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A randomised study of lidocaine and prilocaine for spinal anaesthesia

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Background: Transient neurologic symptoms (TNS) are common after lidocaine-induced spinal anaesthesia (SA). Recent data indicate that TNS may be less frequent after prilocaine-induced spinal anaesthesia, for which reason the isobaric solution was compared with lidocaine.
Methods: One hundred patients scheduled for short urologic procedures under spinal anaesthesia were randomised to receive 80 mg prilocaine or lidocaine, both 20 mg/ml. The clinical course and the duration of anaesthesia were monitored. The following day an anaesthesiologist unaware of the randomisation interviewed the patients using a structured questionnaire.
Results: Following prilocaine spinal anaesthesia the mean time until 2-segment regression was 123(SD 42) min and total sensory block lasted 221(49) min, compared to 106(26) and 181(48) min following lidocaine. TNS occurred in 7/49 patients in the lidocaine group and in 2/50 in the prilocaine group (ns).
Conclusion: TNS occurred also after isobaric prilocaine SA. The frequency was not significantly different from that following lidocaine SA but larger studies are needed to establish the relative risk of TNS following SA induced by the two local anaesthetics. Isobaric prilocaine has a longer duration of action than an equal dose of lidocaine and may be an alternative drug for spinal anaesthesia of intermediate or short duration.

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TRANSIENT pain in the buttocks, thighs and calves after spinal anaesthesia (SA) with hyperbaric lidocaine 50 mg/ml was reported in 4 patients by Schneider et al. in 1993 (1). The phenomenon has been denoted transient radicular irritation (TRI) and later transient neurologic symptoms (TNS). Most local anaesthetics have been implicated (2, 3). The highest incidence is consistently reported after lidocaine SA for surgery in the lithotomy position and we were seeking an alternative to lidocaine for our urologic patients. Bupivacaine carries a low risk of TNS but a reliable spinal block above T10 with a short recovery may be difficult to obtain (4). Prilocaine has been used for spinal anaesthesia for more than 30 years (5). The sensory block induced by a hyperbaric solution of prilocaine lasts as long as, or longer, than a block induced by hyperbaric lidocaine (5, 6). The duration of the plain solution in spinal anaesthesia is only scantily documented (7).

A preliminary report suggested that TNS do not occur after prilocaine SA (7). The aim of the present study was to compare prilocaine SA with lidocaine SA regarding the frequency of TNS and the quality and duration of the sensory and motor block.

Methods

Approval was obtained from the regional ethics committee. Setting the type II error (β)=0.2, type I error (α)=0.05 and estimating a 15% frequency of TNS after spinal anaesthesia with lidocaine and 0% after prilocaine, the number of patients to be enrolled was 90 (8). Adult patients scheduled for elective urologic surgery of <1 h duration under SA gave their written informed consent the day before surgery.

Patients were randomised in the morning using sealed envelopes to receive either 4 ml plain lidocaine 20 mg/ml (Xylocain® Astra) or 4 ml plain prilocaine 20 mg/ml (Xylonest® Astra). Most patients were orally premedicated with oxazepam. After an intravenous infusion of 500 ml acetated Ringer's solution, spinal anaesthesia was performed with a 25, 26, 27 or 29 gauge Quincke needle (O.D. 0.5–0.3 mm). Following the injection, the patients remained sitting for 1 min and were thereafter placed supine or in the lithotomy position according to surgical requirement. Supplemental oxygen was given and the patients were monitored with electrocardiography, pulse oximetry and automated arterial pressure. If systolic blood

Table 1

Demographic data.

	Lidocaine n=49	Prilocaine n=50
Age (years), mean (SD)	65 (17)	69 (12)
Female/male	13/36	15/35
Weight (kg), mean (SD)	75 (15)	74 (11)

pressure dropped to less than 90 mm Hg or sweating and nausea followed a decrease, the fluid infusion rate was increased and ephedrine 5 mg given intravenously.

The motor block and the segmental level of sensory block were assessed at 5-min intervals. The most cranial dermatome with loss of normal sensation to ice or alcohol swabs at 2–3 consecutive tests was taken as the height of the sensory block. The time to reach this level was defined as the onset time. A modified Bromage scale was used for classification of motor blockade (0=intact movement, 1=able to flex knees, 2=unable to flex knees but moves feet, 3=paralysed). Sedation and additional analgesia were provided as needed with intravenous midazolam and fentanyl. After 60 min the regression was tested every 15 min. Sensory block was considered resolved below S1 when there was normal temperature sensation in the feet and motor block resolved when the patient was able to lift straight legs.

The following day the patients were interviewed by an anaesthesiologist unaware of the local anaesthetic given, using a symptom checklist (9). Symptomatic patients were asked to rate the degree of pain on a verbal scale (0=no pain, 10=worst imaginable). Motor and sensory examinations were performed in patients suspected of TNS. Transient neurologic symptoms were defined as bilateral pain in the buttocks, thighs or lower legs occurring after recovery from the spinal anaesthesia. Back pain was not obligatory for TNS definition.

When not stated otherwise, data are presented as means (SD). Categorical variables were analysed with Fisher's exact test and continuous variables with the Student's *t*-test. $P<0.05$ was considered significant.

Results

The study was carried out between February 1998 and January 1999. The groups were similar regarding age, sex and weight (Table 1). In one patient spinal fluid could not be obtained. The most commonly used injection site was L3–4; the interspaces above or below were used with a similar frequency in the groups. Four blocks provided inadequate surgical anaesthesia; the height of the sensory block was too low in two patients in the lidocaine group and two blocks in the prilocaine group were patchy. These patients received general anaesthesia. Their data were included, except for the dermatomal level and regression in the patchy blocks. Penile and anal surgery and transurethral resections of bladder tumours (33 and 37 patients in the lidocaine and prilocaine groups, respectively) were carried out in the lithotomy position. The remaining operations (8 with lidocaine and 9 with prilocaine) were performed with the patients supine.

There were no differences between the groups regarding needle size, motor block or supplemental sedation and analgesia (Table 2). The median peak dermatomal level was T9 (range L2–T2) in the lidocaine group and T10 (range T12–T1) in the prilocaine group. The mean fall in arterial pressure was 20 and 21 mm Hg in the groups, a 14% reduction from baseline. Sensory as well as motor block lasted about 40 min longer in the prilocaine group than in the lidocaine group, that is a 28% difference in duration of motor block and a 22% difference in duration of sensory block (Table 3).

One patient experienced increasing back pain radiating to the buttocks and thighs during regression of the anaesthesia. He had previously had intermittent lumbar back pain. Neurologic examination revealed no signs of root compression. A magnetic resonance

Table 2

Peroperative anaesthesia, numbers.

	Lidocaine n=49	Prilocaine n=50
Patients given fentanyl/midazolam	10	13
Needle gauge 25 or 26	34	39
27 or 29	15	11
Motor block grade 3	45	47
grade 2	3	0
grade 0–1	1	3

Table 3

Spinal anaesthesia characteristics (min), mean (SD).

	Lidocaine	Prilocaine
Onset of block	14.5 (6)	13.4 (4)
Two segments' regression	106 (26)	123 (42)*
Motor block regression	153 (46)	197 (42)**
Sensory block regression<S1	181 (48)	221 (49)**

* $P=0.02$, ** $P<0.01$.

Table 4

Patients with TNS.

Sex	Weight (kg)	Years	Needle*	Distribution of pain	Pain score	Duration	Drug
Male	91	71	25	Back, dorsal legs	5	2 d	Lidocaine
Female	49	41	27	Back, dorsal legs	8	3 d	Lidocaine
Female	75	72	25	Back, legs	–	–	Lidocaine
Male	91	30	29	Back, thighs dorsal	5	2 d	Lidocaine
Male	71	61	27	Legs, mostly right	9.5	3 d	Lidocaine
Male	95	61	25	Thighs, calves	5	4 h	Lidocaine
Male	80	53	27	Back, legs dorsal	5	3 d	Prilocaine
Male	75	81	25	Thighs, dorsal calves	7.5	2 d	Lidocaine
Male	86	71	25	Thighs, dorsal calves	5.5	2 d	Prilocaine

* Size of gauge.

imaging showed a midline disc L2–3 prolapse, which may have caused his symptoms. At the interview 4 patients complained of groin or lower abdominal pain possibly related to surgery, one had experienced paraesthesia without pain in the legs, one in the buttocks, 6 back pain and 5 headache. One patient had a postdural puncture headache that waned within a few days without treatment.

Nine patients fulfilled the criteria for TNS, 7 in the lidocaine group and 2 in the prilocaine group, that is a 14.3% occurrence after lidocaine (95% confidence interval (CI) 4.5–24.1%) and 4% after prilocaine (95% CI 0.5–13.7%), difference 10.3% (95% CI −0.9 to 21.5%), not statistically significant. All patients with TNS had been operated upon in the lithotomy position. Details on the patients with TNS are shown in Table 4.

Discussion

Some authors require back pain and a bilateral distribution of pain for the diagnosis of TNS (3), while others accept dysaesthesia without pain (9, 10) or unilateral distribution of the symptoms (11). We define TNS as bilateral pain radiating to buttocks, thighs or calves, beginning after recovery from the subarachnoidal block. The lack of standardisation may explain some of the variation in frequency between reports; however, among 118 patients with TNS, none reported dysaesthesia in the legs without pain (2). Interviews performed at different points of time may also explain some variation in the reported frequency. We saw our patients only in the morning on the first postoperative day, but after giving thorough information and specifically focusing on these symptoms we would expect to have been contacted if patients experienced symptoms later. The overall incidence of TNS after lidocaine SA in the large epidemiological study by Freedman et al. was 11.9%. Among patients operated in the lithotomy position it was 19.6% (2). This is similar to the frequencies found by us (overall 14%, lithotomy position 17%). Previously reported frequencies of TNS after lidocaine SA in randomised studies vary from 4%, when few patients were operated in the lithotomy position (10) to 30% after urologic or gynaecologic procedures when all surgery was performed in the lithotomy position (12).

The opinions of various authors differ regarding the intensity of pain in TNS; while some authors claim that most of the patients present only mild symptoms (10, 13), in a large epidemiological study almost 80% of the patients with TNS scored 4 or above on a scale from 0 to 10 (2). Pollock et al. (11) reported an average pain intensity score of 6 (range 2–10) in 20 patients with TNS. This is in agreement with our mean pain score of 6.3. None of our patients scored below 5. Without doubt some patients experience severe pain and most require analgesics. The pain associated with TNS is an unpleasant side effect which patients preferably should not be exposed to. As in other studies, the symptoms were short lasting and the patients were pain free after 3 days.

The first two reports of TNS after prilocaine spinal anaesthesia appeared in 1998. In one randomised study using 50 mg hyperbaric prilocaine, TNS occurred in 1/30 (12). In a larger study, 69 mg prilocaine caused TNS in 1/100 patients, which was not significantly different from 4/100 after lidocaine SA (10). Radicular irritation has not previously been reported after isobaric prilocaine; however, neither human nor animal studies indicate that the addition of glucose changes the occurrence of TNS and thus an incidence similar to the one after the hyperbaric solution is expected (2, 14).

The aetiology of TNS is constantly debated (15). The neurotoxic theory has some support in animal studies.

Spinal infusion of 5% lidocaine in rats resulted in more persistent sensory damage than 0.75% bupivacaine (16), and in isolated frog nerves 5% lidocaine caused a higher degree of permanent conduction block than 1.5% lidocaine or 0.75% bupivacaine (17). However, in human studies reductions of the lidocaine concentration have not been shown to reduce the frequency of TNS (11). As pointed out by several authors, the transient symptoms may not be mediated by the same mechanisms as the permanent nerve damage. Alternative explanations have been sought. Dahlgren proposed that haemolysed blood in the subdural space could cause symptoms with early mobilisation (18). The amide local anaesthetics may differ in their effect on spinal blood flow and could thereby possibly differ in their tendency to cause bleeding, but blood-tinged puncture does not correlate with TNS frequency (2). In the same way, a possible harmful effect of early mobilisation supported by a higher incidence of TNS in day-case surgery (2) seems to be contradicted by results of studies comparing local anaesthetic solutions with a similar duration of block, reporting a different incidence of TNS (12). Myofascial pain has also been suggested (19). Again, with a similar degree of motor block it is difficult to explain why lidocaine should cause more relaxation and trauma to muscles and ligaments than the more longer acting local anaesthetics.

Until recently prilocaine has been poorly documented for use in spinal anaesthesia. The few reports that were available at the start of our study used doses from 50 to 125 mg (6, 20). The hyperbaric solution was reported to last as long as an equal dose of hyperbaric lidocaine (6) or about 40% longer (5). Hampl et al. recently found a similar duration of the sensory blockade following subarachnoidal injections of hyperbaric solutions of prilocaine or lidocaine (12). In our study using higher doses of isobaric solutions, the sensory block induced by prilocaine lasted about 20% longer than that induced by lidocaine.

Bupivacaine carries a consistently low frequency of TNS, for which reason small doses have been suggested as an alternative to lidocaine for SA of short duration. However, a sufficient time for surgery combined with a short recovery may be difficult to obtain. Besides, using very low doses of bupivacaine, motor block may be poor and there is little margin for the known individual variation of sensory blockade after spinal bupivacaine (4). Liu et al. found that SA using 11.2 mg hyperbaric bupivacaine in volunteers allowed painful stimulation at the pubis for 80 min followed by normal sensation to pinprick at S2 after 220 (52) min (4). This time to recovery is similar to what we obtained after 80 mg prilocaine in our study. Further studies are needed to compare prilocaine to low dose bupivacaine regarding TNS frequency, surgical anaesthesia and regression time.

In the present study the frequency of TNS after SA did not differ significantly between patients given prilocaine or lidocaine. However, considered together with recently published randomised studies, there may be an indication of a lower frequency after prilocaine. Plain prilocaine 80 mg is suitable for spinal anaesthesia when surgery is of intermediate duration.

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