Cervical Chordotomy by the Anterior Approach

Technique and Advantages

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A new approach to the surgical treatment of lesions of the cervical spine was developed in 1956.1 The spine was attacked by an anterior approach and pathological lesions including cervical discs, osteophytes, fracture-dislocations, and tumors and infections involving the vertebrae have been operated upon successfully by this method with excellent results. The writer’s series of anterior operations on the spine has now exceeded 450 cases, most of which were performed for lesions of the intervertebral disc. Through a small transverse incision in the skin the spine is exposed by blunt dissection in the line of cleavage between the carotid sheath and the larynx or trachea. Ruptured or protruded fragments of disc and vertebral osteophytes encroaching upon the spinal canal are removed through a large hole drilled completely through the vertebral bodies at the interspace. The trephine hole is then filled with a cylindrical dowel of bone to effect a vertebral-body fusion. A generous area of dura mater covering the anterior surface of the spinal cord and nerve roots frequently is exposed during removal of fragments of intraspinal disc. In 1960 it occurred to the writer that if the dura mater was opened, exposing the anterior surface of the spinal cord, this could possibly be an easier surgical approach for section of the anterolateral spinothalamic tract for relief of pain.

Since chordotomy operations in the average neurosurgeon’s practice occur infrequently, some 6 months or more passed after the idea was conceived before a suitable patient appeared. In the meantime the procedure was carried out on several cadavers.

The chordotomy operation, which by laminectomy often is difficult, was found to be accomplished easily by the anterior approach. In the development of a new surgical technique, however, some problems cannot be perfected on autopsy material as situations are not comparable to those found in the living. In this operation, surgical problems such as hemorrhage, the pulsating cord, and the flow of spinal fluid into the wound awaited solution on the living subject. This report will describe the operative technique of cervical chordotomy by the anterior approach which has been used in the past 18 months in a series of 10 cases. The complications encountered and their solution, and the advantages of this operation will be described. A case report of this operation was published recently by Collis4 from Tripler Army Hospital, Honolulu.

The C4-5 level was chosen as the most desirable location for the chordotomy incision in the cervical cord for problems of pain involving the trunk, pelvis and lower extremities. If anterior horn cells are damaged or destroyed at this level, function of the forearm, hand or fingers would not be impaired. Also this level is more accessible surgically by the anterior approach. Hamby5 previously had advocated the C4-5 segment as the optimum area for cervical chordotomy. Experience has proven this to be correct, as no motor deficit has occurred in our patients operated upon at this level. For patients whose pain involved the upper extremities, the anterior approach was made between C2-3. Two patients in our series were operated upon at C2-5 and a high sensory level was obtained. A differential, unilateral section of the spinothalamic tract, as reported by Jenkner,6 was accomplished in 1 patient, and an analgesic level sufficiently
high to include the neck, arm and chest was obtained with sparing of sensation in the trunk and lower extremity.

**Operative Technique**

**Anesthesia.** As many of our anterior operations for cervical disc are done under local anesthesia, it was hoped that this could be used in the chordotomy operation so that sensation could be tested. Local anesthesia was used in the first case, but the patient became uncooperative and a general anesthetic was required. For the second case, local anesthesia was used throughout the operation with good cooperation from the patient. A high sensory level, almost to the clavicle, was obtained with the first incision into the cord. It was decided after this case, that since the incision in the cord is made under direct vision, it would be unnecessary to have the patient’s cooperation to determine if the chordotomy incision was adequate to produce the desired analgesia. Endotracheal general anesthesia has been used in all subsequent cases and good sensory level was obtained without the patient’s cooperation. The operation can be done under local anesthesia in cooperative patients and stimulative experiments on the anterior half of the spinal cord are planned in future cases.

**Preparation.** Prior to positioning and preparation of the patient a malleable lumbar-puncture needle is inserted into the lumbar sac with a short tube and stopcock attached for removal of spinal fluid by aspiration when the dura mater is opened. Also prior to operation a needle is inserted into the anterior surface of the C4-5 disc by the technique of cervical discography, and a portable roentgenogram is taken in the operating room to identify the interspace to be operated upon. When the roentgen ray demonstrates the needle in the correct interspace, a drop of methylene blue dye is injected through the needle to mark the disc for identification when the wound is opened.

The patient is placed in a supine position and secured to the operating table with a strap about the pelvis. The table is tilted or rotated slightly to the right, and the foot is elevated. This will place the head down slightly and the neck in a diagonal rather than horizontal position, which facilitates visualization of the right side of the spinal cord when the dura mater is opened. A sandbag is placed behind the neck. The head is turned 45 degrees to the left and secured to the table with an adhesive band. The neck is prepared with an antiseptic solution and the skin and deep cervical muscles are infiltrated with ½ per cent Xylocaine containing 1 drop of Adrenalin per ounce and 1 ampule of Wydase.

**Exposure.** The technique of the anterior cervical operation described previously is followed for exposure of the anterior dura mater. The transverse incision in the skin is made slightly longer than that used for operation on discs and also a larger opening into the spinal canal is required. The trephine hole is made with a 3⁄8" drill directly in the midline and carried down to the posterior cortex of the vertebral bodies. The anterior interspace on one side of the drill hole should be well cleaned of discal material to permit insertion of the vertebral spreader. This is used throughout the operation, to increase the exposure of the dura mater, and to place the dura mater on a stretch which makes it easier to open. The posterior longitudinal ligament is separated from the posterior margin of the vertebral bodies with a small sharp elevator. The cervical punch is used to remove a generous amount of bone completely around the bottom of the drill hole, as far lateral as possible to “square off” the bottom of the drill hole. Bleeding from the side walls of the drill hole is arrested with Gelfoam and thrombin, and subcortical bleeding from bone around the lower margins of the drill hole is arrested with bone wax.

**Posterior Longitudinal Ligament.** The soft-tissue membrane at the bottom of the drill hole is composed of a few remaining posterior fibers of the annulus fibrosus and the posterior longitudinal ligament. If bone has been well removed, the ligament is seen to thin out laterally into areolar tissue containing veins. The ligament must be incised and elevated in a rectangular flap. The vertebral spreader places the ligament on a stretch. A transverse incision is made 1 to 2 mm. from the lower margin of the bony opening, with a pointed scalpel, long dural hook and groove director. Bleeding from small arterial vessels in the edge of the incised ligament is arrested with a weak cautery. The incision is carried as far lateral as the drill hole will permit or until the membrane thins out. In cutting the vertical limbs of the rectangular flap of ligament, venous bleeding may occur. By using the groove director and pressing upward bleeding may be arrested by pressure until controlled with cautery or Gelfoam. Two traction sutures are placed in the inferior margin of the flap of ligament which is turned upward and sutured to the anterior longitudinal ligament at the outer rim of the drill hole.

**Dural Incision.** The location of the incisions into the dura mater is important so that at the end of the operation a water-tight closure can be made. In our first patient a rectangular flap of dura mater was turned back but this proved difficult to close because the sutures tore through the longitudinal dural fibers. A cruciate incision pro-