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PLASMA CONCENTRATIONS OF LIGNOCAINE AFTER OBTURATOR NERVE BLOCK COMBINED WITH SPINAL ANAESTHESIA IN PATIENTS UNDERGOING TRANSURETHRAL RESECTION PROCEDURES

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SUMMARY

Bilateral obturator nerve block has become a widely accepted technique to avoid adductor contraction during transurethral resection of prostate or bladder tumours. However, little is known about plasma lignocaine concentrations after the block. We conducted this study to assess a safe dose of lignocaine for injection in obturator nerve block. Bilateral obturator nerve block was performed with the aid of a peripheral nerve stimulator in 12 patients after spinal anaesthesia. In group I (n = 6), patients received 2% lignocaine 10 ml (200 mg) for the block; those in group II (n = 6) received 2% lignocaine 15 ml (300 mg). The block was satisfactory and no single adductor contraction was observed in either group during surgery. The peak plasma concentrations of lignocaine were 2.28 (SD 0.29) μg ml^{-1} and 3.75 (0.79) μg ml^{-1} in groups I and II, respectively. The greatest plasma concentration was 5.07 μg ml^{-1} in a patient of group II. There were no symptoms suggesting systemic toxicity. We conclude that bilateral obturator nerve block may be performed safely and effectively with 2% lignocaine 10 ml with the aid of a peripheral nerve stimulator in patients undergoing transurethral resection procedures with spinal anaesthesia.

KEY WORDS

Anaesthetics, local: lignocaine. Anaesthetic techniques, regional: obturator nerve block.

Although spinal anaesthesia is a good indication for the transurethral resection (TUR) of prostate or bladder tumours, inadvertent stimulation of the obturator nerve is one of the most disturbing phenomena, with a danger of bladder perforation [1, 2]. To alleviate this potential danger, use of a bilateral obturator nerve block has been advocated [3–5]. However, the block may be associated with a potential risk of systemic toxicity of local anaesthetics, because a relatively large dose of the drug (10–15 ml of 1.5 or 2% lignocaine) is injected for unilateral obturator nerve block [4]. Furthermore, the pharmacokinetics of local anaesthetics may be altered substantially in patients undergoing TUR, because of increased age [6] and superimposed spinal anaesthesia. To our knowledge, no controlled studies are available on the plasma concentration–time curve after obturator nerve block. Therefore we designed this study to investigate the safest dose of lignocaine for bilateral obturator nerve block in patients undergoing TUR procedures with spinal anaesthesia.

PATIENTS AND METHODS

We studied 12 patients undergoing TUR of prostate or urinary bladder tumours. They gave informed verbal consent to participate in the study, which was approved by the local Institutional Ethics Committee. All patients were premedicated with atropine 0.5 mg and hydroxyzine 25 mg i.m. 1 h before anaesthesia. A 22-gauge cannula was inserted into the left radial artery under local infiltration with 0.25% bupivacaine 0.5 ml for arterial pressure monitoring and blood sampling. Spinal anaesthesia was performed at the L4–5 space after local infiltration with 0.25% bupivacaine. After a free flow of the spinal fluid through a 22-gauge spinal needle was confirmed, 3 ml of hyperbaric local anaesthetic solution, Neopercamine S (a mixture of cinchocaine 7.2 mg and amethocaine 3.6 mg) was injected into the subarachnoid space. When the anaesthetic level reached T12, usually after 3 min, obturator nerve block was begun.

Bilateral obturator nerve block

The patient was placed in the supine position, with the legs slightly abducted. Obturator nerve block was performed using a specially designed insulated needle [7] and a peripheral nerve stimulator (DigiStim III, Neuro Technology, Houston, U.S.A.). The needle was connected to the cathode lead of the nerve stimulator and the surface of the patient via an ECG electrode to the anode. After palpation of the pubic tubercle, a site 2 cm lateral and 2.5 cm inferior to it was marked [8]. The needle was advanced through the point in a slightly medial and cephalad direction until contraction of the adductor was visible with every discharge with the

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TABLE I. *Patient characteristics (mean (SD)). No significant differences in age, body weight, height and duration of the operation between the groups*

	Group I ($n = 6$)	Group II ($n = 6$)
Volume of 2% lignocaine (ml)	10	15
Age (yr)	73 (64–78)	72 (64–84)
Body weight (kg)	52 (6)	57 (15)
Height (cm)	159 (8)	161 (8)
Duration of operation (min)	132 (20)	136 (20)

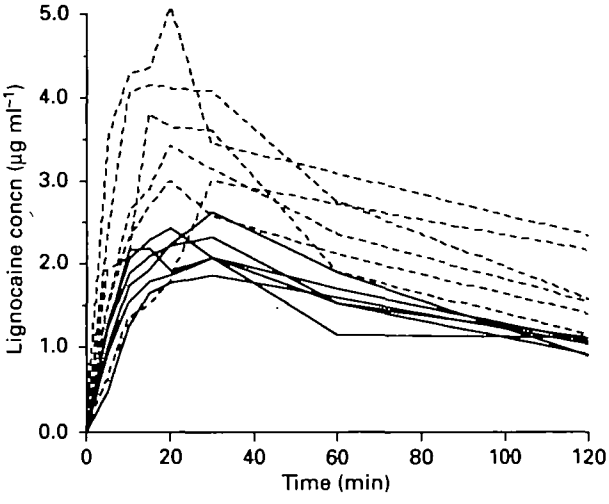

FIG. 1. Plasma lignocaine concentration–time curves after bilateral obturator nerve block with 2% lignocaine 10 ml (——) or 15 ml (---).

TABLE II. *Pharmacokinetic analysis of plasma lignocaine concentration after bilateral obturator nerve block with 2% lignocaine 10 ml (group I) or 15 ml (group II) (mean (SD)). *P < 0.05 compared with group I*

	Group I ($n = 6$)	Group II ($n = 6$)
Peak plasma concn (μg ml^{-1})	2.28 (0.29)	3.75 (0.79)*
Mass peak plasma concn for 100 mg injected (μg ml^{-1})	1.12 (0.14)	1.25 (0.26)
Time to peak plasma concn (min)	25.8 (6.7)	20.0 (5.5)
AUC_{120} (μg ml^{-1} min)	182 (14)	292 (50)*

stimulator turned on. The block needle was advanced on the other side in the same way. Patients were allocated randomly to one of two groups. Bilateral obturator nerve block was performed in group I with 2% lignocaine 5 ml on each side and in group II with 2% lignocaine 7.5 ml on each side. The efficacy of the nerve block was confirmed by disappearance of adductor muscle contraction despite nerve stimulation, which occurred usually after injection of lignocaine 2–3 ml. Patients did not receive any sedatives or analgesics during operation.

Arterial blood samples (1-ml) were collected into glass tubes before obturator nerve block and at 5, 10, 15, 20, 30, 60 and 120 min after the injection of lignocaine. Plasma was separated by centrifugation and its lignocaine concentrations were determined by the fluorescence polarization immunoassay system (TDX system, Abbott Diagnostics, North Chicago) [9]. The detection limits of this method are 0.1–10.0 μg ml^{-1}, with acceptable precision (coefficient of variation = 3.0%). The cross-sensitivity of the assay to bupivacaine is less than 0.5%. The area under the plasma concentration–time curve for lignocaine (AUC_{120}) was calculated by the trapezoidal rule for 120 min.

Data are presented as mean (SD). Statistical analysis was performed by Student's t test for unpaired data. $P < 0.05$ was considered statistically significant.

RESULTS

There were no differences in age, weight, height or the duration of operation between the two groups (table I).

Obturator nerve block was carried out successfully in all patients of both groups. No contractions of the adductor muscle were observed during TUR procedures. There were also no symptoms suggesting CNS toxicity of local anaesthetics such as muscle twitch, dizziness or agitation, although drowsiness was noted in two patients in group II.

Peak plasma lignocaine concentrations were reached after 15–30 min for both groups (fig. 1). The greatest plasma concentrations were 2.62 μg ml^{-1} in a 69-yr-old patient in group I and 5.02 μg ml^{-1} in a 84-yr-old patient in group II. Although the mean peak plasma concentrations were significantly greater in group II than in group I, the mass mean peak plasma concentrations of lignocaine for every 100 mg injected were similar in both groups (table II). AUC_{120} was also proportional to the dose injected (182 (14) μg ml^{-1} min and 292 (50) μg ml^{-1} min in groups I and II, respectively).

DISCUSSION

As the toxicity of local anaesthetics is related closely to their plasma concentrations, it is important for the safety of a neural block to define the plasma concentration–time curve. The present study using two different doses of lignocaine, 200 mg and 300 mg, for bilateral obturator nerve block indicated that plasma lignocaine concentration–time profiles were proportional to injected dose. The peak plasma lignocaine concentration after bilateral obturator nerve block, even with 2% lignocaine 15 ml, was less than 7 μg ml^{-1}, the concentration with the potential for systemic toxicity [10] and in the range 3.0–5.0 μg ml^{-1}, which is considered as a therapeutic concentration for antiarrhythmic effect [11]. Accordingly, bilateral obturator nerve block with the doses used in this study has a minimal risk for systemic toxicity in the elderly undergoing TUR with spinal anaesthesia. Clinically, there were also no symptoms suggesting systemic toxicity, although drowsiness was noted in two patients in group II. Nevertheless, no contraction of the adductor muscle was observed during TUR in either group. Therefore, we think 2% lignocaine 10 ml is sufficient for bilateral obturator nerve block.

We applied a peripheral nerve stimulator to the obturator nerve block to localize the nerve, because paraesthesiae cannot be elicited in a blind technique in patients with spinal anaesthesia. The efficacy of the block was verified also by disappearance of the adductor contraction through injection of lignocaine despite nerve stimulation. The block was performed easily with this technique, even though substantially smaller amounts of lignocaine were used compared with a previous report using a blind technique [4]. Magora and colleagues [8] also emphasized the advantage of using a peripheral nerve stimulator for obturator nerve block to obtain maximal effect with a minimal quantity of local anaesthetics, although they did not use spinal anaesthesia. Smith and Allison reported that sciatic nerve block may also be performed with a lower volume of local anaesthetics with the aid of a nerve stimulator [12].

Mayumi, Dohi and Takahashi [13] observed mean peak plasma concentrations of 3.26–4.11 $\mu g\ ml^{-1}$ 10 min after extradural anaesthesia with 2% lignocaine 10 ml, while a mean peak plasma concentration of lignocaine 3.75 (0.79) $\mu g\ ml^{-1}$ occurred after 15–30 min in group II of our study. The absorption rate of lignocaine after bilateral obturator nerve block under spinal anaesthesia is therefore similar to that after extradural block. The extent to which the decreased cardiac output with increased age and underlying spinal anaesthesia affected the absorption rate of lignocaine in our patients is unknown.

Spinal anaesthesia combined with bilateral obturator nerve block in elderly patients thus seems to be a relatively safe technique with a minimal risk of systemic toxicity. However, we believe that extradural anaesthesia should not be combined with bilateral obturator nerve block, as extradural anaesthesia also requires a significant volume of local anaesthetics. Based on the data of Mayumi, Dohi and Takahashi [13], the peak plasma concentration of lignocaine may reach toxic values if extradural anaesthesia is combined with obturator nerve block.

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