CURRENT COMMENT

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BLUNT-TIP NEEDLE FOR EPIDURAL ANESTHESIA

Dr. Peter A. Cheng of Wilmington, California, believes that the principle disadvantage of epidural anesthesia is the unintentional and unrecognized puncture of the dura (and arachnoid). The possibility of dural puncture with the needles currently in use, even in skilled hands, has limited the widespread use of this form of anesthesia.

In an effort to design a needle that would not puncture the dura, the anatomy of the epidural space and underlying dura mater and arachnoid was studied in the cadaver and in patients during neurosurgical procedures involving this area. With the aid of the hospital machine shop, a blunt-tip needle was made from a conventional 16 gauge spinal needle. This original needle was subsequently refined after suitable tests in the cadaver and patients and is now commercially available.*

In order to test whether or not this needle decreased the chances of accidental dural puncture during its use for epidural anesthesia, the needle was advanced into the epidural space of fresh cadavers and later in patients in the lumbar region and then pressed forward until the anterior wall (vertebral body) of the vertebral canal was contacted without puncturing the dura. The position of the needle was confirmed by roentgenograms taken in different planes. A sharp 16 gauge spinal needle when advanced along the same needle tract produced a puncture of the dura. The same test (advancing the needle until it contacted the vertebral body) was also employed in the cervical and thoracic regions in cadavers without producing dural puncture. No similar test was done above the L_{2-3} interspace in the patients, however, because of the possibility of producing compression injury of the spinal cord.

DESCRIPTION OF THE NEEDLE

Needle Point.—The point is blunt and rounded. The opening, an oval hole proximal to the tip, is directional, as in the Huber needle, and will permit the passage of a nylon (no. 329 or 361) or plastic catheter (B-D 442T) of suitable size. This opening also affords some directional control over the spread of solution injected for single dose epidural anesthesia.

Flange and Shaft.—The shaft is marked in centimeters and millimeters from the tip, to estimate depth of insertion (the epidural space lies at a depth of 4.5 cm. in the average adult subject, between L_{2-3}). The flange is used to facilitate firm gripping of the needle. Since the flange can be unlocked and slid along the shaft, it is used after insertion to help immobilize the needle in the epidural space.

TECHNIQUE OF NEEDLE INSERTION

Step 1.—The skin, as well as the supraspinous ligament and part of intrasupraspinous ligament, is punctured approximately one to one and one-half centimeters deep with a 15 gauge sharp, short beveled needle.

Step 2.—The epidural needle should be checked to determine that the flange is locked tight in the socket. The epidural needle is held firmly between index finger and the thumb, the index finger being used to locate a point approximately two to three centimeters above the end of the needle; the knob of the stylet is located firmly against

* The name and address of the manufacturer may be obtained from ANESTHESIOLOGY, 3 Penn Center Plaza, Philadelphia 2, Pennsylvania.

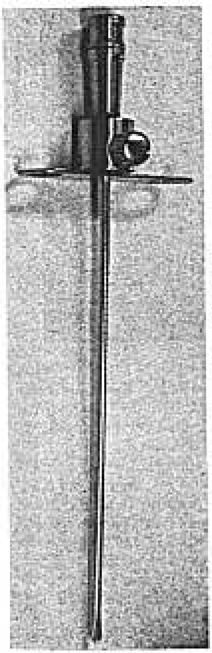
the palm of the hand. The epidural needle is then inserted through the puncture already made by the 15 gauge needle and is inserted two or three centimeters as located by the index finger which is used as a stop.

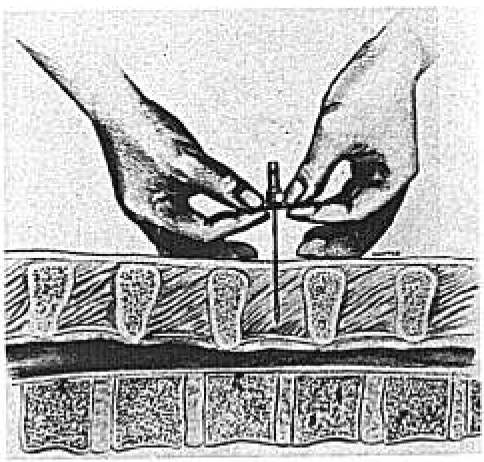
Step 3.—With the epidural needle remaining in place, the stylet is then removed and a few drops of fluid are placed in the socket of the needle for a negative pressure test.

Step 4.—Being sure once again that the flange is locked in the socket, the epidural needle is then grasped in both hands with the thumb and index finger of each hand on the flange, the hands spread in the direction toward the body so that the rest fingers of each hand touch the body for guidance and support (see illustration). The needle is then slowly advanced further into the epidural space. Once the needle has entered the epidural space it may safely be advanced 2-3 mm. without danger of dural puncture, being sure that the whole orifice of the needle tip is in the epidural space.

Step 5.—When it has been determined that the needle is in the epidural space, the flange is released from the socket and the flange is moved down the needle until it is touching the skin. The screw on the flange is then tightened.

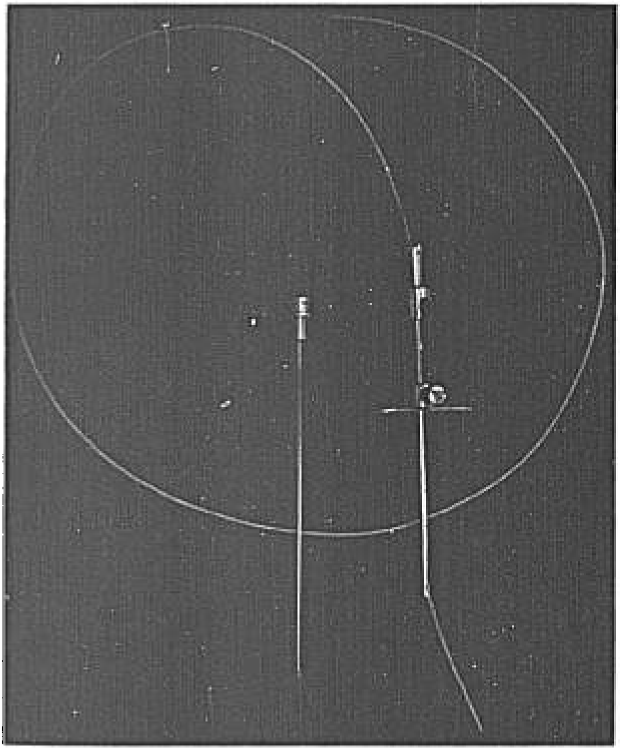
Step 6.—If continuous epidural anesthesia is to be given, a nylon or plastic catheter is inserted through the needle. Each needle is graduated in centimeters and millimeters. The over-all length of the needle is 10 cm. with 8 cm. graduation scribed on the needle. Thus the anesthesiologist can judge exactly how far the catheter is being inserted into the epidural space. When the desired length has been inserted, the needle can be re-





Technique for insertion of blunt-tip needle into the epidural space.

Blunt-tip epidural needle shown at left.



Epidural needle with stylet and plastic catheter.

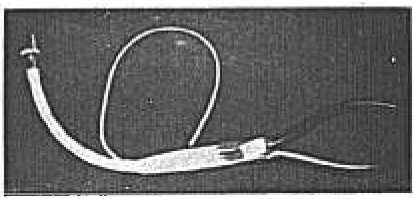
moved slowly, so that the catheter cannot come out with the needle. For single dose epidural anesthesia, the anesthetic is administered directly through the needle. The bevel of the needle should be rotated according to the direction desired for the anesthesia. (The bevel of the needle is on the same side of the screw and the scale.)

Dr. Cheng believes that the advantages of the new blunt-tip epidural needle are : (1) no puncture of dura membrane during insertion of the needle above third lumbar interspace, (2) ease in handling needle with flange, (3) negative pressure in the epidural space more easily appreciated, (4) scale on needle shows depth from skin to epidural space for reinsertion of the needle, (5) flange can be moved on the skin and locked again when needle is in the epidural space and prevents a further insertion of needle during injection of anesthetic agent or insertion of catheter, and (6) side opening of needle tip affords directional control of catheter and also spread of solution for single dose anesthesia. In using any needle, whether sharp or dull, a great degree of care should be exercised to avoid dural puncture. With the needle described herein, dural puncture may take place if the needle is pushed too hard suddenly to the vertebral body, if the patient had a recent subarachnoid puncture and the epidural needle is inserted along the same path, and if the patient has adhesions between the dura and ligamentum flavum, especially in older patients with spinal sclerosis. The dural membrane also may be punctured during insertion of catheter.

DEVICE FOR MOUNTING CUFFS

Dr. Roy W. Nelson of Attleboro, Massachusetts, has disliked putting a new cuff on an endotracheal catheter because of the difficulty in getting it onto the tube without tearing it and causing a leak. In order to overcome this difficulty, he now uses a pair of long machinists pliers from which the serrated edges have been ground off.

The endotracheal tube and the jaws of the pliers are lubricated with an aqueous lubricant, the cuff is slid over the jaws of the pliers, which are then spread open, and the tube is inserted into the cuff (see illustration). The pliers are then removed, and the tube is washed in hot water to remove the lubricant. A job that formerly took ten to fifteen minutes, liberally sprinkled with profanity, is accomplished in about one minute. Apparently the small amount of lubricant between the cuff and the tube does not cause deterioration of either tube or cuff.



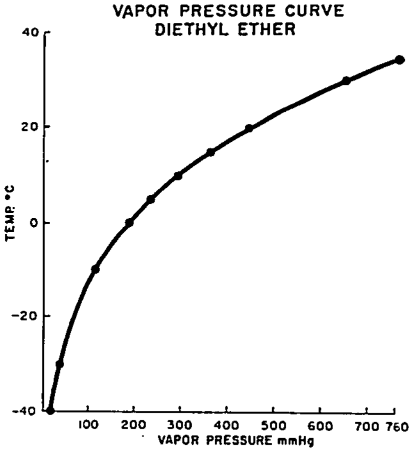
Inserting an endotracheal tube into the cuff with the aid of pliers.

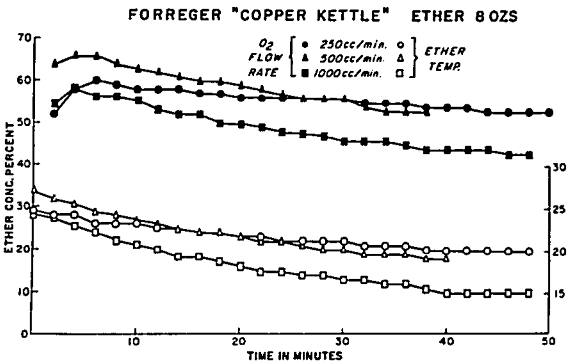
COPPER KETTLE

Dr. S. H. Ngai of New York City remarks that the "copper kettle" was designed to provide reproducible conditions for efficient vaporization and vernier control of vapor delivery.* The copper container is considered important for more efficient heat transfer so that excessive cooling of the liquid agent would not occur. Upon examination of the original calibration determined with liquid ether at 15 C.*, it was found that with a flow of oxygen-through-ether at 800 cc. to 1,500 cc. per minute, approximately equal volume of ether vapor was delivered. Unfortunately, this was commonly taken by users of the "copper kettle" as the basis for estimating ether concentrations in the final anesthetic mixture after dilution. However, an important factor in the vaporization of liquid agent should be considered, that is, the relationship between liquid temperature and vapor pressure. The effect of temperature change upon vapor pressure of ether is considerable. As shown in vapor pressure curve, at 25 C. the vapor pressure is approximately 540 mm. of mercury; at 20 C., 440 mm. of mercury; at 15 C., 360 mm. of mercury and at 10 C., 290 mm. of mercury. Suppose the room temperature is 25 C. and the ether is at the same temperature, the mixture emerging from the "kettle," if saturated, would contain ether vapor at a partial pressure of 540 mm. of mercury, or 71 per cent. With low flow of oxygen-through ether (less than 100 cc. per minute) the temperature drop of the liquid ether with time probably is insignificant. With high flow of oxygen-through-ether (1,000 cc. per minute) the temperature of the liquid ether will become 15 C. after a considerable length of time. It is only then that the ether partial pressure will become 360 mm. of mercury, or 47 per cent. Serial measurement of the ether vapor concentration of effluent mixture from the "kettle" with the aid of a Beckman oxygen analyzer

* Morris, L. F.: ANESTHESIOLOGY 13: 587 (Nov.) 1952

and simultaneous recording of the temperature of the liquid ether in the "kettle" illustrate the change of ether vapor concentration with that of the temperature (see chart). The difference between 71 per cent of ether vapor in the mixture at 25 C. and 47 per cent at 15 C. is significant. It means that at 25 C. a given volume of oxygen carries approximately twice its volume, and at 15 C., and equal volume of ether vapor, *a difference of 100 per cent.* Although careful observation of patient's responses to the anesthetic mixture surpasses all other considerations, users of "copper kettle" should be aware of the effect of changing temperature upon the final ether concentration. It cannot be assumed that a given volume of oxygen-through-ether carries a fixed volume of ether vapor at all times.





Simultaneous recording of ether vapor concentration in volume per cent in effluent mixture and temperature of ether in the "kettle" in relation to time, using a Beckman oxygen analyzer and a Dillon temperature gauge.