Regional Anesthesia and Pain

Nerve stimulator guided pudendal nerve block decreases posthemorrhoidectomy pain

[Le bloc du nerf honteux guidé par neurostimulation diminue la douleur posthémorroïdectomie]

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Purpose: Based on our institution's initial results that reflected reduced postoperative pain using a modified pudendal nerve block technique, we conducted a prospective, randomized, double-blind study to investigate whether a combination of general anesthesia and bilateral nerve stimulator guided pudendal nerve blocks could provide better postoperative pain relief compared to general anesthesia alone or in combination with placebo nerve blocks.

Methods: Following Ethical Committee approval and informed consent 90 patients scheduled for hemorrhoidectomy were randomized to three different groups of 30 patients each: general anesthesia alone, general anesthesia plus nerve stimulator guided pudendal nerve block or general anesthesia plus placebo nerve blocks. Postoperative pain, the primary outcome variable of the study, was assessed by visual analogue scale scores at predetermined time intervals during the postoperative period. Total amount of analgesics, time to return to normal activities and patient satisfaction were also recorded.

Results: The pudendal nerve block group was found to have better postoperative pain-relief ($P < 0.005$), reduced need for analgesics ($P < 0.05$), and also a more rapid return to normal activities ($P < 0.001$) compared to general anesthesia alone or in combination with placebo blocks. The pudendal nerve block group was also associated with significantly higher patient satisfaction ($P < 0.001$) compared to the other two groups.

Conclusion: A combination of general anesthesia and nerve stimulator guided pudendal nerve block showed significantly reduced postoperative pain, shortened hospital stay, and earlier return to normal activity. Thus, this technique deserves more widespread use in patients undergoing hemorrhoidectomy.

Objectif: À partir des premiers résultats obtenus dans notre institution indiquant une réduction de la douleur postopératoire avec l'usage d'une technique modifiée de bloc du nerf honteux, notre étude prospective, randomisée et à double insu voulait vérifier si une combinaison d'anesthésie générale et des blocs bilatéraux du nerf honteux guidés par neurostimulation pouvaient mieux soulager la douleur postopératoire comparativement à l'anesthésie générale employée seule ou en combinaison avec des blocs nerveux simulés.

Méthode : Avec l'accord du Comité d'éthique et le consentement éclairé de 90 patients devant subir une hémorroïdectomie, nous avons formé au hasard trois groupes différents de 30 patients chacun pour recevoir : une anesthésie générale seulement, une anesthésie générale plus un bloc des nerfs honteux guidé par neurostimulation ou une anesthésie générale plus des blocs nerveux simulés. La douleur postopératoire, principale paramètre variable de l'étude, a été évaluée par l'échelle visuelle analogique à des intervalles de temps prédéterminés après l'opération. La quantité totale d'analgésiques, le temps nécessaire au retour des activités normales et la satisfaction du patient ont aussi été notés.

Résultats : Avec le bloc du nerf honteux, il y a eu un meilleur soulagement de la douleur postopératoire ($P < 0,005$), des besoins réduits d'analgésiques ($P < 0,05$) et un retour plus rapide aux activités normales ($P < 0,001$), comparé à l'anesthésie générale seule ou en combinaison avec des blocs simulés. Le bloc du nerf honteux a aussi été associé à une plus grande satisfaction des patients ($P < 0,001$) que les deux autres modes anesthésiques.

Conclusion : Une combinaison d'anesthésie générale et de bloc du nerf honteux guidée par neurostimulation a montré une douleur postopératoire significativement réduite, un plus court séjour hospitalier et un retour hâtif à l'activité normale. Cette technique pourrait donc être largement utilisée dans les cas d'hémorroïdectomie.

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Accepted for publication May 19, 2004.

Revision accepted September 30, 2004.

HEMORRHOIDECTOMY is frequently associated with significant postoperative pain of considerable duration.¹ The pain is often described as agonizing² and is accompanied by a substantial consumption of both opioid and non-opioid analgesics,³ leading to extended periods of sick-leave.⁴ Despite numerous attempts to modify both surgical techniques⁵⁻⁷ and anesthetic regimens,⁸⁻¹³ this problem remains clinically important.

A modification of the pudendal nerve block (PNB) technique has been used at our institution since 1999 in order to reduce postoperative pain following hemorrhoidectomy. Initial results have pointed to significantly reduced postoperative pain, shortened hospital stay and earlier return to work and normal activity. The aim of the current study was to corroborate our previous observational data by conducting a prospective double-blind placebo-controlled randomized trial. The primary outcome variables were postoperative pain assessed by visual analogue scale (VAS) scores at predetermined time intervals during the postoperative period, time to return to normal activities and postoperative analgesics' consumption.

Methods

Following Ethical Committee approval and written informed consent, 90 patients, aged 20 to 69 yr, 58 males and 32 females, scheduled for hemorrhoidectomy with Shackelford's classification grades II to IV¹⁴ were randomly assigned to one of three groups using the sealed opaque envelope technique based on computer generated random numbers; standardized general anesthesia (GA; $n = 30$) or GA with bilateral PNB ($n = 30$) or GA with placebo nerve blocks (PL; $n = 30$).

Patients with chronic renal failure, coagulopathy, symptoms of bladder neck obstruction, or patients for whom it would not be possible to conduct a telephone follow-up were not eligible for study inclusion. The study was conducted and funded at the Makassed General Hospital between June 1, 2002, and May 31, 2003.

Type of surgical procedure

All patients underwent open radical hemorrhoidectomy.¹⁵ Skin flaps were raised next to the squamocutaneous junction and advanced up to the dentate line (origin of the plexus). Excision of the plexus was then performed and the rectal mucosa was sutured to the fibres of the internal sphincter muscle.

Protocol for GA

All patients were given *iv* preoperative sedation before induction of anesthesia (midazolam 0.15 mg·kg⁻¹).

FIGURE 1 Landmarks for the injection points for the pudendal nerve block.

GA was induced by *iv* fentanyl (1.5 µg·kg⁻¹) and thiopental (3–5 mg·kg⁻¹) followed by endotracheal intubation facilitated by atracurium (0.5 mg·kg⁻¹). Anesthesia was subsequently maintained with isoflurane 1 to 3%, nitrous oxide 70% and oxygen 30%. The isoflurane concentration was adjusted with the intention of keeping heart rate and blood pressure within $\pm 25\%$ of preinduction values.

PNB technique

PNB or placebo injections were performed with the patient in the lithotomy position. Four separate injection points were used as indicated in Figure 1. Thus, patients in the GA group received only GA whereas patients assigned to the PL or PNB groups received a pudendal injection of either normal saline or a local anesthetic mixture (containing a mixture of bupivacaine, lidocaine, fentanyl and clonidine), respectively (total volume of injection 0.7 mL·kg⁻¹). Following aseptic preparation of the skin each of the four injection sites was infiltrated with 1 mL of 1% lidocaine. At the posterior injection points at four and eight o'clock (Figure 1) a 22-gauge 10-cm nerve stimulator needle (Stimuplex, B.Braun, Melsungen, Germany) was subsequently advanced approximately 7 to 10 cm (depending on patient size) perpendicularly to the skin in all planes, using a stimulating current of 2.5 to 5.0 mA and 1 Hz (Stimuplex, B.Braun, Melsungen, Germany). When appropriate nerve stimulation of the pudendal nerve with its inferior rectal nerve and per-

ineal branches could be verified (visualized as ipsilateral contractions of the posterior parts of the anal sphincter) the needle-tip position was optimized in a normal fashion by preserving muscle contractions while reducing the stimulating current to 0.5–0.6 mA, and the injection was performed.

A similar procedure was used for the anterior injection points (two and ten o'clock) but at these locations the needle was only advanced to a depth of 4 to 5 cm. The response to pudendal nerve stimulation at these locations will consist of a contraction of the more anterior parts of the ipsilateral anal sphincter and also contraction of the transversalis perineum superficial muscle.

0.2 mL·kg⁻¹ were injected at each of the posterior injection points (four and eight o'clock) and 0.15 mL·kg⁻¹ were injected at each of the anterior injection points (two and ten o'clock; total volume of injection: 0.7 mL·kg⁻¹). The time needed to perform the pudendal block ranged between ten to 20 min.

Each 20 mL of the local anesthetic mixture contained: 6 mL lidocaine 2%, 6 mL lidocaine 2% with adrenaline 5 µg·mL⁻¹, 5 mL bupivacaine 0.5%, 1 mL fentanyl 50 µg·mL⁻¹ and 2 mL clonidine 75 µg·mL⁻¹. This mixture has previously been reported to provide long-lasting postoperative pain relief after peripheral nerve blocks performed for various types of surgical interventions.^{16–19}

To allow for adequate blinding the solution used for injection (saline or local anesthetic mixture) was prepared by an independent nurse outside the operating room and the randomization code was not broken before the end of the study. Patients, data collection nurses, surgeons, and anesthesiologists were thus all kept unaware of the nature of the injected solution.

Data collection

Demographic data, duration of surgery and recovery room stay, postoperative nausea and vomiting (PONV), urinary retention, patient satisfaction and duration of hospital stay were recorded. Postoperative pain was assessed at rest at predetermined time intervals during the first six postoperative days (six hour, 12 hr, 24 hr, 36 hr, 48 hr, three days, four days, five days, and six days; Figure 2) using a VAS (0 - no pain and 100 - worst possible pain) and was also recorded at the first postoperative defecation. Amount of opioids consumed was recorded for the first six postoperative days. Following hospital discharge the patients were instructed to note the following: number of postoperative days required until the patient was able to sit and walk without pain and also the time (days) until return to work (employed patients) or normal

FIGURE 2 Visual analogue pain scores (mean, 95% confidence interval) during the first six postoperative days. A significant difference exists at all time points between PNB group and the other two study groups with a statistical significance of at least $P < 0.005$. PNB = pudendal nerve block.

activity (unemployed patients); these patient data were all collected at a 30-day follow-up telephone call.

The decision to discharge the patient from hospital was entirely made by the surgeon in charge according to established clinical routine (discharge criteria: adequate control of pain and nausea, ambulation without aid and spontaneous voiding).

Pharmacological management of postoperative pain

Patients with a VAS > 40 during the stay in hospital were given *im* pethidine (1 mg·kg⁻¹) as supplemental analgesia, whereas patients with VAS score < 40 were given an oral combination of dextropropoxifen (30 mg) and paracetamol (400 mg; Diantalvic, Hoechst-Marion-Roussel, France). Following discharge, patients were prescribed 20 mL of lactulose (Duphalac, Solvay Pharmaceuticals B.V., NL-Weesp, The Netherlands) twice daily and oral diclonefac 50 mg (Voltaren, Licence Novartis Pharma AG, Basle, Switzerland) three times daily for three weeks. Patients were also prescribed an oral dextropropoxifen - paracetamol combination if they needed additional analgesia following hospital discharge.

Statistics

The assessment of postoperative pain by VAS was used as the primary end-point of the study. Secondary end-points were consumption of analgesics, duration of hospital stay and time to return to work/normal activities.

FIGURE 3 Percentage of patients requiring opioid-containing analgesics during the first six postoperative days. A significantly lower requirement for supplemental opioid-containing analgesics was found in the PNB group throughout this time period ($P < 0.05$). PNB = pudendal nerve block.

Based on our previous observational data 30 patients in each group were found to be necessary in order to detect a 30% difference in VAS scores at six hours between the three groups with a confidence level of 95% ($\alpha = 0.05$) and a power of 90% ($\beta = 0.10$).

ANOVA tests with repeated measures were performed to determine significant differences for mean values between the study groups regarding age, height, weight, duration of operation, length of hospital stay and VAS scores. Chi-square tests were used for testing the differences in sex, PONV and need for supplemental opioid administration. P values less than 0.05 were considered significant.

Results

All included patients were entered into the final data analysis. The groups were similar with regard to sex, age, weight, height, body mass index, hemorrhoid grade, duration of surgery and recovery room stay (Table I). The incidences of PONV and urinary retention were also found to be similar between groups (Table II).

The average VAS scores at rest for the first six postoperative days were significantly lower in the PNB group compared to the GA and PL groups ($P < 0.005$; Figure 3). The vast majority of GA and PL patients needed supplemental *iv* or oral analgesics during the first six postoperative days (Figure 3) and the opioid consumption in the GA and PL groups was significantly

higher compared to the PNB group ($P < 0.05$). VAS score associated with the first postoperative defecation was also significantly lower in the PNB group compared to the other two study groups (Table II).

PNB patients had a significantly shorter duration of pain associated with walking and sitting (mean one day; $P < 0.001$) compared to GA and PL patients (mean six days; Table II). Five patients from the GA group and two patients from the PL group experienced severe exacerbation of pain on postoperative day four or five, necessitating readmission to the emergency room for adequate pain control.

The vast majority of PNB patients (97%) left the hospital within 24 hr which was significantly earlier than GA and PL patients ($P < 0.05$; Table II).

PNB patients were back to work or normal activity significantly sooner in comparison to GA and PL patients ($P < 0.01$). On average, PNB patients (seven days) were back to work or normal activity one week before GA patients (14 days) and PL patients (14 days; Table II).

Patient satisfaction with the anesthetic technique and postoperative pain relief was significantly higher in the PNB group (90%) compared to the GA group (37%) and the PL group (33%; $P < 0.0001$; Table II).

Discussion

In the present prospective, randomized, controlled clinical trial, GA combined with PNB for hemorrhoidectomy was associated with better pain-relief, reduced need for analgesics, less pain at first defecation and also a more rapid return to work or normal activities compared to GA alone or in combination with a placebo nerve block. The combined anesthetic technique was also associated with significantly higher overall patient satisfaction compared to the other two alternatives.

Postoperative pain following hemorrhoidectomy is usually very intense²⁰ and the pain at the first postoperative defecation has been described "like passing bits of broken glass."²¹ Severe postoperative pain usually leads to prolonged convalescence associated with substantial analgesic consumption, which in turn results in a typical sick-leave period of two to three weeks.⁴ Attempts to improve the situation by using new surgical techniques have unfortunately not been entirely successful^{5,7} and the results from using different types of topical application or infiltration of local anesthetics have been equally disappointing.⁸⁻¹³ Excellent surgical anesthesia and also good initial postoperative analgesia can be accomplished by the use of caudal or spinal anesthesia but the postoperative analgesia is short-lived and is also associated with disturbing side-effects e.g., urinary reten-

TABLE I Demographic data and duration of surgery and recovery room stay

	GA	PNB	PL
Number of patients	30	30	30
Sex (male:female)	19:11	18:12	21:9
Age (yr)	38.0 (11.3)	37.6 (9.8)	37.0 (10.2)
Height (cm)	168.4 (8.9)	167.3 (7.8)	168.6 (10.4)
Weight (kg)	73.4 (13.8)	70.4 (14.0)	74.5 (14.3)
<i>Body mass index</i>			
< 25	13	17	13
25–30 (overweight)	13	10	14
> 30 (obese)	4	3	3
<i>Hemorrhoid grade</i>			
II	7	5	6
III	12	11	12
IV	11	14	12
Time in operating room (hr)	1.0 (0.25)	1.1 (0.31)	1.0 (0.31)
Time in recovery room (hr)	1.2 (0.44)	1.0 (0.35)	1.2 (0.47)

Data are reported as mean (SD) or count (%). No statistical differences were observed between the three study groups. GA = general anesthesia; PNB = pudendal nerve block; PL = placebo.

TABLE II Postoperative and follow-up data

	GA	PNB	PL	<i>P value</i> †
Nausea	4 (13.33%)	3 (10.0%)	4 (13.33%)	N.S.
Vomiting	2 (6.67%)	0	3 (10%)	N.S.
Urine retention	3 (10.0%)	0	3 (10.0%)	N.S.
<i>Hospital stay</i>				<i>P = 0.05</i>
Outpatient	2	5	3	
One day	18	24	19	
Two or more days	10	1	8	
Pain with first defecation (VAS)	62.3 (17.4)	20.5 (17.6)	61.5 (11.6)	<i>P = 0.0001</i>
	60 (30-85)	20 (10-80)	60 (35-80)	
Pain during walking (days)	5.4 (6.9)	0.7 (1.0)	5.6 (6.8)	<i>P = 0.001</i>
	4 (0-30)	0 (0-4)	4.5 (0-30)	
Pain while sitting (days)	5.8 (6.1)	1.03 (1.2)	6.0 (5.9)	<i>P = 0.0001</i>
	5 (0-20)	1 (0-3)	5 (0-20)	
Time to return to work (days)	14.1 (7.5)	6.6 (2.9)	14.3 (7.2)	<i>P = 0.0001</i>
	15 (3-30)	7 (3-15)	15 (5-30)	
<i>Overall patient satisfaction</i>				
No	19 (63.3%)	3 (10%)	15 (50%)	
Yes	11 (36.7%)	27 (90%)	15 (50%)	<i>P = 0.0001</i>

† Results comparing the means of the three groups show that the means of the GA and PL groups are not significantly different and that the mean of the PNB group is significantly higher. GA = general anesthesia; PL = placebo; PNB = pudendal nerve block; VAS = visual analogue scale.

tion.^{12,13} Finding a method that can reduce postoperative pain substantially and, thus, would allow a more rapid recovery would be of great importance both for the patient and society in general.

The results of the present study corroborate our previous pilot observations of superior pain-relief, decreased consumption of analgesics, shorter hospital stay and a reduced period of sick-leave following an anesthetic regimen consisting of GA combined with a

PNB using a mixture of local anesthetics, fentanyl and clonidine (Appendix, available as Additional Material at www.cja-jca.org). Our current data are also in keeping with the findings of Luck *et al.* who, in a small prospective randomized clinical trial, found the combination of GA and ischiorectal fossa block with plain local anesthetics to produce improved analgesia during the first 24 hr following hemorrhoidectomy compared to GA alone.²²

In addition to the apparent cost savings for the health care system by a reduced duration of hospital stay and the obvious advantages both for the employer and the employee from a shorter sick-leave period, maybe the most interesting finding of the study was the extended period of pain-relief associated with our PNB technique.

The high success rate seen obtained in the present study is most likely due to the use of a nerve-stimulator guided technique that will improve the accuracy of needle placement and hence the chance of an adequate nerve block. However, the use of such a nerve-stimulator guided technique cannot explain the extended period of postoperative analgesia that significantly outlasted the expected duration (five to six hours) of the local anesthetic component of the mixture used for the block. This is in keeping with our previously published experience with this particular anesthetic mixture that has been associated with surprisingly long duration of analgesia following different types of surgery.^{16–19} Administration of clonidine²³ and opioids^{24,25} with local anesthetic solutions has been found capable of prolonging the duration of peripheral nerve blocks, but the observed period of analgesia following the use of the current mixture of local anesthetics, fentanyl and clonidine outlasts an additive or even a synergistic effect of the drugs used and, instead, infers a preemptive analgesic action.²⁶

Although preemptive analgesia has been validated in various experimental pain models, very few studies have been able to substantiate this concept in the clinical setting.¹⁶ A recent study by Giannoni and co-workers in pediatric tonsillectomy patients, showing improved postoperative analgesia for five days following pre-incision infiltration of the tonsillar fossae with a mixture of local anesthetic and clonidine,²⁶ corroborates our results. Recent case reports and experimental studies by Lavand'homme and Eisenach have also been able to show prolonged periods of pain-relief following administration of local anesthetic-clonidine solutions close to injured nerves.²⁷ Based on their own results and also previous studies by other research groups they speculate that clonidine is causing this effect by an interaction with the immune system, resulting in reduced recruitment of macrophages and lymphocytes at the nerve injury site and shift of the proportion of macrophages from the pro- to the anti-inflammatory phenotype.²⁷ Since hemorrhoidectomy will inevitably injure a large number of nerve endings and minor nerves at the site of surgery, such a theory could, potentially, explain the very long-lasting effects associated with our local anesthetic mixture.

In summary, in the present prospective, randomized controlled clinical trial the combination of GA and a PNB, using a mixture of local anesthetics, fentanyl and clonidine, was found to substantially reduce postoperative pain, consumption of analgesics, pain at first defecation and shorten the time to return to normal activities and work compared to GA alone or in combination with a PL. The use of a PNB was also associated with a very high overall patient satisfaction. Thus, the positive results of the present study appear to merit more widespread use of guided PNB in hemorrhoidectomy patients.

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