Wound infiltration with lidocaine prolongs postoperative analgesia after haemorrhoidectomy with spinal anaesthesia

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Purpose: There are few clinical data examining whether sensitization of peripheral nerves contributes to postoperative pain when the entry of noxious impulses to the central nervous system is blocked. We hypothesized that wound infiltration with lidocaine would provide better postoperative analgesia than with normal saline following haemorrhoidectomy with spinal blockade.

Methods: In a randomized, placebo-controlled, blinded study, 168 adults undergoing haemorrhoidectomy were allocated to two groups. In Group L ($n = 88$) local infiltration was provided with lidocaine 1% and in Group S ($n = 80$) with normal saline. Following spinal anaesthesia with lidocaine 3%, the surgeon infiltrated 15 ml of either infiltration solution to the surgical area. Postoperative analgesia was obtained by continuous epidural administration of 90 mg eptazocine in normal saline for 48 hr. Supplemental analgesics were given on request. Postoperative pain control was assessed at rest and

during coughing with a 10 cm VAS on the 1st, 2nd, and 3rd postoperative days (POD).

Results: The VAS scores at rest in Group L were lower than those in Group S throughout the postoperative period. During coughing, VAS scores in Group S were increased on the 3rd postoperative day, while those in Group L remained constant (4.42 ± 0.27 vs 3.14 ± 0.28 , $P < 0.05$). Fewer patients in Group L than in Group S required supplemental analgesics.

Conclusion: Preoperative lidocaine infiltration to the surgical area provided prolonged postoperative analgesia in patients receiving haemorrhoidectomy with spinal anaesthesia.

Objectif: Nous ne possédons que peu de données portant sur l'influence de la sensibilisation des nerfs périphériques sur la douleur postopératoire quand la voie d'entrée des stimuli nocifs au système nerveux central est bloquée. Nous avons assumé que l'infiltration d'une plaie avec de la lidocaïne peut procurer une meilleure analgésie postopératoire que le sol. physiologique après une hémorroïdectomie sous rachianesthésie.

Méthodes: Au cours d'une anesthésie contrôlée avec placebo et en aveugle, 168 adultes programmés pour une hémorroïdectomie étaient répartis en deux groupes. Dans le groupe L ($n = 88$), une infiltration à la lidocaïne 1% était effectuée et dans le groupe S ($n = 88$), on utilisait du sol. physiologique. Après une anesthésie épidurale à la lidocaïne 3%, le chirurgien infiltrait le site chirurgical avec 15 ml d'une des deux solutions. L'analgésie postopératoire était réalisée par l'administration épidurale de 90 mg d'éptazocine dans du sol. physiologique pendant 24 h. Des analgésiques additionnels étaient administrés à la demande. Le contrôle de la douleur postopératoire était évalué au repos et pendant la toux sur une EVA de 10 cm les 1e, 2e et 3e jours postopératoires.

Résultats: Au repos les scores d'EVA du groupe L étaient inférieurs à ceux du groupe S pendant la période postopératoire. Pendant la toux, les scores d'EVA du groupe S augmentaient à la 3e journée postopératoire, alors que ceux du groupe L étaient constants ($4,42 \pm 0,27$ vs $3,14 \pm 0,28$, $P <$

Key words

ANAESTHESIA: ano-rectal;
ANAESTHETICS, LOCAL: lidocaine;
ANAESTHETIC TECHNIQUES: spinal, epidural;
ANALGESIA: postoperative;
ANALGESICS: eptazocine, loxoprofen.

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0,05). Moins de patients du groupe L que du groupe S avaient besoin d'analgésiques additionnels.

Conclusion: L'infiltration préopératoire de lidocaïne au site chirurgical procure une analgésie postopératoire prolongée aux hémorroïdectomisés sous rachianesthésie.

Functional alterations in both peripheral and central nervous systems, characterized by an increase in perception of noxious stimuli, may be primarily involved in the development of acute persistent pain following injury such as surgery or others.¹⁻³ The reduction of central sensitization by nerve blockade and/or opioid administration has been demonstrated in animal studies.^{4,5} Since potent nociceptive signals are generated not only by the surgical procedure but also by the action of inflammatory mediators released into wound tissues,^{3,6} local infiltration with local anaesthetics may offer superior protection of the central nervous system from noxious stimuli than nerve blockade at the level of spinal cord. Tverskoy *et al.* showed that local infiltration with local anaesthetic during general anaesthesia provided greater postoperative analgesia in patients receiving inguinal herniorrhaphy than spinal anaesthesia alone.⁷ General anaesthesia, as currently employed, is unlikely to suppress entry of noxious stimuli into the central nervous system completely.⁸ There are few clinical data examining explicitly whether wound infiltration with local anaesthetics prevents sensitization of peripheral nerves when the entry of noxious impulses to central nervous system is blocked. We, therefore, tested the hypothesis that wound infiltration with lidocaine prior to surgical incision provided greater postoperative analgesia than with normal saline in patients scheduled for haemorrhoidectomy during spinal anaesthesia.

Methods

Patients

Before commencing this study, institutional ethics committee approval and informed consent were obtained. One hundred and sixty-eight adult patients scheduled for elective haemorrhoidectomy during spinal anaesthesia and who had requested of an epidural catheter for postoperative pain management were studied. The criteria for exclusion from the study were; ASA physical status ≥ 3 , age > 75 yr, or those with neurological disorders. All patients received 50 mg hydroxyzine and 0.5 mg atropine *im* before induction of anaesthesia.

Anaesthetic protocol

On arrival at the operation room, the patients were placed in the right decubitus position. By using a combi-

nation of epidural and spinal needle and loss of resistance technique, a 17-gauge Tuohy needle (Uniever 80 mm; Murako Medical Co., Tokyo) was first advanced via a lateral approach at the L_{3/4} or L_{4/5} interspace. After spinal anaesthesia with a 26-gauge spinal needle (Uniever 26G spinal needle, 116 mm; Murako Medical Co., Tokyo) through the Tuohy needle was induced with 1.5 ml lidocaine 3% in a 30° head-up position. An epidural catheter was inserted for postoperative pain management. The patients were randomly allocated to the two groups according to the wound infiltration solution; Group L ($n = 88$) received lidocaine 1% and Group S ($n = 80$) normal saline. Both solutions contained 1:100,000 epinephrine to reduce bleeding from the surgical area. Prior to surgical incision, the surgeon, who was blinded as to the patient group, infiltrated 15 ml of either solution to the surgical area with a 24-gauge needle. All patients in both groups were operated upon by one surgeon. At the end of surgery, 100 mg indomethacin *pr* was given to all patients in both study groups.

Postoperative pain management and assessment

In Matsushima Hospital, continuous administration of epidural eptazocine (1-1,4-dimethyl-10-hydroxy-2,3,4,5,6,7-exahydro-1,6-methano-1H-4-benzazonine), an opioid agonist-antagonist,⁹ has been employed in patients who requested preoperatively. All patients, blinded to group allocation, received the same explanation of postoperative pain management, including epidural eptazocine administration and the use of supplementary analgesics. Postoperatively, the epidural catheter was connected to a continuous infusion balloon system (Drug infusion balloon catheter, 40–48 hr type; DIB International Co., Tokyo, Japan), loaded with 90 mg eptazocine (6 ml) in 34 ml normal saline for 48 hr. The patients were allowed to take either loxoprofen sodium (120 mg; a nonsteroidal anti-inflammatory drug) *po* or an indomethacin suppository (50 mg) for supplementary analgesia when necessary. In patients who suffered from very severe pain, 15 mg eptazocine *im* was injected on request by the ward nurses who were blinded to the study protocol. The patients were visited every morning on POD 1, 2, and 3 by the Pharmacy Pain Service Team blinded to the study grouping. Patients were asked to rate their peri-anal pain at rest and during coughing, using a 10 cm visual analogue scale (VAS) graded from 0 (no pain) to 10 (the most severe pain imaginable). Simultaneously, the patients were asked to score on the VAS when the first passage of feces occurred postoperatively.

Data analysis

The VAS data were analyzed using multiple analysis of

TABLE I Patient characteristics

	Normal saline (n = 80)	Lidocaine (n = 88)
Age (yr)	47.4 ± 1.5	48.5 ± 1.4
Male/female	47/33	48/40
Body weight (Kg)	60.1 ± 1.2	57.4 ± 1.2
Operation time (min)	9.8 ± 0.5	9.9 ± 0.4
Number of haemorrhoids operated		
– Ligation	0.89 ± 0.08	0.73 ± 0.08
– Ligation and excision	2.13 ± 0.12	2.18 ± 0.1

Data are expressed as mean ± S.D. There were no significant differences found between the groups.

FIGURE Evaluation of postoperative analgesia by visual analogue scale (VAS) at rest and during cough. Values are expressed as mean ± SEM. Abbreviations: Group S = wound infiltration with normal saline group; Group L = wound infiltration with lidocaine 1% group.

* $P < 0.05$ between the two groups throughout the study period,

$P < 0.05$ compared with POD 1 and 2,

@ $P < 0.05$ versus Group L on POD 3.

variance with repeated measurement. When significant differences were found, Bonferroni's corrected paired *t* test was employed for post hoc testing. The Mann-Whitney *U* test and Chi-square test were employed where appropriate. A $P < 0.05$ was considered statistically significant.

Results

Patient demographic data were not different between the two groups (Table I). The number of haemorrhoids which were ligated or ligated-and-excised was comparable between the two groups (Table I).

The VAS scores across the evaluation periods are depicted in the Figure. The VAS scores at rest in Group L were lower than those in Group S throughout the study ($P < 0.05$). While the VAS scores during coughing in Group L remained constant, those in Group S

TABLE II Percentage of patients who requested supplementary analgesics

	Normal saline	Lidocaine
Loxoprofen sodium		
– 0 POD	3.8%	0%
– 1 POD	66.3%	4.5%*
– 2 POD	75%	65.9%*
– 3 POD	46.3%	27.3%*
Indomethacin suppository		
– 0 POD	0%	0%
– 1 POD	6.3%	1.1%*
– 2 POD	70%	38.6%*
– 3 POD	42.5%	34.1%*
Eptazocine		
– 0 POD	0	0
– 1 POD	13.7%	4.5%*
– 2 POD	0	0
– 3 POD	0	0

* $P < 0.05$ vs normal saline group by chi-square test.

were increased on POD 3 ($P < 0.05$). The VAS score at the first passage of feces in Group L was decreased compared with that in Group S (3.45 ± 0.35 cm vs 4.14 ± 0.37 cm, $P < 0.05$), whereas the day scores were not different (2.3 ± 0.1 POD vs 2.0 ± 0.1 POD, respectively). Seven patients in Group L did not require any supplemental analgesia throughout the study period compared with three in Group S. Fewer patients in Group L required either loxoprofen sodium or indomethacin suppositories throughout the POD 1 to POD 3 than in Group S (Table II). On POD 1, more patients in Group S requested eptazocine injection than in Group L (Table II).

Discussion

While wound infiltration with local anaesthetics is a classical technique employed during surgery, little interest regarding its beneficial effect on postoperative pain was raised until this decade.^{3,10} Dahl and Kehlet recently reviewed and concluded that incisional local anaesthesia had only a small effect on pain and/or opioid requirements that was probably without any clinical relevance.¹⁰ However, this large, randomized, double-blind prospective study supported the view that prolonged analgesia could be obtained by wound pre-infiltration with local anaesthetics even in the presence of spinal block. Ejlsens *et al.*, suggested that pre-incisional infiltration of the surgical wound produced prolonged postoperative analgesia compared with post-incisional infiltration.¹¹ The current study further indicated that the prevention of peripheral sensitization is important in reducing postoperative acute pain in terms of both intensity and duration.

Compared with previous studies, several issues concerning our study design require mention. First, most previous studies employed a relatively small number of patients to obtain either positive or negative conclusion regarding postoperative analgesia by wound infiltration.^{12,13} Only one retrospective study with 631 orthopaedic patients¹⁴ showed a reduction of analgesic requirement and the prolongation of the time to the first analgesic in patients receiving local infiltration anaesthesia. Second, previous studies to examine the effects of wound infiltration with local anaesthetics^{7,15} have been performed mainly using general anaesthesia, which is unable to suppress the entry of noxious stimuli into the spinal cord.⁸ Since we employed spinal anaesthesia to prevent central sensitization at the level of the spinal cord in both study groups, the data can determine whether the prevention of peripheral sensitization played a role in obtaining prolonged postoperative relief. Third, it might be argued that wound infiltration was sufficient to minimize the repeated entry of noxious stimuli into the spinal cord. In order to keep technical factors and surgical stress consistent, an experienced surgeon, blinded to the study grouping, was engaged throughout the study. Although the validity of local infiltration anaesthesia could not be appreciated due to spinal anaesthesia, lidocaine infiltration reduced postoperative pain following haemorrhoidectomy. Finally, it is uncertain whether the small differences in VAS values at rest between the two groups are clinically important. In this study, more patients in Group S required supplementary analgesia throughout the postoperative period. Furthermore, cough-induced dynamic VAS scores increased on POD 3 only in Group S, probably because of stopping epidural eptazocine administration. Yet, the VAS at rest was higher in patients in Group S than in Group L throughout the study. Therefore, we believe that wound infiltration with lidocaine is effective even when central sensitization is prevented.

In addition to the primary effect of local anaesthetics producing neural blockade, they may also possess an anti-inflammatory action.¹⁶ Thus, infiltration of local anaesthetics into the surgical area may depress noxious impulses to the central nervous system not only by direct nerve block but also by impeding the release of inflammatory mediators. Another study suggested that infiltration of local anaesthetics resulted in the reduction of leukocyte migration and metabolic activation in the surgical area.¹⁷ Indomethacin suppositories may depress inflammatory responses by modifying the prostaglandin cascade in the surgical wound.^{18,19} The lack of any difference in cough-induced dynamic pain on POD 1 and 2 between the two groups could be attributed to differ-

ences in the consumption of supplemental analgesics such as indomethacin suppositories.

In conclusion, the employment of wound infiltration with lidocaine prior to surgical incision reduced both postoperative pain and the requirements for supplemental analgesics following haemorrhoidectomy with spinal anaesthesia. Although the underlying mechanism remains to be determined, the concept of preemptive analgesia by preventing peripheral sensitization may play a role in this prolonged postoperative pain relief.

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