty in swallowing. This is probably caused by local edema of the esophagus from retraction, for it disappears usually in 48 hours. The pain from the operative wound can be controlled by aspirin. The patient's reaction to any operation for relief of pain can be determined by the length of time he is required to remain in the hospital. Forty of the 47 patients were hospitalized an average of 4.3 days. There were 7 patients who remained in the hospital 10 days or longer (average 17 days) for postoperative convalescence. The longest period of hospitalization was necessitated by the only serious complication encountered with this operation. Because of a technical error in the use of instruments, the posterior longitudinal ligament was separated from the bodies of the vertebrae with subsequent intraspinal hemorrhage and possible direct injury to the spinal cord. This patient was hospitalized for 22 days. The patient had severe neurological deficits immediately following surgery but improved slowly and finally made an excellent recovery with only minimal residual weakness of the right hand and spasticity in the right lower extremity.

The results obtained in this group of patients in relieving pain has been most gratifying. Pain in the neck, shoulder and/or upper extremity was the primary symptom for which the patients sought medical treatment. All patients had received various forms of conservative therapy for months or years without relief. These pains were completely relieved in 42 of 47 patients, and improved in 5. A good example of this group is the oldest patient, aged 73, wife of a doctor, who had suffered pain in the neck, shoulder and upper arms for "many years." She had worn a cervical collar for 4 years and

was never free of pain. Roentgenograms disclosed three degenerated disks (Fig. 5A). At operation the upper two disks were removed under local anesthesia, followed by fusion of the vertebral bodies. The patient remained in the hospital only 2 days. She discarded her brace completely within 2 months. She states the pain she now has is less than 15 per cent of her preoperative pain and is tolerable.

In 8 patients the pain was either not relieved or made worse by the initial operation. These 8 patients were reoperated upon during their initial hos-

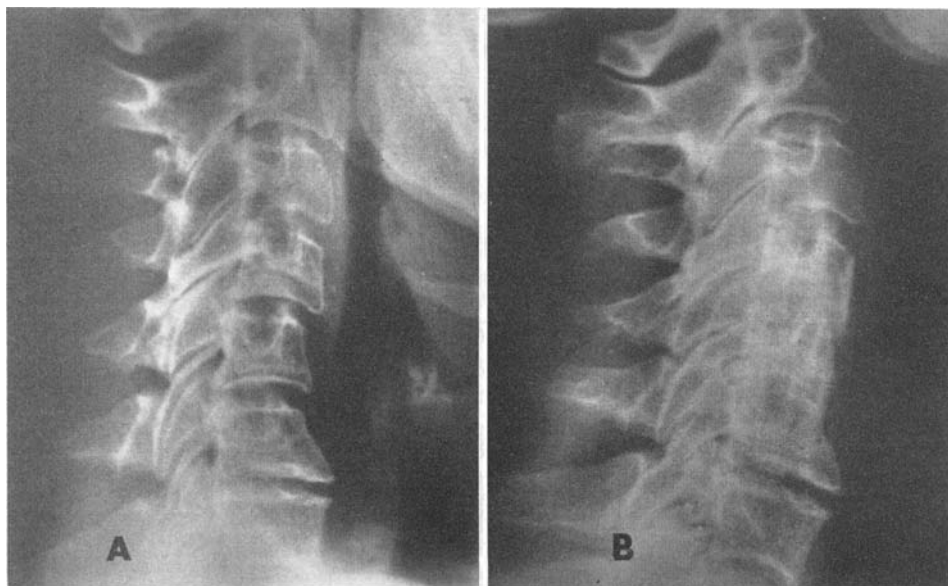


FIG. 5. *Case 3.* Doctor's wife, aged 73. Pain in neck, shoulder and arm "for years". Wore cervical brace 4 years.

(A) Preoperative roentgenogram. Intraspinous midline disk and osteophyte protrusions C4-5, C5-6 and C6-7 (also verified by myelogram). Anterior subluxation C4 on 5.

(B) Postoperative film, 5 months following removal of 4th and 5th cervical discs and fusion of both joints. Patient, 85 per cent relieved of pain; cervical brace discarded.

pitalization or shortly thereafter. In 2 patients a second abnormal disk was removed, followed by fusion of the vertebral bodies. In 4 patients an ill-fitting bone graft was removed and replaced by another. There were 2 patients in whom postoperative hematomas developed. All 8 patients made eventual complete recoveries. There were no wound infections. There were 29 patients who demonstrated neurological deficits preoperatively, including weakness, changes in muscle tone or tendon reflexes, and demonstrable sensory change with subjective numbness and paresthesias. A complete recovery occurred in 20 of these patients, 6 were markedly improved and the symptoms remained the same in 2. One patient was considered worse.

In this series are included 3 patients with acute traumatic laceration of the disk and fracture dislocation of the cervical spine. A detailed description

of these cases is the subject of another report. Suffice it to say that removal of the injured disk and vertebral-body fusion by this method performed shortly after injury have shortened the convalescent period of these patients 3 to 8 weeks.

Postoperative roentgenograms have been obtained at frequent intervals to determine the fate of the bone grafts and the rate of fusion. Fusion occurred in 6 to 8 weeks in the majority of the cases. A complete interbody fusion occurred in 44 patients within 3-4 months after operation. In 3 patients, the bone graft underwent absorption. One of these patients is pain-free; the other 2 have tolerable residual pain in the neck and shoulder.

COMMENT

This operation is indeed a most welcome and gratifying substitute for the conventional methods of surgical attack on ruptured cervical intervertebral disks through the lamina and spinal canal. The operation is a great deal more simple. From the patient's standpoint, the operation is considerably less painful and disabling than other surgical procedures, with rapid postoperative recovery and short period of hospitalization. Technically, it is possible to remove completely both soft-tissue and bony elements encroaching upon the nerve roots or the spinal cord a great deal more satisfactorily than has ever been possible by the posterior approach. The dangers of injury to the spinal cord and nerve roots in the posterior operation, usually by hemorrhage and/or retraction, are almost entirely eliminated. Finally, the most important contribution to the treatment of degenerated cervical disks (cervical spondylosis) by this new procedure is the fact that the vertebral bodies are firmly fused together in a very short period of time. This arrests the degenerative process at the joint which, if permitted to continue, may accumulate large osteophytes on the margin of the vertebra with encroachment upon the spinal canal and possibly result in chronic irreparable damage to the spinal canal and/or nerve root.

A discussion of the criteria and indications for this operation has not been included in this presentation. Likewise a description of pain resulting from disease of the cervical disks has been omitted. Our experience with this surgical approach has presented a singular opportunity to study the problems of pain encountered with these lesions. The data which have been accumulated are most enlightening and will be reported in a later communication.

SUMMARY AND CONCLUSIONS

The operative technique for removal of ruptured cervical intervertebral disks by an anterior approach followed by vertebral-body fusion is given in detail. The rationale of this operation and the advantages over the conventional surgical methods of treating cervical disks are presented. The operation is not technically difficult. As far as the patient is concerned, it may be classified as a minor operation resulting in very little if any postoperative pain or complication and requiring only 3 to 4 days of hospitalization. For this rea-

son, therefore, one may be justified in offering this type of treatment to patients with disease of the cervical disks in lieu of the so-called "conservative treatment" consisting of traction of the head, analgesics, cervical braces, heat treatments, etc. These forms of therapy frequently are ineffectual in relieving the patient's clinical symptoms, even when administered over a period of weeks or months. Although our experience with this operation is limited, the gratifying results obtained in relieving pain in the neck, shoulder and arm would indicate a bright future for this form of surgical treatment. The anterior surgical approach may replace some operative procedures now employed for treatment of clinical symptoms resulting from rupture and degeneration of the cervical intervertebral disks.

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DISCUSSION*

DR. JOHN RAAF: Your Program Chairman, Dr. Jack French, asked me to substitute for Drs. Spurling and Mack in discussing these papers. I realize that neither mentally nor physically can I fill the shoes of those gentlemen. After Dr. French made his request, I searched my hotel room for material for the discussion. I could find only the Gideon Bible. If my remarks seem a little old-fashioned, it may be because of the fact that my source material is not quite as up-to-date as that just presented.

For some time I have been trying to decide whether anterior cervical fusion is in the same category as Russian tonsillectomy. Perhaps you all saw the report from the Soviet Union a few years ago that tonsillectomy is performed from the lower end of the alimentary canal because the Russian citizen is not allowed to open his mouth.

I am a great admirer of Dr. Cloward's prodigious energy and his abundance of ideas but so far I have not been able to bring myself to do either discograms or anterior cervical fusions. It is true that there are a number of very fine blind pianists, but I doubt that one can pound on the strings that make up the brachial plexus with the same abandon that one can pound on piano strings.

One reason I have avoided discograms is the pain involved. Some patients I have seen

* In addition to Dr. Cloward's paper, another on the same subject was presented at this meeting by Drs. G. W. Smith and R. A. Robinson (see *J. Bone Jt. Surg.*, 1958, 40-A: 607-623).

after discograms have been performed by others, have informed me it was necessary for them to stay in bed 2 or 3 weeks after the test because of pain. I wonder if Dr. Cloward would comment on this point?

If anterior cervical fusion has merit, I think the indications should be clearly delineated. Sometimes, regardless of what one does to a patient's spine, he improves anyway. I recall that 8 or 9 years ago I performed a myelogram and visualized a large cervical protruded disc. Because there was a common spinous process for the 2nd and 3rd cervical vertebrae, I miscounted and explored the wrong space. The patient recovered and worked comfortably for years until recently he fell and again had cervical disc symptoms. At an operation a short time ago I removed the protruded disc which had been visualized 8 or 9 years previously.

DR. WILLIAM B. SCOVILLE: I have been asked to give the "Hartford" approach to this problem. For some years, we have offered an exhibit on cervical discs which is presented again at this meeting, representing the work of the speaker and associates, Drs. Whitcomb, Dunsmore and Reilly, surveyed by our former resident, Dr. Robert McLaurin. This exhibit is based on 400 operative cases. In discussing the interesting papers by Dr. Cloward and Dr. Smith, I ask that we define our terms of classification because of the existence of four really distinctly different forms of cervical ruptured discs: (1) The central soft disc, a very rare and very serious condition generally causing paraplegia. (2) The central spondylosis or bony-ridge type which gives a pseudo-amyotrophic lateral sclerosis picture of anterior root plus long tract signs, a chronic and not common syndrome. (3) The laterally placed cervical discs consisting of the bony, hard, or osteophytic type, causing a chronic, nagging, low-grade discomfort in neck and arm. (4) The true "soft" lateral cervical ruptured disc which may be chronic or acute and utterly or mildly disabling.

In our 400 operative cases, 388 were lateral, only 12 were central, and 340 of the lateral ones were of the soft variety. Hence, the bulk of our experience is with this latter type, and in this type I presume to take issue on the necessity for an anterior approach. My friend, Rupert Raney, originally presented the anterior approach to the laterally placed bony type of cervical ruptured disc at a meeting of the American Academy of Neurological Surgery some 10 years ago. He has given up this approach because he feels the posterior approach through the facet is simpler and because of one serious mishap attributed to thrombosis of the anterior spinal artery. We tend towards this feeling of a simpler approach because of the extraordinarily good and rapid results obtained in our keyhole, posterior exposure through the facets with uncapping and unwalling of the involved root by the use of an electric drill and a milking out of the soft disc fragment without curettage of the interspace. So far, there have been no recurrences in contradistinction to the lumbar discs. In the case of the osteophyte or bony type, decompression alone by the same technique is generally sufficient. There has been zero mortality, zero infection, and a review of the results in 165 cases of industrial workers showed that 97 per cent were improved, with 86 per cent markedly improved, and with all but 3 returning to work at their former jobs. Sixteen per cent returned to work in under 2 weeks and 60 per cent in under 1 month. The only appreciable morbidity was 2 cases of complications attending local block anesthesia and 3 cases of air emboli, two of them grave, which we believe can be forestalled with adequate precautions and should always be guarded against when the patient is in the upright position.

Aside from the simplicity and excellence of results in the posterior keyhole, facet, electric-drill approach, mention should also be made of an observation which may militate against the anterior fusion approach. That is, approximately one-fourth of our laterally placed ruptured soft discs have shown the rupture to be at the interspace adjacent to but not at an interspace revealing arthritic narrowing and partial fusion by roentgen ray. This suggests to us that a damaged or partially immobilized interspace puts additional strain on the space above or below it, resulting in lateral rupture of the disc. May not fusion of a cervical interspace cause this same stress on adjacent interspaces?

I wish to thank you for this opportunity to discuss this stimulating subject.

DR. A. EARL WALKER: When Dr. Smith first attempted this procedure some 5 years ago, I thought it was a logical approach to some of the problems of cervical disc, and when he left Hopkins we have continued, with Dr. Robinson, to carry out this procedure.

We did find that some of our patients complained of discography, so that recently we have been carrying this out at the time of operation. This has the disadvantage in that the patient can't tell you when his pain is reproduced. The site of the degenerated disc can usually be ascertained by the dispersion of the dye.

We have also modified the procedure a little bit in that we now put the head in traction to open up the intervertebral space when the disc has been removed, which I think allows less likelihood of compression of the root posteriorly by spurs which may be left.

I would affirm the statements that these patients can be gotten up in a few days. Many will go back to work in a couple of weeks.

DR. GEORGE PERRET: We first heard of this procedure in 1954 when Dr. Dereymaeker, of Louvain, Belgium, traveled in this country and visited various neurosurgical centers, reporting on 34 cases that he already had at that time. He demonstrated his operation to us and I understand also in other neurosurgical clinics; his method of operating was exactly the one that was shown by Dr. Smith today.

He reported success in treating root irritation and also long tract signs in cases of discs, cervical ridge syndrome and other types of cervical arthropathies. Since that time we also have done this operation with satisfactory results.

DR. RALPH B. CLOWARD: One always encounters objections when presenting something new and out of the ordinary. The old statement that "you can't teach an old dog new tricks" may be applicable to this new cervical disk operation. Since most of us are reluctant to give up a surgical procedure, that has proven to be satisfactory, for something new, Dr. Raaf is perfectly justified in his objections. I know the difficulty he encounters in his state with industrial accident cases, labor unions and lawyers processing litigation cases.

I might mention here that none of the patients in this series has had law suits pending for whiplash injuries caused by automobile accidents or other mishaps. They are patients who have suffered persistent disabling pain in the neck, arm and shoulder for months or years: pain that has not responded to any form of conservative treatment. In this group of patients, the results obtained in relieving the pain by a relatively minor surgical procedure have been so spectacular we feel the operation is justified.

The question about pain from diskography: The manner in which the diskogram is performed will determine the amount of pain the patient will experience.

The cervical disc is a relatively small structure. The nucleus pulposus of a normal cervical disc will accept only 0.2 to 0.3 cc. of a liquid solution. Using the 2-needle technique, a very fine needle is inserted into the nucleus and injected with a tuberculin syringe. If the disc is normal and only 0.3 cc. is injected, the patient experiences little or no pain. When a pathological disc is injected the pain may be intense, but lasts only from 3 to 5 minutes. The patient will accurately localize the pain, which is often identical with his clinical symptoms. The pain usually has completely disappeared by the time the patient leaves the x-ray room. I have never encountered a patient who complained of persistent pain in the neck or back following a cervical or lumbar diskogram which lasted more than 24 hours.

Dr. Raaf's question as to the indications for operation, I believe has been answered. My patients have had chronic lesions which had not responded to other forms of treatment, and they have no legal suits pending. This is the type of case that should be chosen. Dr. Scoville does a different type of operation depending on which of the four varieties of disc he is treating. With this operation, it makes no difference what type of disc the patient has or its location. Whether it is a soft disc or a hard one, whether it is located in the midline or to one side, they can all be rapidly and safely removed by a single anterior midline approach. With the posterior method, one may remove one lesion and leave another, that is, remove a small fragment from beneath the nerve root and leave the large midline osteophyte. This leaves the

patient with the possibility of symptoms developing at a later date or continuing with symptoms in the neck or shoulder. By this new operation all pathology is removed and the joint is immobilized, thus eliminating all conditions that can be responsible for pain.

The simplicity of this operation from both the surgeon's standpoint and the patient's is most gratifying. From the surgical standpoint, there is no comparison. We have all struggled with laminectomies, drilled holes in facets, spent hours trying to arrest bleeding from large epidural veins; and then struggling to remove a large hard lump from beneath the tight swollen nerve root. If a lesion is midline an extensive laminectomy with retraction of the cord is necessary. The dangers to the nerve roots and/or the spinal cord by these procedures are obvious.

By this operation, there is no harm done to the nerve roots or cord because these structures are never seen or handled. That is the simplicity of the procedure from the surgeon's standpoint.

From the patient's standpoint, I have had patients tell me the operation was not as bad as a tonsillectomy, be it Russian or otherwise, because they experienced little or no pain from the procedure. The only thing that is cut with the operation is the skin. Since no muscles have been cut the patients can move head and neck around freely and can be up and about the following day and they are very happy.