Percutaneous Interruption of Spinal-Pain Tracts by Means of a Strontium$^{90}$ Needle*

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Anterolateral cordotomy for pain, first performed in Philadelphia by Martin in 1912, has a long established and honored position among neurosurgical operations. So undeniable are its merits that it has stood the test of time despite a mortality that has ranged between 4 and 25 per cent\(^3\) and a period of convalescence that is not inconsiderable. The lesion that is required in the anterolateral tract itself is very small, yet the operation is major. The lesion is of a magnitude that may be made accurately and discretely by the beta-emitting radioactive isotopes, and it would seem that percutaneous introduction of such an isotope should produce as effective a result as open operation with section by a knife. Such a puncture with the needle is impossible in the thoracic region because of the overlap of laminae and the posterior migration of the interarticular joints. The lack of overlap in the cervical region makes insertion lateral to the cord simple and the anterior migration of the interarticular joints on C1 and C2 allows percutaneous access to the anterior as well as to the lateral aspect of the cord (Figs. 1 and 2). The vertebral artery enters the dura mater through the atlanto-occipital space and the 2nd cervical nerve enters through the C1-C2 interval. The C1-C2 interval is, therefore, preferable (Fig. 3).

Though it is the rule that those isotopes emitting beta particles of greatest penetration have the shortest half lives, it has been possible by using a strontium-yttrium source to provide both longevity of activity and penetration of particles. A strontium-yttrium needle suitable for our purposes has been constructed by one of us (P.V.H.).\(^1\)

Using the physical and biological data obtained in laboratory experiments and knowing that the average cord at this level is 10 mm. in anteroposterior diameter and almost 14 mm. in width, it is possible to plan a field of beta irradiation to any desired depth in the anterolateral cord. Fig. 4 shows such a field for a 15-min. irradiation. The needle, inserted at 45° to the sagittal plane, lies against the anterior dura mater 3 mm. from the midline. Increasing or decreasing penetrations may be provided by moving the point of the needle in relation to the midline or by altering the period of radiation. A 5-min. dose would decrease the cut by 1 mm.

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\(^1\) Aided by a grant from the Douglas Smith Foundation and the Simms Foundation, and by U. S. Public Health Service General Research Support Grant 1-GS-67.

\(^\dagger\) Operated by the University of Chicago for the United States Atomic Energy Commission.

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Fig. 1. Top drawing illustrates how interpedicular joints interfere with anterolateral insertion of needle in the lower cervical region. Bottom drawing shows unsuitability of the atlanto-occipital space because of the vertebral artery.
Fig. 2. Air myelogram showing easy access to anterior surface of cord at C1-C2 interval. The position of the cord relative to the posterior surface of the dens varies with flexion and extension.

A 30-min. dose would deepen it by 0.6 mm. Thus duration provides a relatively fine adjustment. It is seen that the position at the tip of a needle provides a coarse adjustment and is a most critical factor in the precision of the operation. Larger or smaller cords than average demand appropriate adjustment of the field of radiation.

**Technic**

Under local anesthesia a thin-walled, No. 17, lumbar-puncture needle is inserted between the 1st and 2nd cervical vertebrae so as to approach the midline anterior to the cord at an angle of 45°. Local anesthesia must be *perfect*, for the

Fig. 3. Radiograph of Sr-90-Y-90 needle in position for cordotomy.