Comparison of intrathecal meperidine and lidocaine in endoscopic urological procedures

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The purpose of this study was to determine if a small dose of intrathecal meperidine would achieve adequate spinal anaesthesia while minimizing complications and to compare its effectiveness with lidocaine. The spinal anaesthetic effects of five per cent lidocaine 0.5 mg · kg^{-1} in 7.5 percent glucose (n = 20) or five per cent meperidine 0.5 mg · kg^{-1} (n = 22) were evaluated in 42 ASA physical status II or III patients. Intrathecal injection of the anaesthetic agent was given with the patient in the sitting position in which he remained for ten minutes before being placed in the lithotomy position. The onset time for sensory blockade was seven minutes in the lidocaine group and ten minutes in the meperidine group. Final sensory levels were identical in both groups. Mean arterial blood pressure decreased significantly in the lidocaine group but not in the meperidine group. Motor block was absent in ten patients in the meperidine group but was present in all the patients in the lidocaine group. Duration of postoperative analgesia was 968 min in the meperidine group and 681 min in the lidocaine group (NS). Complications such as nausea, vomiting, itching, drowsiness and respiratory depression were similar in the two groups. It is concluded that low-dose meperidine, 0.5 mg · kg^{-1}, is effective as a spinal anaestheic agent and has few complications.

Nous avons évalué la mépéridine intrathécale en tant qu'anesthésique, et l'avons comparé à la lidocaine. En position assise, on fit une injection sous-arachnoïdienne de 0,5 mg · kg^{-1} de lidocaine cinq pour cent dans du dextrose 7,5 pour cent (n = 20) ou de 0,5 mg · kg^{-1} de mépéridine cinq pour cent (n = 22) à 42 patients de classe ASA II ou III. Dix minutes plus tard le patient était placé en lithotomie. Le bloc sensitif apparaissait au bout de sept minutes avec la lidocaine et de dix minutes avec la mépéridine et atteignait un niveau final semblable avec les deux agents. Une baisse de la pression artérielle moyenne et un bloc moteur survenaient avec la lidocaïne mais pas avec la mépéridine. L'analgésie postopératoire durait en moyenne 968 min avec la mépéridine et 681 min avec la lidocaine (NS). La prévalence de nausée, de vomissement, de prurit et de dépression respiratoire était semblable entre les deux groupes. Il semble donc qu'à dose de 0,5 mg · kg^{-1}, la mépéridine intrathécale soit un anesthésique efficace amenant peu de complications.

Key Words
ANAESTHESIA: urology;
ANAESTHETIC TECHNIQUE: spinal;
ANAESTHETICS, LOCAL: lidocaine, meperidine.

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The subarachnoid injection of meperidine has been shown to produce anaesthesia similar to that produced by intrathecal administration of local anaesthetic drugs.[1-4] Local anaesthetics can cause sympathetic blockade and hypotension which require intravenous fluid therapy before the administration of spinal anesthesia. The haemodynamic consequences of intrathecal administration of meperidine have not been compared with intrathecal lidocaine.

This study was conducted to evaluate the therapeutic efficacy and associated complications of low-dose (0.5 mg · kg^{-1}) intrathecal meperidine compared with (0.5 mg · kg^{-1}) lidocaine for spinal anaesthesia in urological procedures.

Methods

Studies were conducted on 42 patients undergoing endoscopic urological procedures between January 1988 and July 1988. They were of ASA physical status II and III between the ages of 61 and 87 yr.

Institutional approval and patients' consent were obtained. A five per cent hyperbaric solution of aqueous preservative-free meperidine hydrochloride was used in Group I ($n = 22$). For the control group, lidocaine five per cent in glucose 7.5 per cent was used (Group II, $n = 20$). The patients were randomly assigned to one of the two groups. They were given diazapam 0.12 mg · kg^{-1} PO as premedication.

In the operating room, an intravenous line was established and 100 ml lactated Ringer's solution was infused over 15 min. Baseline blood pressure, heart rate, respiratory rate and oxygen saturation by pulse oximetry were recorded after which a subarachnoid puncture was performed with the patient in the sitting position using a 22-gauge spinal needle at the lumbar vertebral level of L_{2-3} or L_{3-4}. After either lidocaine 0.5 $mg \cdot kg^{-1}$ or meperidine 0.5 $mg \cdot kg^{-1}$ was injected intrathecally the spinal needle was withdrawn and the patient remained in the sitting position for ten minutes before being placed in the lithotomy position. Each patient was assessed with respect to the onset and duration of sensory and motor blockade. Vital signs, requirements for postoperative analgesia and complications were recorded by a member of the anaesthesia team who had all information about the patient except which intrathecal drug had been administered. Measurements of blood pressure, heart rate, respiratory rate, oxygen saturation, sensory and motor block were made every minute for the first 15 min and throughout the intraoperative period. Vital signs were recorded every three minutes. The patients were tested with an ice cube and pin prick to determine the level of sensory block. The onset and duration of the blocks were noted in minutes. Motor blockade was determined every minute for the first 15 min according to the modified Bromage score:[5] 0 = no paralysis, 1 = inability to raise extended legs, 2 = inability to flex knee, 3 = inability to flex the ankle joint.

Presence of sensory and motor blockade was assessed every five minutes postoperatively until normal pin-prick sensation and ability to lift the legs were noted.

Intraoperatively, decreases in mean arterial blood pressure greater than 20 per cent below baseline were attributed to sympathetic blockade from spinal anaesthesia and were treated with vasopressors and intravenous lactated Ringer's solution was used to compensate for blood loss. A respiratory rate of less than ten $\cdot min^{-1}$ was treated with IV naloxone. Patients were questioned frequently to elucidate the presence of nausea and to assess their mental alertness. Nausea and vomiting associated with hypotension were treated with oxygen and small doses of IV vasopressors. If nausea and vomiting persisted after correction of hypotension the patients were treated with metaclopramide 10 mg IV.

Patients were discharged from the recovery room by a blinded observer who was not told which anaesthetic agent the patient had received. Close clinical observation of the patient was continued on the floor during the first 24 hr. The time from the administration of anaesthesia to the time that the patients first complained of pain was considered as the duration of postoperative analgesia. In the statistical treatment of the study results, intergroup differences were tested for significance by comparing data with an unpaired student's t test or chi-square test, as appropriate. $P < 0.05$ was taken as the minimum level of significance.

TABLE I Surgical procedures

	Meperidine *n*	*Lidocaine* *n*
Transurethral resection of prostate	10	11
Transurethral resection of bladder tumour	7	7
Transurethral resection of bladder neck	3	1
Cystoscopy retrograde pyelography	1	1
Ureteroscopy	1	0

Results

Twenty-two patients received intrathecal meperidine and 20 received lidocaine. Their ages ranged from 61 to 84 yr (mean 69 yr) in Group I (lidocaine group) and from 60 to 87 yr (mean 67 yr) in Group II (meperidine group). The operations performed in both groups were similar and there were no significant intergroup differences (Table I).

Sensory blockade

The onset time of sensory blockade was significantly shorter (7.0 ± 0.67 min) ($P < 0.01$) in the lidocaine group compared with the meperidine group (10.0 ± 0.55 min). The final sensory level was T_8-T_{11} in Group I and T_6-T_{11} in Group II. One patient in each group had inadequate sensory blockade resulting in discomfort when the bladder was being filled. This was relieved in both patients with IV fentanyl.

Motor blockade

There was no significant difference in the onset time of motor block when it occurred in the meperidine and lidocaine groups (Table II). Motor block was absent in ten patients in the meperidine group but was present in all patients in the lidocaine group (Table III). Complete motor block (Grade III) was seen in 13 patients in the lidocaine group compared with no block in the meperidine group ($P < 0.005$) (Table III). In Group II the mean duration of motor block was 100 min while in eight patients in Group I the motor blockade was shorter than the mean duration of surgery which was 56 min. Only four patients in the meperidine group demonstrated motor blockade which extended into the recovery room and the mean duration of motor block in these patients was 92 min.

Haemodynamic stability

In Group I there was a decrease in mean blood pressure of 15 per cent from 105 ± 2 to 95 ± 4 mmHg (NS) while in Group II there was a decrease in mean blood pressure of

TABLE II Clinical data

	Group I meperidine	*Group II lidocaine*	
Onset of sensory block (min)	10.0 ± 0.55	7.0 ± 0.67	$P < 0.01$
Onset of motor block (min)	11.5 ± 0.44	10.5 ± 0.82	NS
Final sensory level	T_8–T_{11}	T_6–T_{11}	NS
Duration of sensory block (min)	100.0 ± 2.83	112.0 ± 4.91	NS
Number of patients with inadequate block	1	1	NS
Number of patients with postop analgesia >24 hr	8/22	4/20	NS

(Mean ± SEM)

TABLE III Comparison of motor blockade between the two groups according to the modified Bromage score

Motor block (Grades)	*Group I meperidine n*	*Group II lidocaine n*
0	10	0
1	6	1
2	6	6
3	0	13

TABLE IV Comparison of mean BP (mmHg) before and after spinal anaesthesia

		Prespinal	*Postspinal*	
Group I	Meperidine	105.0 ± 2.44	95.0 ± 4.5	NS
Group II	Lidocaine	109.0 ± 3.6	85.0 ± 2.7	$P < 0.001$

(Mean ± SEM)

22 per cent from 109 ± 4 to 85 ± 3 mmHg ($P > 0.001$) (Table IV). Only three patients in Group I received ephedrine, 5 mg IV, for correction of their blood pressure compared with six patients in Group II.

Intraoperative complications

No respiratory distress (respiratory rate $< 10 \cdot min^{-1}$ or hypoxia ($SaO_2 < 90$ per cent) was observed in any of the groups. Only one patient was noted to have itching above the analgesic level of the block and one patient had drowsiness in the meperidine group, and did not require treatment. No other intraoperative or postoperative complications were noted. Urinary retention was not a problem because all patients had their bladders catheterized. None of the patients studied suffered a post-spinal headache.

Postoperative analgesia

In Group I 8 of 22 patients (36.3 per cent) did not require analgesics for 24 hr compared with 4 of 20 patients (20 per cent – NS) (Table II). The mean duration of analgesia was 968 minutes in Group I while in Group II it was 681 minutes.

Discussion

Meperidine, one of the phenylpipedrine derivatives resembles local anaesthetics in many ways.[1] The molecular weight and pKa were 283 and 7.7–8.15 respectively for the meperidine and 234 and 7.9 for lidocaine.[6] It has also been postulated in many previous studies that meperidine produces peripheral sensory and motor blockade after intrathecal injection[2–4,7,8] by acting like a hyperbaric local anaesthetic solution.

In a study of 20 patients reported by Famewo and Naguib[3] spinal meperidine 1 $mg \cdot kg^{-1}$ was associated with decreases in arterial blood pressure of more than 20 per cent (four patients), nausea and vomiting in 30 per cent (six patients) and pruritis in 25 per cent (five patients). In a similar study by Sangarlangkarn and Klaewlang[4] using 100 mg meperidine in 20 patients, nausea and vomiting occurred in 55 per cent (11 patients), drowsiness occurred in 70 per cent (14 patients), respiratory depression in five per cent (one patient), itching in ten per cent (two patients), and bronchospasm in five per cent (one patient). Larger doses of meperidine (1 $mg \cdot kg^{-1}$) used by Mircea *et al.*[3] and Cozian *et al.*[7] also resulted in higher levels of sensory and sympathetic blockade which led to hypotension, bradycardia and decreases in oxygen saturation.

The half-life of intrathecal meperidine in humans is short; six hours after a bolus of intrathecal meperidine only 0.4 per cent of the initial bolus is detected in lumbar CSF.[8] Meperidine concentrations at the C_7-T_1 level have been shown to decline rapidly, therefore minimizing the chances of delayed respiratory depression.[9] The delayed systemic effects of intrathecal meperidine are also reduced by its high lipid solubility which causes rapid efflux into the venous and lymphatic systems.[6]

Limited motor blockade of short duration allows early ambulation of patients and is an important characteristic of this technique as it may reduce the recovery room stay. It has been suggested that intrathecal meperidine produces

postoperative analgesia by an effect on the nociceptive synaptic junctions in the dorsal horn of the spinal cord.[10]

We postulated that by reducing the dose of meperidine to 0.5 $mg \cdot kg^{-1}$ therapeutic efficacy is maintained and complications are minimized. However, we did not demonstrate a difference in complications between the meperidine and the lidocaine groups in this study and the postoperative duration of analgesia was not significantly different. A greater incidence of hypotension in the lidocaine group may be due to a higher sensory level (T_6) compared with a level of T_8 in the meperidine group.

In conclusion, we have shown that similarities exist between intrathecal meperidine 0.5 $mg \cdot kg^{-1}$ and lidocaine 0.5 $mg \cdot kg^{-1}$. Lidocaine produced a slight reduction in systemic arterial blood pressure. Intrathecal meperidine in a dose of 0.5 $mg \cdot kg^{-1}$ was an effective spinal anaesthetic and this reduced dose minimized complications previously seen with higher doses.

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