

COMPUTED TOMOGRAPHY FINDINGS OF THE EPIDURAL SPREAD OF CONTRAST MEDIA

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SUMMARY

The spread of analgesic and local anesthetics in the epidural space was demonstrated in 13 patients by computed tomography examinations performed after lumbar epidural injection of radiographic contrast material via a percutaneous catheter. The volume of contrast material was equal to the volume of analgesic.

As a result, the upper level of contrast material was found at upper thoracic segments (T4 and above) in 6 of 13 patients (46%), middle thoracic segments (between T5 and T8) in 4 of 13 patients (31%) and lower thoracic segments (between T8 and T12) in 3 of 13 patients (23%).

Key Words: Epidural space, pain, opioid, analgesia, metrizamide, computed tomography, epidural spread.

INTRODUCTION

The demonstration of the presence of opiate receptors within the dorsal horn gray matter of the spinal cord first gave rise to the concept that narcotic analgesics might be effective at an extracranial site. It is now accepted that administration of epidural narcotic agents to cancer patients achieves good analgesia of a length comparable with that achieved via the parenteral route (1,2). The administration of epidural narcotics for the relief of postoperative pain, first used by Cousins et al. (3), has a number of advantages including a decreased incidence of side effects and less pulmonary complications postoperatively.

The first descriptions of this technique prompted attention to segmental anesthesia. This is performed by the administration of epidural morphine delivered through a cannula which has been advanced to the level of the dermatome from which the pain originates.

Fromme and Steidle (4) reported that post-

thoracotomy pain could be relieved by both thoracic and lumbo-epidural techniques using the same dose and quality of analgesic agent. According to this finding, it can be concluded that injection of an analgesic agent has a migration capacity up to the thoracic region. If so this is very important from application point of view.

The purpose of this study is to investigate the highest level of spread of an epidurally delivered contrast media injected in the lumbar region, with the aid of computed tomography (CT).

MATERIALS AND METHODS

Thirteen patients (six male and seven female) aged between 21 and 61 years of age made up the study group. The age, sex and surgical procedure performed in each case are shown in table I.

Table I. Details of patients studied.

Patient No.	Age (yr)	Sex	Procedure
1	56	F	Nephrolithotomy
2	61	F	Pyelolithotomy
3	21	M	Pyelolithotomy
4	36	F	Osteotomy
5	50	F	Meniscectomy
6	31	F	Nephrectomy
7	35	M	Pyelolithotomy
8	31	M	Ureterolithotomy
9	52	M	Excision of mass from ilium
10	37	M	Pyelolithotomy
11	61	F	Osteotomy
12	34	F	Nephrectomy
13	34	M	Intertrochanteric fracture

*Epidural catheter was placed preoperatively.

All patients were premedicated with atropine sulphate 0.50 mg and of pethidine HCl 50 mg intramuscularly 45 minutes prior to surgery, and anesthetized with a variety of inhalational anesthetic agents. Epidural catheters, providing postoperative pain relief, were placed either preoperatively (in two patients) or postoperatively (in eleven patients).

In each case, the patient was positioned, the puncture site was carefully cleaned and draped and the epidural space was identified by the "hanging drop" sign using a 16G Tuohy needle. The technique was performed using the L3-4 intervertebral space. The catheters were advanced 20cm in a cephalad direction and fixed to the skin with surgical drape or plaster.

Morphine sulphate was administered postoperatively when the patients first complained of pain, and was administered as required from then on. Morphine sulphate (2mg in 2ml) was mixed with 5ml of isotonic saline solution and 7ml of the solution was administered each time analgesia required.

CT examination was performed with a "Philips Tomoscan 350" on the first day following mobilisation of the patient. First the position of the end of the catheter was controlled with the aid of digital radiography. The end of the catheter was seen at the level of L1 to T12. Iohexol (Omnipaque 300 mg/ml) Nycomed As-Oslo) in the same volume as that of the analgesic (7ml), was injected through the cannula and the highest level of radiocontrast material within the epidural space until they were no longer required to deliver analgesia.

RESULTS

Epidural morphine administration provided adequate postoperative pain relief in all patients and no supplementary analgesia was required.

Iohexol caused no side effects when injected into the epidural space. CT demonstrated the spread of radioopaque material to the upper thoracic segments (T4 and above) in 6 of 13 patients (46%), to the middle thoracic segments (between T5 and T8) in 4 of 13 patients (31%) and to the lower thoracic segments (between T8 and T12) in 3 of 13 patients (23%). The highest level of epidural spread for each patient is shown in table II.

Table II. The puncture site and the highest level of epidural spread for each patient.

Patient no	Puncture site	Highest level
1	L3-L4	T7
2	L3-L4	T1
3	L3-L4	T12
4	L3-L4	T1
5	L3-L4	T4
6	L3-L4	C6
7	L3-L4	T6
8	L3-L4	T9
9	L3-L4	T6
10	L3-L4	T9
11	L3-L4	C5
12	L3-L4	T6
13	L3-L4	T1

DISCUSSION

A number of reports identify the anatomy of the epidural space using epidurography or CT examination (5-10), but we have been unable to find any report defining the spread of a limited volume of a radioopaque material within the epidural space. Radiological examination of the epidural space with contrast medium has been called peridurography (9,11), canalography (12) or epidurography (5,10). Radioopaque solution injected into the epidural space spreads irregularly and the highest level to which it extends following injection cannot be reliably identified by normal radiological techniques. In this study we circumvented this problem by employing CT scanning.

A study indicating a possible significant spread of an agent from the point of injection by Fromme et al (4) in 1985 prompted this study. Those workers compared thoracic and lumbar epidural morphine injections in the alleviation of postthoracotomy pain. They injected 6mg of morphine in a volume of 13ml by each route and observed pain relief of equal quality and duration.

In this study, 7ml of iohexol was injected via a cannula into the epidural space at a level of T12 or L1. The solution spread upward as far as the upper thoracic segments in 46%, middle thoracic segments in 31% and lower thoracic segments in 23%. All pa-

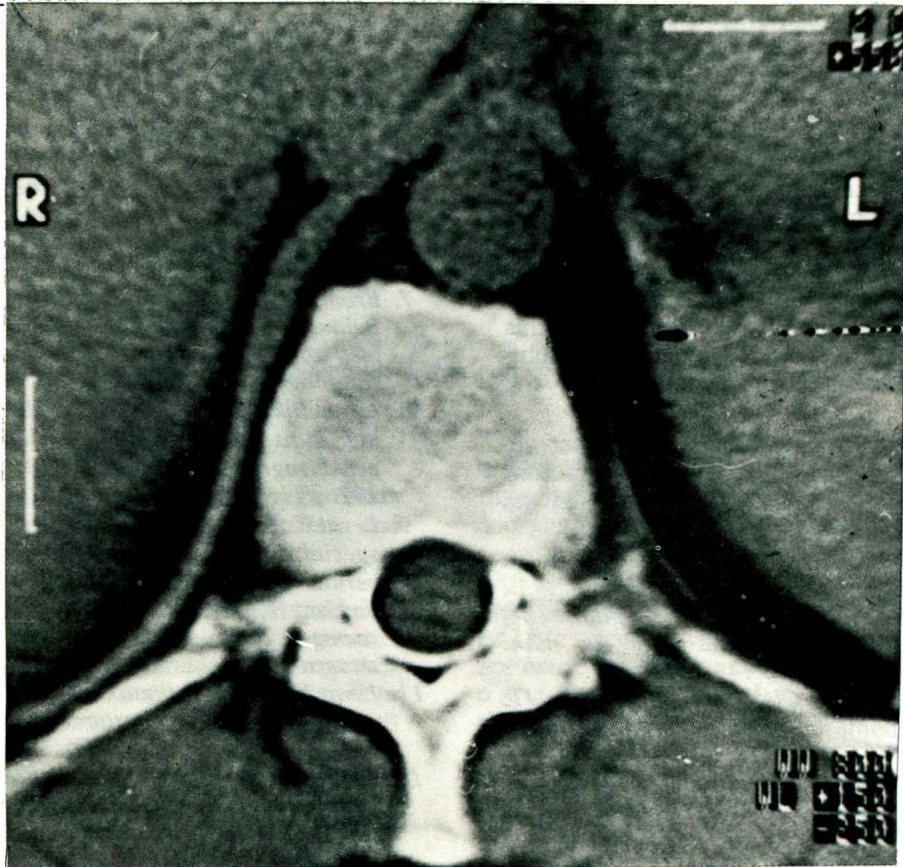


Fig. 1. CT sections of case 2. from level T10/11 revealed epidural spread of contrast material.

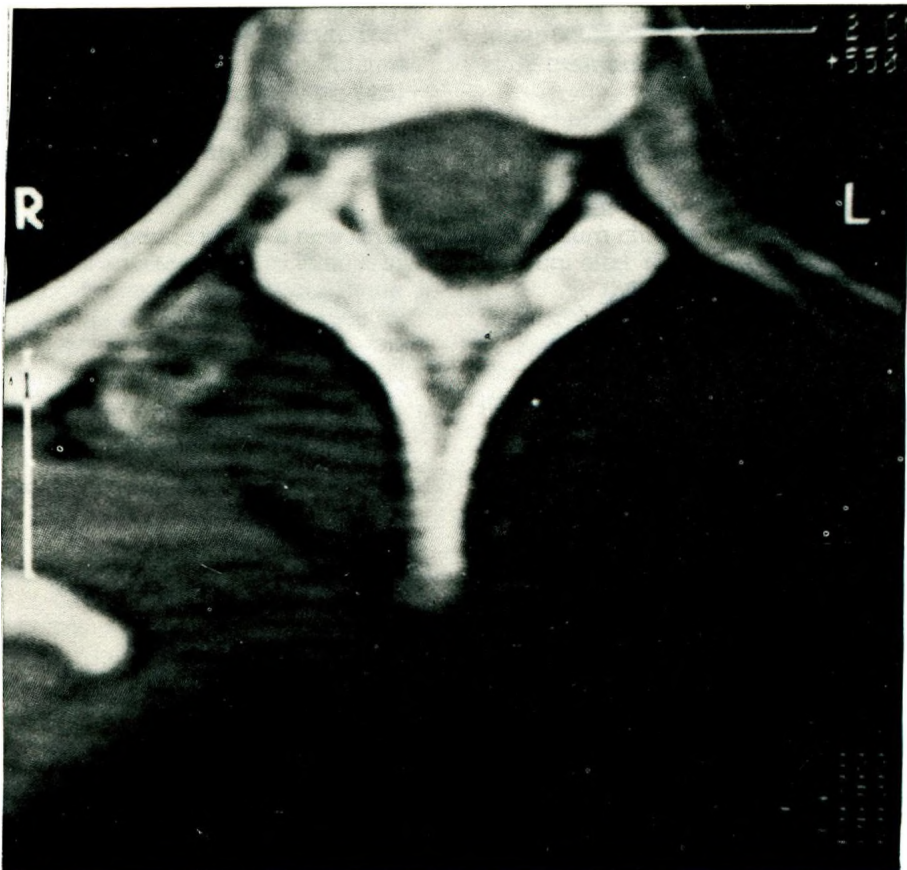


Fig. 2. CT sections of case 2. from level T2. This was the highest level where contrast media was detected in this case.

tients who received 2mg of morphine sulphate in 7ml of solute noted adequate pain relief and so we may conclude that morphine in adequate quantities reached the highest levels reported by Fromme in his study.

The lumbar epidural technique has advantages over the thoracic approach. In the thoracic region the intervertebral space is narrow, the angle between the spinous process is acute and there is risk of traumatising the cord. Moreover even if the segmental property of epidural analgesia is accepted this study demonstrates that solutions injected via a lumbar epidural catheter can reach higher than T8 in 76 % of patients.

In conclusion we can emphasize that lumbar administration of analgesic agents has a satisfactory therapeutic effect in relieving pain arising in the thoracic region.

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