Spinal anaesthesia with meperidine as the sole agent

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Twenty male patients of ASA physical status I or II undergoing surgery of the perineal or inguinal areas received intrathecal meperidine in a dose of $1 \text{ mg} \cdot \text{kg}^{-1}$ as the sole anaesthetic agent. There was sensory and motor block within ten minutes of intrathecal injection of meperidine and surgery was performed with complete analgesia. The duration of surgery was 39.7 ± 14 (mean $\pm$ SD) minutes.

Prolonged postoperative analgesia was obtained and some patients did not require additional narcotic analgesic during the postoperative period, lasting up to seven days. Side effects included nausea and vomiting (six patients), hypotension (five patients), pruritus (five patients) and urinary retention (two patients). There was no early or late respiratory depression. It is concluded that intrathecal meperidine in a dose of $1 \text{ mg} \cdot \text{kg}^{-1}$ is effective as the sole agent for spinal anaesthesia and produces prolonged postoperative analgesia. It offers an advantage for such painful operations as haemorrhoidectomy and anal fissurectomy where its prolonged analgesic effect is desirable. It could also serve as an alternative agent for spinal anaesthesia when a local anaesthetic is not available.

Key words

ANAESTHETIC TECHNIQUES: spinal anaesthesia;
ANALGESIC: meperidine; PAIN: postoperative.

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In 1979, Wang *et al.*¹ reported the first controlled study of intrathecal opioid in humans, while Behar and colleagues² reported the first effective use of epidural opioid in humans.

Since then, many clinical studies³⁻⁶ have been published, reporting different degrees of success or failure with the use of epidural and intrathecal opioids for the relief of pain. However, there are very few reports on the use of intrathecal opioids as the sole agent in spinal anaesthesia for surgery.

This paper reports our experience with intrathecal meperidine as the sole agent for spinal anaesthesia.

Methods

Twenty male patients of ASA physical status I or II presenting for surgery of the perineal or inguinal areas were studied. The protocol was approved by the Ethics Committee, and informed consent was obtained from the patients.

The age of the patients ranged between 19 and 70 years (mean 41.6 ± 15 SD) and the weights between 40 and 100 kg (mean 68.9 ± 14.3). Seven patients underwent inguinal herniorrhaphy, six patients haemorrhoidectomy, five patients anal fissurectomy while two patients underwent cystoscopy and internal urethrotomy. Diazepam 10 mg were given as premedication to six patients while 14 patients received no premedication. No patient received narcotic premedication.

In the operating room, an intravenous line was established, after which subarachnoid puncture was performed with the patient in the sitting position, using a 22 gauge spinal needle at the lumbar vertebral level of L3/4 or L4/5. When cerebrospinal fluid was obtained, preservative-free meperidine in a dose of $1 \text{ mg} \cdot \text{kg}^{-1}$ was injected intrathecally using the undiluted concentration of $50 \text{ mg} \cdot \text{ml}^{-1}$. The spinal needle was then withdrawn and the patient remained in the sitting position for about one minute before lying supine.

Intraoperatively, the electrocardiogram was continuously monitored, and the arterial blood pressure measured every five minutes by an electronic oscillometer. The tidal volume was measured using an electronic respirometer attached to a face mask, while the end-tidal carbon dioxide was monitored using an infra-red CO₂ analyser. Arterial blood gases were checked at 30 minutes and 60 minutes after intrathecal injection of meperidine.

The pin-prick test was done every two minutes until the onset of sensory block and subsequently every five minutes until the highest dermatome level of sensory block was attained. The patients were similarly asked to lift their legs in order to establish the onset of weakness. Heaviness or difficulty in lifting the legs was taken as an indication of partial motor block. In addition the patients were observed for discomfort, pain, nausea, vomiting, pruritus and any other side effects during the intraoperative and postoperative periods.

Postoperatively the pin-prick test was repeated every ten minutes (approximately) until normal pin-prick sensation returned, while the times for the return of normal ability to lift the legs were noted. Thereafter, the patients were transferred from the post-anaesthetic recovery room to the wards.

Close clinical observation of the patients continued on the ward. During the first 24 hours, the blood pressure, heart rate and respiratory rate was monitored hourly while arterial blood gases were done four-hourly. One of the authors was always available for immediate assessment of patients should there be any complaint or problem.

If the patient complained of pain during the postoperative period, the severity was evaluated using a linear analogue pain scale from 0–10. The scale was explained to the patient, with 0 corresponding to "no pain" and "10" corresponding to "severe unbearable pain." Meperidine 0.8 mg·kg⁻¹ was prescribed intramuscularly if the pain severity exceeded 3. Before discharge from the hospital, a clinical examination was performed to exclude any neurological deficit.

Results

Sensory and motor block

Intrathecal meperidine in a dose of 1 mg·kg⁻¹ produced sensory block of the lower limbs and lower abdomen. The mean time of onset of sensory

block was 6.3 ± 2.7 (mean $\pm$ SD) minutes. The maximum level of sensory block varied between T12 and T3 with a mean of T7. Regional anaesthesia was obtained for surgery which lasted for 39.7 ± 14 minutes.

The mean time of onset of motor weakness of the lower limbs was 6.9 ± 2.6 minutes and the duration of weakness was 54.5 ± 18.7 minutes.

Complications

Nausea and vomiting occurred in six patients (30 per cent). The onset was between 10 and 40 minutes (mean 27 minutes) after the spinal block.

No patient showed evidence of respiratory depression, either clinically or as indicated by end-tidal CO₂ monitoring and arterial blood gases done intraoperatively and postoperatively.

A decrease (less than 20 per cent of pre-block value) in blood pressure occurred in three patients within the first 30 minutes of the block. This was promptly corrected by intravenous fluid therapy. In two other patients, intravenous ephedrine was required to treat hypotension of more than 40 per cent of the pre-block value. Bradycardia occurred in four patients and responded promptly to intravenous injection of atropine 0.6 mg. Five patients (25 per cent) developed pruritus. This was more commonly experienced on the face (especially the nose) and the anterior upper chest. Two patients (ten per cent) had difficulty in micturition but only one patient was catheterized.

Postoperative analgesia

Fifteen patients had pain scores from 0 to 2 and did not require any narcotic supplement during the postoperative period lasting up to seven days. Three patients had pain scores from 3 to 4 and required only one dose of intramuscular meperidine throughout the postoperative period. Two patients had pain scores between 5 and 6 and required three doses of intramuscular meperidine during the postoperative period.

Patients were quickly ambulant in the postoperative period. No neurological complications were observed in any patient.

Discussion

Of the opioids, the phenylperidine derivatives such as meperidine have the closest structure to the local anaesthetics, with similar molecular weights and

pka.⁷ For instance, meperidine has a molecular weight of 247 and a pka of 8.5, while lidocaine has a molecular weight of 234 and a pka of 7.9. Concentrations of meperidine between two and four per cent have been reported to produce profound peripheral nerve block,⁸ indicating the local anaesthetic action of this drug.

Contrary to earlier claims that spinal opioids act predominantly on the brain,⁹ recent studies suggest a selective spinal analgesic effect in humans.^{10,11} Opioids are thought to act on presynaptic and postsynaptic receptors in the substantia gelatinosa of the spinal cord dorsal horn where they inhibit neurone cell excitation.^{10,12} Local anaesthetics, on the other hand, act by axonal membrane blockade, predominantly in the spinal nerve roots. The efficacy of intrathecal meperidine 1 mg·kg⁻¹ in this study probably reflects the combined local anaesthetic and spinal opiate effects. Mircea *et al.* have also reported successful spinal anaesthesia with intrathecal meperidine, 1 mg·kg⁻¹ body weight.¹³

The prolonged postoperative analgesia observed is remarkable, and some of these patients did not require any additional analgesic during postoperative periods lasting up to seven days. No neurological complications were observed. Faden and Jacobs¹⁴ reported dose-related flaccid hindlimb paralysis in the rat following intrathecal administration of four peptides belonging to the dynorphin family. This motor dysfunction was not reversed or blocked by naloxone, indicating that it was probably not mediated by opioid receptors. Frank *et al.*¹⁵ also reported convulsive activity restricted to the hindlimbs following intrathecal injection of morphine in rats. This spinal convulsive action of morphine was not mediated by specific opiate receptors. In our study only transient motor weakness of the lower limbs were observed, similar to what is commonly seen following intrathecal administration of local anaesthetic agents.

With regards to side effects, a slight decrease in blood pressure occurred in some patients but this usually responded well to intravenous fluid administration alone or combined with ephedrine. It is pertinent to note that there was no incident of early or late respiratory depression in this series. Most of the reported cases of respiratory depression following spinal opioids have been with morphine.^{16,17} Whereas extradural and intrathecal administration of morphine have been extensively studied, the

same is not true of other opioids. Very few similar reports are available on meperidine, especially given via the intrathecal route. Morphine is a highly ionised and hydrophilic drug so that intrathecal injection will produce a high CSF concentration which will move out slowly into the spinal cord receptor^{18,19} with rostral spread which can result in delayed respiratory depression.¹⁶ A delay of up to 11 hours has been noted before the onset of respiratory depression following spinal morphine.¹⁶ Naloxone has been reported effective for reversing such respiratory depression without reversing analgesia.²⁰ Meperidine, unlike morphine, is highly lipophilic. This allows a rapid onset of action and minimal residual CSF concentration of the drug available from rostral spread to the brain. It has been reported²¹ that delayed respiratory depression does not occur after epidural fentanyl which has lipophilic properties similar to meperidine.

The mechanism of the pruritus associated with spinal opioids is not certain. It is unlikely to be due to histamine release since pruritus occurs with fentanyl which does not cause systemic release of histamine,²² and antihistamines are ineffective in treating it. It is also unlikely to be due to the preservatives in the opioid since it occurs also with preservative-free preparations.⁷ It has been suggested that pruritus may be due to alteration in sensory modulation following opioid spread over the spinal cord to the brain.²³ The pruritus does not appear to be dose-related. The prominent feature of facial pruritus has been explained by the rapid penetration of the opioid to the superficially placed caudal portions of the spinal tract of the trigeminal nerve.⁷ Naloxone has been found effective in the control of pruritus in some cases.²³ An unexplained observation is that pruritus does not occur following intrathecal β -endorphin.²⁴

The mechanism of urinary retention following spinal opioids is not completely clear but its antagonism by naloxone in some cases would suggest involvement of opiate receptors, probably through inhibition of acetylcholine release from efferent post-ganglionic innervation of the detrusor muscle.⁷

The reported incidence of nausea and vomiting after intrathecal opioid is generally higher than after epidural opioid and higher with morphine than meperidine. The incidence was 30 per cent in this series. Bromage reported an incidence of 50 per

cent following epidural morphine.²³ It has been suggested that nausea and vomiting is due to rostral spread of opioid to the vomiting centre and to the chemoreceptor trigger zone.

While it is not advocated that meperidine should replace conventional local anaesthetics as agents for spinal anaesthesia, intrathecal meperidine offers an advantage where severe postoperative pain is anticipated, for example following haemorrhoidectomy and anal fissurectomy. Also when local anaesthetics are not available, as occurs in some developing countries, intrathecal meperidine can be used as an alternative. Further clinical trials are however needed before this can be advocated as a routine practice.

In conclusion, intrathecal meperidine in a dose 1 mg·kg⁻¹ is effective as the sole agent for spinal analgesia, and produces prolonged postoperative analgesia.

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Résumé

Vingt patients classe ASA I et II devant subir une chirurgie périnéale ou inguinale ont reçu de la meperidine intrachécale à des doses de $1 \text{ mg} \cdot \text{kg}^{-1}$ comme seul agent anesthésique. On a obtenu un bloc moteur et sensitif en dedans de dix minutes de l'injection intrachécale de meperidine et la chirurgie a été accomplie avec une analgésie complète. La durée de la chirurgie était de 39.7 ± 14 (moyenne $\pm$ SD) minutes.

L'analgésie post-opératoire prolongée a été obtenue et certains patients n'ont requis aucune dose additionnelle de narcotiques pour sept jours dans la période post-opératoire. Les effets secondaires incluent les nausées et vomissement (six patients), hypotension (cinq patients), prurit (cinq patients) et rétention urinaire (deux patients). Il n'y avait aucune dépression respiratoire ni précoce ni tardive. On conclut que l'injection intrachécale de meperidine à des doses de $1 \text{ mg} \cdot \text{kg}^{-1}$ est efficace comme seul agent pour l'anesthésie rachidienne et produit une analgésie post-opératoire prolongée. Elle offre l'avantage d'abolir la douleur après des opérations comme l'hémoroïdectomie et la fissurectomie anale où une analgésie prolongée est désirable. Elle pourrait être une alternative en anesthésie rachidienne quand un anesthésique local n'est pas disponible.