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Preemptive Analgesia with Local Lidocaine Infiltration for Single-Level Open Disc Operation

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Abstract: To evaluate the impact of preemptive local analgesia at the incision site for postoperative pain in patients undergoing disc operation. In this prospective, randomized, double-blinded, placebo-controlled study 166 patients were assigned to either lidocaine (n = 83) or placebo (n = 83) groups. The incision site was infiltrated with either 20 mL of 2% lidocaine and 0.9% saline in lidocaine group or 0.9% saline before the incision. Morphine (5 mg) was used for postoperative pain treatment. Postoperative pain was measured with Visual Analog Scale (VAS) in 6, 12, 24 and 48 h. Data were analyzed with SPSS software, using Chi-square and t-tests. The groups were matched for age, sex, type of operation, mean length of hospital stay and mean length of operation. Statistical analysis revealed no significant difference in visual analog scores of pain severity at 6, 12, 24 and 48 h after surgery between lidocaine and placebo groups (6 h: 38.22±26.87 vs. 34.52±24.43, p = 0.35; 12 h: 33.26±28.83 vs. 28.01±24.71, p = 0.20; 24 h: 26.71±23.31 vs. 22.85±22.48, p = 0.27; 48 h 16.35±10.16 vs. 15.23±8.90 p = 0.45). The amount of narcotics used post operatively had no meaningful difference in the groups (lidocaine 10.07±8.24 mg vs. placebo 10.54±9.31 mg p = 0.73). Preemptive analgesia with lidocaine 2% used subcutaneously before skin incision has no effect in reducing postoperative pain, narcotics demand and duration of hospital stay.

Key words: Discectomy, lidocaine; pain, preemptive analgesia

INTRODUCTION

Pain transmission from periphery to the central nervous system leads to modification or plasticity of this system and may result in more prolonged and pronounced pain perception, even after cessation of the painful stimulus (Woolf, 1989). Analgesia before the onset of pain, that is, preemptive analgesia prevents plasticity of the central nervous system and hence gives more effective pain relief (Woolf, 1989; Woolf and Chong, 1993; Kehlet, 1989). Preemptive analgesic strategies have involved interventions at one or more levels along the pain pathway (Kehlet and Dahl, 1993; Abram and Yaksh, 1993; Tverskoy *et al*., 1990, 1994; Ke *et al*., 1998; Aida *et al*., 1999; Bugedo *et al*., 1990; Sabanathan, 1995; Souter *et al*., 1994; Kelly *et al*., 2001). Surgery may be the clinical setting where preemptive analgesia techniques will be the most effective because the onset of the intense noxious stimulus is known (Kehlet and Dahl, 1993). It is essential to recognize that otherwise adequate levels of general anesthesia with a volatile drug such as isoflurane do not prevent central sensitization (Gottschalk *et al*., 1998). Thus, the potential for central sensitization exists even in unconscious patients who appear to be clinically unresponsive to surgical stimuli. In spite of all proceedings in recognition of pathophysiology of pain, pharmacology of analgesics and development of advanced techniques in control of pain, postoperative pain is yet a major issue in patient care (Apfelbaum *et al*., 2003). Preemptive analgesia strategies have included infiltration with local anesthetics (Abram and Yaksh, 1993; Tverskoy *et al*., 1990; Vaida *et al*., 2000), nerve block (Ke *et al*., 1998), epidural block (Aida *et al*., 1999; Tverskoy *et al*., 1994; Gottschalk, 1998), subarachnoid block (Vaida *et al*., 2000), intravenous analgesics (Bugedo *et al*., 1990) and antiinflammatory drugs (Sabanathan, 1995). Since infiltration of the operative field with local anesthetic lidocain is very cheap, the needed

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drug is easily available and has few side effects, we have focused on it to evaluate its efficacy on postoperative pain of patients undergoing open intervertebral disc surgery.

MATERIALS AND METHODS

This randomized, double blind, placebo controlled, clinical trial carried on 166 cases, (94 men and 72 women) with one level lumbar intervertebral disc herniation, in a 21 month period from January 2003 to October 2005, admitted to Naghavi Hospital of Kashan University of Medical Sciences (KAUMS), after approving by the Institutional Ethics Committee and obtaining informed consent from each of the patients. The patients were randomly assigned into lidocaine or placebo groups via computer-generated random number table. Patients with allergy to thiopental, morphine and history of substance abuse, those receiving chronic analgesic medications, systemic vascular diseases, neurological disorders, diabetes mellitus and previous spine operations were excluded from the study.

In operation room after IV cannulation, each patient received 2 mL kg^{-1} of Ringer solution, followed by 2 μg kg^{-1} fentanyl 3 minutes before induction of anesthesia as a premedication. Then anesthesia was induced with 5 mg kg^{-1} of sodium thiopental and endotracheal cuffed tube of suitable size inserted after administration of 1.5 mg kg^{-1} of succinylcholine. Further neuromuscular block was achieved by 0.2 mg kg^{-1} of atracurium and repeated every 30 min intraoperatively. Anesthesia maintained with nitrous oxide 50% and halothane 0.5% in oxygen. Intravenous fentanyl (1 μg/kg/h) was given intraoperatively for additional analgesia. Monitoring included noninvasive arterial blood pressure, heart rate, peripheral oxygen saturation, end-tidal CO_2 monitoring and electrocardiogram.

While in prone position placebo group received 20 cc of saline with 1/500,000 epinephrine and lidocaine group 20 cc lidocaine 2% with 1/500,000 epinephrine subcutaneously. Study drugs were prepared by an anesthesiologist independent to the study and were injected subcutaneously 5 min before the incision. Operation was a single level unilateral keyhole procedure by excision of caudal part of superior lamina and ligamentum flavum, gentle retraction of nerve root and excision of the disc. At the end of the operation, in supine position anesthesia was discontinued and residual neuromuscular blockade was antagonized by 40 μg kg^{-1} of neostigmine and 20 μg kg^{-1} atropine. The patients were extubated after full awakening. Surgical time was defined from skin incision to the last suture. All patients were monitored in the Post Anesthesia Care Unit (PACU) for 2 h and then returned to the ward. Severity of pain was graded with the use of a 100 mm Visual Analogue Score (VAS) printed on a slide rule bar (Astra USA Inc., Westborough, MA) 6, 12, 24 and 48 h postoperatively, with the patients in supine position. In the PACU or ward after measurement of pain severity if it was 4 and greater, 5 mg of morphine was administrated intramuscularly. Length of the operation, pain severity at the above mentioned times, amount of opiates used postoperatively and length of hospital stay was recorded for both groups. Data were analyzed in the SPSS statistical program (SPSS Inc., Chicago). Pairwise comparisons were performed using Student's t-test for independent samples. The two-level data (e.g., patient gender) were compared using the Chi-square test. $p<0.05$ was considered statistically significant.

RESULTS AND DISCUSSION

From 166 patients, 83 were assigned into the lidocaine and 83 into the placebo group. The groups were matched for age, sex and types of operations ($p>0.05$ for all). Additionally we compared mean length of hospital stay and mean duration of surgery and found no significant differences between the two groups (Table 1).

Table 2 demonstrates visual analog scores between the two groups in various times. Statistical analysis revealed no significant difference in pain severity at 6, 12, 24 and 48 h after surgery.

The amount of narcotics used post operatively had no meaningful difference in the groups (Table 2).

Table 1: Demographic data and operation characteristics

	Groups		
Characteristics	Lidocaine group	Placebo group	p-value
Number	83	83	
Age	40.68±11.24	43.21±13.57	0.23
Sex (M:F)	46:37	48:35	0.5
Operation time (min)	115.44±37.37	104.28±30.68	0.1
Hospital stay (day)	5.03±2.53	4.86±2.15	0.64
Lumbar vertebra	46	49	0.37
Lumbosacral vertebra	37	34	0.37

Values represent Mean±SD

Table 2: Postoperative intravenous consumption of morphine and visual analog pain scores after surgery in patients receiving lidocaine or placebo

	Groups		
Characteristics	Lidocaine group	Placebo group	p-value
Pain score after surgery			
6 h	38.22±26.87	34.52±24.43	0.35
12 h	33.26±28.83	28.01±24.71	0.20
24 h	26.71±23.31	22.85±22.48	0.27
48 h	16.35±10.16	15.23±8.9	0.45
Postoperative consumption of morphine	10.07±8.24	10.54±9.31	0.73

Values represent Mean±SD

In this study there was no significant difference between the two groups in severity of postoperative pain. The main concept of preemptive analgesia is better control of post injury pain. This subject was evaluated with the amount of narcotics used for relieving postoperative pain in patients. As it is shown in Table 2 there is no significant difference in the amount of narcotics administered to both groups. Afferent nociceptive input to the spinal cord during and after tissue injury results in alterations in sensory processing in the spinal cord and expansion of receptive fields resulting in hyperalgesia and prolongation of postinjury pain (Woolf, 1983; Cook *et al*., 1987; LaMotte *et al*., 1992). A proximal neural block performed before experimental thermal injury prevented the development of hyperalgesia in human volunteers (Pedersen *et al*., 1996). The concept of preemptive analgesia in perioperative pain management is based on the premise that preoperative administration of analgesics will modify the afferent nociceptive barrage from the site of injury, thus preventing the development of central sensitization and hyperalgesia.

Several studies have demonstrated the effect of lidocaine infiltration on pain and opiate consumption after surgery. Lowenstein *et al.* (2006) showed preoperative preemptive analgesia with lidocaine infiltration reduces pain in the first hours after hysterectomy. Rosaeg *et al.* (1998) demonstrated that tumescent infiltration with lidocaine before reduction mammoplasty resulted in better pain control in the early postoperative period and reduced requirements for opiate analgesic medication. Some other studies have not shown this effect. In a study on 119 patients undergoing thoracotomy the patients were randomly allocated into two groups, one receiving 1% lidocaine and epinephrine and the other saline and epinephrine at the site of thoracotomy skin incision. Injection of lidocaine did not decrease the amount or type of pain during hospital stay (Cerfolio *et al*., 2003). In another study it was found that local anesthetics decrease the demand of analgesics but have no effect on severity of pain (Ong *et al*., 2005). In a review of 80 randomized trials including 3,761 patients in which 1964 patients received preemptive treatment, 20 trials comparing preemptive with post-incision application of peripheral local anesthetics were analyzed (Møiniche *et al*., 2002; Dahl and Møiniche, 2004). These were divided into trials of wound infiltration, peripheral nerve block and intraperitoneal infiltration. Sixteen trials compared preoperative incision local anesthetics with similar post-incision administration. Quantitative analysis was possible for 14 of these trials. Visual Analog Score (VAS) between treatment groups was not significant. It was concluded that there was no evidence for improved pain relief with preemptive local anesthetic wound infiltration compared with a similar post-incision administration of medications (Møiniche *et al*., 2002).

Several possible reasons may explain conflicts between our results and other studies. First and perhaps the most important, is that the idea of preemptive analgesia does not work as well in the spine as it does in other areas of the body (Bell *et al*., 2001; Di Marco *et al*., 2001; Johansson *et al*., 1994; Erichsen *et al*., 1995). This may be because local infiltration of the skin and subcutaneous tissues will not prevent nociceptive impulses from the deeper structures transmitting to the central nervous system. Periosteum, disc annulus, paravertebral musculature and ligaments all have nociceptors, which may have been sensitized prior to operation due to the patient's underlying problem needing the surgery. Another possibility may be inadequate amount of administered lidocaine on the one hand and short duration of action of the drug on the other hand (Souter *et al*., 1994) and a final possibility may be inadequate number of cases which may be the cause of the trend but not a statistically significant difference between the groups.

As a whole it can be concluded that, at least when used alone, subcutaneous infiltration of lidocaine before skin incision has no effect in reducing postoperative pain, narcotics demand and duration of hospital stay. Further investigations affecting various mechanisms involved in production, conduction and perception of pain in different parts of the nervous system are recommended.

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REFERENCES

Abram, S.E. and T.L. Yaksh, 1993. Morphine, but not inhalational anesthesia, blocks post-injury facilitation. The role of preemptive suppression of afferent transmission. Anesthesiology, 78: 713-721.

Aida, S., H. Baba, T. Yamakura, K. Taga, S. Fukuda and K. Shimoji, 1999. The effectiveness of preemptive analgesia varies according to the type of surgery: A randomized, double-blind study. Anesth. Analg., 89: 711-716.

Apfelbaum, J.L., C. Chen, S.S. Mehta and T.J. Gan, 2003. Postoperative pain experience: Results from a national survey suggest postoperative pain continues to be undermanaged. Anesth. Analg., 97: 534-540.

Bell, R.F., A. Sivertsen, P. Mowinkel and H. Vindenes, 2001. A bilateral clinical model for the study of acute and chronic pain after breast-reduction surgery. Acta Anaesthesiol Scand., 45: 576-582.

Bugedo, G.J., C.R. Carcamo, R.A. Mertens, J.A. Dagnino and H.R. Muñoz, 1990. Preoperative percutaneous ilioinguinal and iliohypogastric nerve block with 0.5% bupivacaine for post-herniorrhaphy pain management in adults. Reg. Anesth., 15: 130-133.

Cerfolio, R.J., A.S. Bryant, C.S. Bass and A.A. Bartolucci, 2003. A prospective, double-blinded, randomized trial evaluating the use of preemptive analgesia of the skin before thoracotomy. Ann. Thorac. Surg., 76: 1055-1058.

Cook, A.J., C.J. Woolf, P.D. Wall and S.B. McMahon, 1987. Dynamic receptive field plasticity in rat spinal cord dorsal horn following C-primary afferent inputs. Nature, 325: 151-153.

Dahl, J.B. and S. Møiniche, 2004. Pre-emptive analgesia. Br. Med. Bull., 71: 13-27.

Di Marco, P., F.P. Grippaudo, G.D. Rocca and R.D. Vita, 2001. Role of Pre-emptive analgesia in reduction mammoplasty. Scan J. Plast. Reconstr. Hand Surg., 3: 297-300.

Erichsen, C.J., J. Vibits, J.B. Dahl and H. Kehlet, 1995. Wound infiltration with ropivacaine and bupivacaine for pain after inguinal herniotomy. Acta Anesthesiol. Scand., 39: 67-70.

Gottschalk, A., D.S. Smith, D.R. Jobes, S.K. Kennedy and S.E. Lally *et al*., 1998. Preemptive epidural analgesia and recovery from radical prostatectomy: A randomized controlled trial. JAMA., 279: 1076-1082.

Johansson, B., H. Glise, B. Hallerback, P. Dalman and A. Kristoffersson, 1994. Preoperative local infiltration with ropivacaine for postoperative pain relief after cholecystectomy. Anesth. Analg., 78: 210-214.

Ke, R.W., G. Portera, W. Bagous and S.R. Lincoln, 1998. A randomized, double-blinded trial of preemptive analgesia in laparoscopy. Obstet. Gynecol., 92: 972-975.

Kehlet, H., 1989. Surgical stress: The role of pain and analgesia. Br. J. Anaesth., 63: 189-195.

Kehlet, H. and J.B. Dahl, 1993. The value of multimodal or balanced analgesia in postoperative pain treatment. Anesth. Analg., 77: 1048-1056.

Kelly, D.J, M. Ahmad and S.J. Brull, 2001. Preemptive analgesia II: Recent advances and current trends. Can. J. Anesth., 48: 1091-1101.

LaMotte, R.H., L.E.R Lundberg and H.E. Torebjork, 1992. Pain, hyperalgesia and activity in nociceptive C units in humans after intradermal injection of capsaicin. J. Physiol., 448: 749-764.

Lowenstein, L., E.Z. Zimmer, M. Deutsch, Y. Paz, D. Yaniv and P. Jakobi, 2006. Preoperative analgesia with local lidocaine infiltration for abdominal hysterectomy pain management. Eur. J. Obstet. Gynecol. Reprod. Biol., 136: 239-242.

Møiniche, S., H. Kehlet and J.B. Dahl, 2002. A Qualitative and Quantitative systematic review of preemptive analgesia for postoperative pain relief. The role of timing of analgesia. Anesthesiology, 96: 725-741.

Ong, C.K, P. Lirk, R.A. Seymour and B.J. Jenkins, 2005. The efficacy of preemptive analgesia for acute postoperative pain management: A meta-analysis. Anesth. Analg., Mar., 100: 754-756.

Pedersen, J.L., M.E. Crawford, J.B. Dahl, J. Brennum and H. Kehlet, 1996. Effect of preemptive nerve block on inflammation and hyperalgesia after human thermal injury. Anesthesiology, 84: 1020-1026.

Rosaeg, O.P., M. Bell, N.T. Cicutti, K.C. Dennehy, A.C. Lui and B. Krepski, 1999. Pre-incision infiltration with lidocaine reduces pain and opioid consumption after reduction mammoplasty. Reg. Anesth. Pain. Med., 24: 581-582.

Sabanathan, S., 1995. Has postoperative pain been eradicated? Ann. R. Coll. Surg. Engl., 77: 202-209.

Souter, A.J., B. Fredman and P.F. White, 1994. Controversies in the perioperative use of nonsteroidal anti-inflammatory drugs. Anesth. Analg., 79: 1178-1190.

Tverskoy, M., C. Cozacov, M. Ayache, E.L. J.r. Bradley and I. Kissin, 1990. Postoperative pain after inguinal herniorrhaphy with different types of anesthesia. Anesth. Analg., 70: 29-35.

Tverskoy, M., Y. Oz, A. Isakson, J. Finger, E.L. Jr Bradley and I. Kissin, 1994. Preemptive effect of fentanyl and ketamine on postoperative pain and wound hyperalgesia. Anesth. Analg., 78: 205-209.

Vaida, S.J., B. Ben David, M. Somri, M. Croitoru, E. Sabo and L. Gaitini, 2000. The influence of preemptive spinal anesthesia on postoperative pain. J. Clin. Anesth., 12: 374-377.

Woolf, C.J., 1983. Evidence for a central component of post injury pain hypersensitivity. Nature, 308: 686-688.

Woolf, C.J., 1989. Recent advances on the pathophysiology of acute pain. Br. J. Anaesth., 63: 139-146.

Woolf, C.J. and M.S. Chong, 1993. Preemptive analgesia-treating postoperative pain by preventing the establishment of central sensitization. Anesth. Analg., 77: 362-379.