

## POSTOPERATIVE WOUND ANALGESIA: A RENEWED MODALITY?

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Effective postoperative analgesia is important from the patient's perspective and can also improve clinical outcomes. Recent surveys report only modest success in providing suitable analgesia, as 30% to 86% of surgical patients report moderate to severe pain after a surgical procedure. Although "advanced" analgesic techniques, such as epidural analgesia or perineural catheters, can provide superior analgesia, many of these analgesic modalities are labor-intensive and expensive. A promising modality that might help improve postoperative analgesia is the relatively simple technique in which the surgeon directly places a catheter to infuse local anesthetic into wounds at the end of the procedure. This modality can be widely used, is technically efficient, offers the potential to provide complete analgesia or to substantially reduce the need for opioids and their related side effects, can be used for several days, and can now, with the introduction of new portable pumps, be used on an ambulatory basis (1). *Journal of NYSORA; 13: 9-17*

1. Liu SS, Richman JM, Thirlby RC, Wu CL. Efficacy of continuous wound catheters delivering local anesthetic for postoperative analgesia: a quantitative and qualitative systematic review of randomized controlled trials. *J Am Coll Surg* 2006 Dec;203(6):914-32

### POSTOPERATIVE WOUND ANALGESIA

#### Wound analgesia with diclofenac

Postoperative pain mostly results from sensitization of afferent fibers at injury sites driving central sensitization. Recently, peripheral processes have gained attention as mechanisms of hyperalgesia, and prostaglandins are among highly sensitizing agents. To date, perioperative administration of a single local dose of nonsteroidal antiinflammatory drugs has shown inconclusive efficacy. Rather than a single bolus, the current study of De Kock et al. (1) evaluates the postoperative analgesic effect of diclofenac continuous intrawound infusion after elective cesarean delivery. Ninety-two parturients were randomly allocated to receive a 48-h continuous intrawound infusion with 240 ml containing 300 mg diclofenac, 0.2%

ropivacaine, or saline. In the ropivacaine and saline groups, patients also received 75 mg intravenous diclofenac every 12 h for 48 h. Postoperative evaluation included intravenous morphine consumption by patient-controlled analgesia and visual analog pain scores. Punctate mechanical hyperalgesia surrounding the wound and presence of residual pain after 1 and 6 months were also assessed. Continuous diclofenac infusion significantly reduced postoperative morphine consumption (18 mg; 95% confidence interval, 12.7-22.2) in comparison with saline infusion and systemic diclofenac (38 mg; 95% confidence interval, 28.8-43.7) ( $P=0.0009$ ) without unique adverse effects. Postoperative analgesia produced by local diclofenac infusion was as effective as local ropivacaine infusion with systemic diclofenac. After elective cesarean delivery, continuous intrawound infusion of diclofenac demonstrates a greater opioid-sparing effect and better postoperative analgesia than the same dose administered as an intermittent intravenous bolus.

1. Lavand'homme, Patricia M. M.D., Ph.D.; Roelants, Fabienne M.D.; Waterloos, Hilde R.N.; De Kock, Marc F. M.D., Ph.D. Postoperative Analgesic Effects of Continuous Wound Infiltration with Diclofenac after Elective Cesarean Delivery. *Anesthesiology*; June 2007 - Volume 106 - Issue 6 - pp 1220-1225

### **Incisional pain after Cesarean section**

Beyond the sensitization of damaged tissue, surgical incision also induces central neuronal sensitization and probably the development of residual pain after surgery (1) Recent studies mention cesarean delivery as a cause of chronic pain (2), representing a significant problem in 6-12% of patients 10 months after the procedure(3). Among the established risk factors for development of chronic pain after surgery, the severity of acute postoperative pain is one of the most striking (1,3). Although different nociceptive mechanisms participate in incisional pain (4,5), acute postoperative pain results in part from sensitization of primary afferent nociceptors at the site of injury, which in turn drives pain and enhanced responsiveness of central neurons (6).

1. Perkins FM, Kehlet H: Chronic pain as an outcome of surgery: A review of predictive factors. *Anesthesiology* 2000; 93:1123-33
2. Almeida EC, Nogueira AA, Candido dos Reis FJ, Rosa e Silva JC: Cesarean section as a cause of chronic pelvic pain. *Int J Gynaecol Obstet* 2002; 79:101-4
3. Nikolajsen L, Sorensen HC, Jensen TS, Kehlet H: Chronic pain following caesarean section. *Acta Anaesthesiol Scand* 2004; 48:111-6
4. Brennan TJ: Frontiers in translational research: The etiology of incisional and postoperative pain. *Anesthesiology* 2002; 97:535-7
5. Dirks J, Moiniche S, Hilstedt KL, Dahl JB: Mechanisms of postoperative pain: Clinical indications for a contribution of central neuronal sensitization. *Anesthesiology* 2002; 97:1591-6
6. Zahn PK, Brennan TJ: Primary and secondary hyperalgesia in a rat model for human postoperative pain. *Anesthesiology* 1999; 90:863-72

### **Preemptive Vs. Postincisional Wound Analgesia**

The concept of preemptive analgesia to reduce the magnitude and duration of postoperative pain was paved in 1983 by Woolf, who showed evidence for a central component of postinjury pain hypersensitivity in experimental studies. Subsequently, an overwhelming amount of experimental data demonstrated that various antinociceptive techniques applied before injury were more effective in reducing the postinjury central sensitization phenomena as compared with administration after injury.

Finally, these promising experimental findings were taken into clinical testing of the hypothesis. Although early reviews of clinical findings were mostly negative, there is still a widespread belief of the efficacy of preemptive analgesia among clinicians.

Steen et al. (1) compared sixteen trials of preoperative incisional local anesthetics with similar postincisional administration. Bupivacaine (0.25-0.5%), ropivacaine (0.75%), and lidocaine (1-1.5%) were administered in volumes between 4 and 45 ml depending on the extent of the surgical incision and type of procedure. Intraoperative fentanyl or alfentanil and nitrous oxide were coadministered in 10 and 13 studies, respectively. Evaluated surgical procedures were hernia repair, appendectomy, hysterectomy, tonsillectomy, total knee replacement, laparoscopy, breast biopsy, and odontologic surgery.

Pain scores were significantly reduced 24 h after surgery in the preemptive group in one trial and at certain time points in the postincisional group in two other trials. In the other trials, no differences in pain scores between groups were observed. Quantitative analysis was only performed with 14 trials because of lack of dispersion measures in the last two trials. Using a fixed-effect model ( $P = 0.29$ ), the WMD of VAS pain scores between treatment groups was nonsignificant (WMD, 0 mm; 95% CI, -3 to 4).

Analgesic demand was significantly reduced by 50% over a 6-h observation period in one trial, and time to first analgesic request was prolonged by 4 h in another trial in the preemptive compared with the postsurgical treatment groups. In none of the other trials were significant differences observed between study groups.

A number of studies suffered from low internal sensitivity because of low pain scores in either group. Furthermore, statistical power analysis was only performed in seven of the trials, revealing an 80-90% power of detecting a difference of 10-15 mm VAS. In summary, there is no evidence for improved pain relief with preemptive local anesthetic wound infiltration compared with a similar postincisional administration.

1. Moiniche, Steen M.D.; Kehlet, Henrik M.D., D.M.Sc.; Dahl, Jørgen Berg M.D., D.M.Sc. A Qualitative and Quantitative Systematic Review of Preemptive Analgesia for Postoperative Pain Relief: The Role of Timing of Analgesia. *Anesthesiology*, March 2002 - Volume 96 - Issue 3 - pp 725-741.

### **Pediatric Wound Analgesia**

Forty-nine boys scheduled for day-case inguinal herniotomy studied to compare ilio-inguinal nerve block and wound infiltration for postoperative analgesia. Both techniques were simple to perform and produced no complications. In the ilio-inguinal block group, 100% had either no pain or very mild discomfort when assessed 60 minutes after return to the day unit, compared to 95% in the infiltration group. Some children did appear to have pain following discharge but in all cases this responded well to simple analgesics. It was concluded that both techniques provide satisfactory analgesia whilst the complications of narcotics are avoided, and suggest that simple infiltration of the wound with local anaesthetic solution should be encouraged in pediatric anesthesia (1).

Machotta et al. (2) compared the postoperative pain relief for inguinal herniotomy in children provided by instillation of bupivacaine into the wound with that provided by a caudal block. Fifty-eight children aged 0-5 years having elective unilateral hernia repair were studied in this prospective, randomized, single-blind study. Anesthesia was induced and maintained with oxygen, nitrous oxide, sevoflurane and propofol. Patients were randomly assigned to receive caudal analgesia with 1.0 ml.kg<sup>-1</sup> body weight (BW) bupivacaine 0.25% or wound instillation with 0.2 ml.kg<sup>-1</sup> BW bupivacaine 0.5% at the end of surgery. Pain was assessed over 24 h using a modified 10-point objective pain scale. During the first postoperative hour in the postanesthesia care unit (PACU), intravenous (i.v.) piritramide (0.05 mg.kg<sup>-1</sup>) was administered to any child scoring 5 or more points on the pain scale. On the ward, rectal acetaminophen was administered by a staff nurse when considered necessary. Thirty children in the caudal group and 28 children in the wound instillation group were studied. There were no statistically significant differences between the groups regarding need for i.v. opioids, discharge time from the PACU and administration of acetaminophen. No statistically significant differences in postoperative pain score were observed in 16 of a total of 17 postoperative observations. No complications and no adverse effects were observed. Instillation of bupivacaine into a wound provides postoperative pain relief following hernia repair, which is as effective as that provided by a postoperative caudal block.

1. Reid MF, Harris R, Phillips PD, Barker I, Pereira NH, Bennett NR. Day-case herniotomy in children. A comparison of ilio-inguinal nerve block and wound infiltration for postoperative analgesia. *Anaesthesia*. 1987 Jun;42(6):658-61
2. Machotta A, Risse A, Bercker S, Streich R, Pappert D. Comparison between instillation of bupivacaine versus caudal analgesia for postoperative analgesia following inguinal herniotomy in children. *Paediatr Anaesth*. 2003 Jun;13(5):397-402.

### **Continuous Wound Analgesia after a Cesarean Section**

Givens et al. (1) investigated the efficacy of continuous local anesthetic infusion system for pain control after cesarean delivery. This was a randomized prospective double-blind study. Patients who underwent cesarean delivery had a pain system implanted subcutaneously after closure of the fascia. Patients were randomized to receive an infusion of either 0.25% bupivacaine (n = 20) or normal saline solution (n = 16) into the wound for 48 hours. Postoperative pain (determined with a visual analog scale) and postoperative morphine use were assessed at 12, 24, and 48 hours. There were no significant differences in patient demographics or visual analog pain scores at any time interval between the bupivacaine versus the placebo group.

However, narcotic requirements to produce this amount of pain relief were significantly less in patients who received bupivacaine infusion rather than normal saline solution at all time intervals. The continuous local anesthetic infusion system appears to be effective in reducing postoperative morphine use after cesarean delivery.

1. Givens VA, Lipscomb GH, Meyer NL. A randomized trial of postoperative wound irrigation with local anesthetic for pain after cesarean delivery. *Am J Obstet Gynecol*. 2002 Jun;186(6):1188-91.

### **Ketamine Wound Analgesia**

Patients with unilateral (n = 14) and bilateral (n = 4) herniorrhaphy participated in this study. With bilateral herniorrhaphy, at the end of the surgery, the wound was infiltrated with a solution of bupivacaine 0.5% and ketamine 0.3% on one side and a solution of bupivacaine 0.5% only, on the other. With unilateral herniorrhaphy, the patients were randomly assigned to one of two groups (n = 7). One group at the end of the surgery received the infiltration with a solution of bupivacaine 0.5% and ketamine 0.3%, the other group received the infiltration with a solution of bupivacaine 0.5% only. The duration of the local anesthetic (response to a von

Frey filament) and postoperative analgesic (time to mild spontaneous pain) effects of the infiltrations, as well as wound pain threshold 24 h after surgery (pressure algometry), were determined. In patients with unilateral herniorrhaphy, the addition of ketamine for wound infiltration enhanced the duration of infiltration anesthesia (206 +/- 76 versus 343 +/- 108 min,  $P < 0.02$ ) and analgesia (240 +/- 45 versus 420 +/- 151 min,  $P < 0.03$ ). Similar enhancement of the local anesthetic effect was observed in patients with bilateral herniorrhaphy. The increase in pain threshold to pressure on the wound with the addition of ketamine was evident in bilateral herniorrhaphy patients and also with a combination of bilateral and unilateral results (1.39 +/- 0.40 versus 2.35 +/- 0.92 kg,  $P < 0.02$ ). In the group of five volunteers, the subcutaneous infiltration with 0.3% ketamine produced a local anesthetic effect lasting only 10-20 min. The results indicate that ketamine acting via a peripheral mechanism can profoundly enhance anesthetic and analgesic actions of a local anesthetic administered for infiltration anesthesia (1).

1. Tverskoy M, Oren M, Vaskovich M, Dashkovsky I, Kissin I. Ketamine enhances local anesthetic and analgesic effects of bupivacaine by peripheral mechanism: a study in postoperative patients. *Neurosci Lett.* 1996 Aug 30;215(1):5-8.

### **Magnesium- Ropivacaine Wound Analgesia**

A prospective, randomized, double-dummy study was undertaken to compare the effects of magnesium sulphate (MgSO<sub>4</sub>) administered by the intravenous vs. the infiltration route on postoperative pain and analgesic requirements. Forty ASA I or II men scheduled for radical retropubic prostatectomy under general anesthesia were randomized into two groups (n=20 each). Two medication sets A and B were prepared at the pharmacy. Each set contained a minibag of 50 ml solution for IV infusion and a syringe of 45 ml for wound infiltration. Group MgSO<sub>4</sub>.IV patients received set A with 50 mg/kg MgSO<sub>4</sub> in the minibag and 190 mg of ropivacaine in the syringe. Group MgSO<sub>4</sub>/L received set B with isotonic saline in the minibag and 190 mg of ropivacaine +750 mg of MgSO<sub>4</sub> in the syringe. The IV infusion was performed over 30 min at induction of anesthesia and the surgical wound infiltration was performed during closure. Pain was assessed every 4 h, using a 100-point visual analogue scale (VAS). Postoperative analgesia was standardized using IV paracetamol (1 g/6 h) and tramadol was administered via a patient-controlled analgesia system.

The follow-up period was 24 h. The total cumulative tramadol consumption was 221 +/- 64.1 mg in group MgSO<sub>4</sub>.IV and 134 +/- 74.9 mg in group MgSO<sub>4</sub>/L ( $P < 0.01$ ). VAS pain scores were equivalent in the two groups throughout the study. No side-effects, due to systemic or local MgSO<sub>4</sub> administration, were observed. Co-administration of MgSO<sub>4</sub> with ropivacaine for postoperative infiltration analgesia after radical retropubic prostatectomy produces a significant reduction in tramadol requirements (1).

1. Tauzin-Fin P, Sesay M, Svartz L, Krol-Houdek MC, Maurette P. Wound infiltration with magnesium sulphate and ropivacaine mixture reduces postoperative tramadol requirements after radical prostatectomy. *Acta Anaesthesiol Scand.* 2009 Apr;53(4):464-9.

### **Intraleural Bupivacaine Wound Analgesia**

Demmy et al. (1) compared a simplified method of intraleural bupivacaine administration with traditional analgesic therapy to decrease postoperative pain and opioid usage in patients after thoracoscopy. Thirty patients who had non-rib-spreading thoracoscopic operations under general anesthesia were prospectively randomized to no local anesthetic infusion (control), intermittent bolus (30 mL every 6 hours), or continuous infusion (5 mL/h). Bupivacaine (0.25%) was delivered through the pleural infusion channel of a specially designed single silicone 28F chest tube. Total intravenous fentanyl patient-controlled analgesia (boluses with basal rate) infused in the first 24 hours postoperatively was the designated primary study end point. Escalations of analgesic therapy, including ketorolac administration, were standardized across all groups. Nurses assessed pain control at onset and every 6 hours by visual analog pain scales (VAPS, 100 mm). VAPS were repeated 10 minutes later to assess any opioid or bupivacaine bolus effects. No study-related adverse events occurred. Compared with controls, pooled VAPS scores and 24-hour fentanyl consumption were significantly lower for the intermittent and continuous administration groups (1753 vs 1180 vs 1177 microg/24 h, respective median;  $p = 0.04$ ) Early (6-hour) VAPS analgesic responses were more certain for intermittent (10 of 10) and continuous (10 of 10) patients than controls (7 of 10,  $p = .04$ ). Five continuous patients successfully maintained VAPS scores below 20 mm throughout the study vs 3 intermittent and 2 controls ( $p = .045$ ). Intermittent or continuous intraleural bupivacaine infused through the chest tube reliably reduces postoperative pain and 24-hour opioid usage in thoracoscopy patients.

1. Demmy TL, Nwogu C, Solan P, Yendamuri S, Wilding G, DeLeon O. Chest tube-delivered bupivacaine improves pain and decreases opioid use after thoracoscopy. *Ann Thorac Surg.* 2009 Apr;87(4):1040-6; discussion 1046-7.

### **Sternotomy Wound Analgesia**

The use of large doses of opioid analgesics to treat pain after cardiac surgery can prolong the time to tracheal extubation and interfere with recovery of bowel and bladder function in the postoperative period. White et al. (1) investigated the efficacy of a continuous infusion of bupivacaine 0.25% or 0.5%, at the median sternotomy site, for 48 h after cardiac surgery in reducing the opioid analgesic requirement and improving the recovery process. In this prospective, randomized, placebo-controlled, double-blind clinical trial, 36 consenting patients undergoing open-heart surgery with a standardized general anesthetic technique had two indwelling infusion catheters placed at the median sternotomy incision site at the end of surgery. The patients were randomly assigned to receive normal saline (control), bupivacaine 0.25% or bupivacaine 0.5% via an elastomeric infusion pump at a constant rate of 4 ml/h for 48 h. Patients evaluated their chest pain using an 11-point verbal rating scale, with 0 = no pain to 10 = worst pain imaginable. In addition, the postoperative opioid analgesic requirements and opioid-related adverse effects were recorded. Patient satisfaction with their pain management was assessed at specific intervals during the postoperative period using a 100-point verbal rating scale, with 1 = highly dissatisfied to 100 = highly satisfied. Finally, serum bupivacaine concentrations were measured 24 and 48 h after surgery. Compared with the control group, there was a statistically significant reduction in verbal rating scale pain scores and patient-controlled analgesia morphine use in the bupivacaine-0.5% group. Patient satisfaction with their pain management was also improved in the bupivacaine-0.5% (vs. control) group.

However, there were no significant differences in patient-controlled analgesia morphine use between the bupivacaine-0.25% and control groups. Although the duration of the intensive care unit stay (30 vs. 34 h, respectively) was not significantly decreased, the time to ambulation (1 +/- 0.5 vs. 2 +/- 1 days, respectively) and the duration of hospital stay (4.2 vs. 5.7 days, respectively) were lower in the bupivacaine-0.5% group than in the control group. Mean +/- SD serum bupivacaine

concentrations at 48 h in the bupivacaine-0.25% and bupivacaine-0.5% groups were 0.5 +/- 0.5 and 1.3 +/- 0.7 microg/ml, respectively. A continuous infusion of bupivacaine 0.5% at 4 ml/h is effective for decreasing pain and the need for opioid analgesic medication as well as for improving patient satisfaction with their pain management after cardiac surgery. Patients in the bupivacaine-0.5% group were able to ambulate earlier, leading to a reduced length of hospital stay.

1. White PF, Rawal S, Latham P, Markowitz S, Issioui T, Chi L, Dellaria S, Shi C, Morse L, Ing C. Use of a continuous local anesthetic infusion for pain management after median sternotomy. *J Surg Educ.* 2008 Jul-Aug;65(4):254-8.

### **Iliac Crest Wound Analgesia**

Singh et al. (1) made a parallel design, prospective, double-blinded, randomized, controlled trial composed of 2 independent groups treated with a continuous infusion catheter (saline vs. Marcain) placed into the iliac crest bone graft site (ICBG) to determine the long-term effects of postoperative continuous local anesthetic agent infusion at the ICBG harvest site in reducing chronic pain, narcotic usage and improving long-term, postoperative function and satisfaction with the surgical procedure. Harvesting iliac crest bone has been shown to be a source of pain and morbidity. In their initial study, they reported that patients who received local anesthetic at the graft site noted a reduction in acute postoperative pain (VAS) and narcotic usage. Twenty-six patients underwent posterior iliac crest bone graft harvesting. Patients were randomly assigned to receive 96 mL (2 mL/h x 48 hours) of either 0.5% Marcain or normal saline delivered via a continuous infusion catheter placed at the ICBG harvest site. Postoperative pain scores, narcotic use/frequency, activity level, and length of stay (LOS) were recorded and reported previously. At a minimum of 4 years after surgery (mean, 4.7 years; range, 4.5-5.4 years), all patients completed a questionnaire documenting their current VAS pain score (iliac crest), frequency of pain (days per month), level of activity, chronic pain at the ICBG site, and overall satisfaction with the procedure. Nine of 11 patients (82%) in the treatment group and 10 of 14 patients (71%) in the control group were available at final follow-up (1 death occurred in the control group unrelated to the study). The treatment group had a statistically significant decrease in the graft site pain VAS score (1.4 vs. 4.8) and increased satisfaction with the procedure at a minimum of 4 years postprocedure (P < 0.05). Additionally, no patient in the treatment group developed

chronic iliac crest dysesthesias (0 of 9) versus 7 of 10 patients (70%) in the control group ( $P < 0.05$ ). Continuous infusion of 0.5% Marcain at the ICBG harvest site significantly reduced chronic dysesthesias. Overall satisfaction with the procedure, number of painful days per month, and VAS scores were significantly better in the treatment group at 4 years. No long-term complications were attributed to either the ICBG site or the catheter-infusion system. The use of continuous local anesthetic infusion at the iliac crest may help in alleviating graft-related pain beyond the perioperative phase.

1. Singh K, Phillips FM, Kuo E, Campbell M. A prospective, randomized, double-blind study of the efficacy of postoperative continuous local anesthetic infusion at the iliac crest bone graft site after posterior spinal arthrodesis: a minimum of 4-year follow-up. *Spine*. 2007 Dec 1;32(25):2790-6.

### **Thoracotomy Wound Analgesia**

A prospective randomized double-blind study examined the effect of local wound infusion of anesthetics on pain control in the thoracotomy wound of patients undergoing minimally invasive cardiac surgery. Patients who underwent coronary artery bypass grafting or cardiac valvular procedures via a minimally invasive thoracotomy were studied. Patients were enrolled and randomly allocated to two groups with different modalities of postoperative analgesia. The thoracotomy wound infusion group received 0.15% bupivacaine infused continuously at 2 mL/h through a catheter embedded in the wound, as well as intravenous patient-controlled analgesia. The control group had patient-controlled analgesia alone with a sham thoracotomy wound infusion of normal saline. Verbal analog pain scores (0-10 points) and recovery profiles were investigated. There were 19 patients in each group for complete data analysis. On the first day after the operation, infusion of local anesthetics significantly reduced the verbal analog pain scores both at rest and during motion (thoracotomy wound infusion vs control). The improved pain relief with thoracotomy wound infusion persisted at day 3 and even at 3 months after the operation. No difference was noted about time to extubation, length of intensive care unit stay, or hospital stay. In this controlled double-blind study, thoracotomy wound infusion and patient-controlled analgesia were superior to patient-controlled analgesia alone in reducing pain at 1, 3, and 90 days after minimally invasive cardiac surgery (1).

1. Chiu KM, Wu CC, Wang MJ, Lu CW, Shieh JS, Lin TY, Chu SH. Local infusion of bupivacaine combined with intravenous patient-controlled analgesia provides better pain relief than intravenous patient-controlled analgesia alone in patients undergoing minimally invasive cardiac surgery. *J Thorac Cardiovasc Surg*. 2008 Jun;135(6):1348-52.

### **Tramadol Wound Analgesia**

It has been demonstrated that tramadol is an effective analgesic. Demiraran et al. (1) aimed to compare postoperative analgesic effects of wound infiltration with tramadol (T) or bupivacaine (B) and intramuscular tramadol (I) after herniotomy in children. In this study, 75 children were randomly assigned to group T, group B and group I. Wound infiltration was performed to the patients in group T (2 mg.kg<sup>-1</sup> tramadol in 0.2 ml.kg<sup>-1</sup> saline) and group B (0.2 ml.kg<sup>-1</sup> 0.25% bupivacaine) into the surgical incision. Twenty minutes before the end of the surgery 2 mg.kg<sup>-1</sup> tramadol was injected i.m. in group I. Faces pain scale was used for assessing pain severity. Patients with pain score >2 were treated with paracetamol. The frequency of side effects and analgesic use were recorded. Patients were discharged on the next day. No side effects were recorded in any group. The pain scores of the patients at the first, fourth and eighth hours were significantly higher in group B and group I than group T ( $P < 0.05$ ). The pain scores of the patients at the first hour were significantly higher in group I compared with group B ( $P < 0.05$ ). Average time to first analgesic requirement was significantly longer in group T (6.72±/4.09 h after herniotomy) than both group I (4.49±/3.9 h) and group B (6.04±/3.7 h) ( $P < 0.05$ ). Wound infiltration with tramadol may be a good choice for postoperative analgesia in children having inguinal herniotomy (1).

1. Demiraran Y, Ilce Z, Kocaman B, Bozkurt P. Does tramadol wound infiltration offer an advantage over bupivacaine for postoperative analgesia in children following herniotomy? *Paediatr Anaesth*. 2006 Oct;16(10):1047-50.

### **Levobupivacaine Wound Analgesia**

A prospective, randomized, controlled trial compared the efficacy of different protocols of local tissue infiltration with levobupivacaine or levobupivacaine-methylprednisolone at the surgical site for pain relief after lumbar discectomy. The objective of the study was to determine the efficacy of preemptive wound infiltration with levobupivacaine and levobupivacaine-methylprednisolone at the surgical site for

pain relief. Patients usually suffer significant pain after lumbar discectomy. Wound infiltration with local anesthetics with or without corticosteroids is one method to address this. A total of 100 patients were randomly allocated to five equal groups as follows: Group I had the musculus multifidi near the operated level infiltrated with 30 mL 0.25% levobupivacaine and 40 mg methylprednisolone just before wound closure; Group II had the same region infiltrated with 30 mL 0.25% levobupivacaine alone before closure; Group III had this region infiltrated with 30 mL 0.25% levobupivacaine and 40 mg methylprednisolone before the incision was made; in Group IV this region was infiltrated with 30 mL 0.25% levobupivacaine alone before incision; and in Group C (controls) this region was infiltrated with 30 mL 0.9% NaCl just before wound closure. Demographics, vital signs, postoperative pain scores and morphine usage were recorded. All four treatment groups showed significantly better results than the control group for most parameters. The treated groups had lower parenteral opioid requirements after surgery, lower incidences of nausea and shorter hospital stays. Further, the data indicate that, compared with infiltration of these drugs at wound closure, preemptive injection of levobupivacaine or levobupivacaine-methylprednisolone into the muscle near the operative site provides more effective analgesia after lumbar discectomy. Our data suggest that preemptive infiltration of the wound site with levobupivacaine alone or combined with methylprednisolone provides effective pain control with reduced opiate dose after unilateral lumbar discectomy (1).

1. Gurbet A, Bekar A, Bilgin H, Korfali G, Yilmazlar S, Tercan M. Pre-emptive infiltration of levobupivacaine is superior to at-closure administration in lumbar laminectomy patients. *Eur Spine J.* 2008 Sep;17(9):1237-41. Epub 2008 Apr 19.

### **Wound Analgesia for living kidney donors**

Sorbello et al. (1) evaluated the efficacy of an analgesic regimen based on levobupivacaine continuous infusion into the surgical wound of living kidney donors (LKDs). Fifty adult LKDs (mean age, 53.1 +/- 5.3 years; age range, 52-68 years) were retrospectively assigned to a no wound infusion (NWI) group (n = 25) or a wound infusion (WI) group (n = 25). At the end of surgery, patients in the WI group received 10 mg intramuscular morphine; a peridural catheter was placed 10 cm between the intercostal muscles fibers close to the lower rib extremity,

and a solution of levobupivacaine, 150 mg/100 mL, was started at 5 ml/h(-1). Patients in the NWI group received intramuscular morphine, 10 mg, every 8 hours; intravenous tramadol, 100 mg, was planned as a rescue drug for incidental pain. Pain was measured using a visual analog scale (VAS) ranging from 1 (no pain) to 10 (maximum pain) in both the basal condition (VASb) and during coughing (VASc) at 1 hour after leaving the operating room and 6, 12, and 24 hours thereafter. At 1, 6, 12, and 24 hours, VASb values in the NWI vs the WI group were 5.2 vs 3.1, 6.8 vs 4.1, 5.8 vs 4.9 (all p < .01), and 5.4 vs 5.1, respectively, and VASc values were 8.2 vs 6.3, 8.8 vs 5.9, 7.1 vs 5.3, and 6.8 vs 5.1 (all p < .01). Mean VAS score was significantly higher between 1 and 6 hours in the NWI group for all VASb measurements vs VASc values. Tramadol consumption was higher in the NWI group than in the WI group. Continuous wound infusion with 5 mL/h(-1) levobupivacaine, 1.5 mg/mL(-1), resulted in a safe and effective analgesic protocol in LKDs both in the immediate postoperative period and in the first day after surgery, a result that was more effective than a morphine-tramadol regimen. No adverse effects were recorded, which confirmed the safety of the technique. It is probable that better results could be achieved with dedicated administration devices.

1. Sorbello M, Paratore A, Morello G, Tindaro Sidoti M, Rinzivillo D, Molino C, Di Tommaso C, Parrinello L, Veroux P, Corona D, Giuffrida G, Zerbo D, Veroux M. Wound levobupivacaine continuous infusion for postoperative analgesia in living kidney donors: case-control study. *Transplant Proc.* 2009 May;41(4):1128-31.

### **Wound Analgesia and the stress response in children**

Cnar et al. (1) compared the postoperative analgesic effects of preincisional and postincisional wound infiltration with levobupivacaine and postoperative cortisol and prolactin levels in children following inguinal hernia repair. Ninety-six children aged 2-10 years who were undergoing elective inguinal hernia repair were randomly enrolled in this study. In group A (n = 32), 0.25 ml/kg levobupivacaine (5 mg/ml) was infiltrated after induction of general anaesthesia. In group B (n = 32), 0.25 ml/kg levobupivacaine (5 mg/ml) was infiltrated before the end of the surgery. Group C (n = 32) did not receive levobupivacaine infiltration at any time. Mean arterial pressure, heart rate, objective pain score, adverse effects and the number of rescue analgesics were recorded for 24 h. Blood samples were withdrawn following induction of anaesthesia and at 40 min after the end of surgery for measurement of blood cortisol and prolactin levels. The

rescue analgesic administration, objective pain scores, heart rate, postoperative plasma cortisol and prolactin levels were higher in group C than in either group A or group B ( $P < 0.05$ ). There were no differences in these parameters between the two treatment groups ( $P > 0.05$ ). Postoperative plasma cortisol and prolactin levels were significantly higher in all three groups than preoperative plasma cortisol and prolactin levels ( $P < 0.001$ ). Wound infiltration with levobupivacaine after induction of general anaesthesia and before the end of the surgery both provide postoperative pain relief following hernia repair, and decrease the stress response to postoperative pain.

1. Cnar SO, Kum U, Cevizci N, Kayaoglu S, Oba S. Effects of levobupivacaine infiltration on postoperative analgesia and stress response in children following inguinal hernia repair. *Eur J Anaesthesiol.* 2009 May;26(5):430-4.

### **Intra-articular Wound Analgesia**

In a randomized, double-blind, placebo, parallel and controlled study, 80 patients with osteoarthritis who underwent unilateral TKA were randomly assigned to two groups: Trial Group, where patients received intra-articular intraoperative injection containing morphine, bupivacaine and betamethasone, and Control Group, where patients received normal saline as control. All patients received patient-controlled analgesia (PCA) for 48 h postoperatively. It was found that intra-articular cocktail analgesic injection significantly reduced the morphine consumption during the 0-36 h postoperative period and the total morphine consumption. VAS at rest in Trial Group at postoperative 6, 10, 24 and 36 h was significantly lower than that in Control Group, and VAS during activity in Trial Group at postoperative 24 h and 36 h was significantly lower than that in Control Group. The time of ability to perform an active straight leg raise and to actively reach 90 degrees knee flexion, as well as ROM of the knee at the 15th postoperative day, was better in Trial Group than those in Control Group. There were no significant differences in postoperative wound healing, infection, blood pressure, heart rate, rash, respiratory depression, urine retention and DVT between the two groups. The occurrence of nausea and vomiting in Trial Group was lower than that of Control Group. This study revealed that intra-articular cocktail analgesic injection reduced the need for morphine and offered a better pain control, without apparent risks following TKA (1).

1. Fu P, Wu Y, Wu H, Li X, Qian Q, Zhu Y. Efficacy of intra-articular cocktail analgesic injection in total knee arthroplasty - A randomized controlled trial. *Knee*, 2009 Mar 17.

### **Effects of different doses of levobupivacaine infiltration on wound healing**

The easiest method in postoperative analgesia is the infiltration of the wound with local anesthetic drugs. Although many local anesthetic drugs have been used for this type of infiltration, studies on levobupivacaine are rare. The aim of this study was to investigate the effects of different concentrations of levobupivacaine infiltration on wound healing. Forty female Wistar-Albino rats (280-300 g) were included in the study, which were randomly separated into four groups. Rats were infiltrated with 1.25 mg/mL levobupivacaine in group L(1.25) ( $n = 10$ ), with 2.50 mg/mL levobupivacaine in group L(2.5) ( $n = 10$ ), with 3.75 mg/mL levobupivacaine in group L(3.75) ( $n = 10$ ), and with normal saline in control group ( $n = 10$ ). Breaking-strength measurements, levels of hydroxyproline, and fibrotic index were evaluated in the tissue samples taken from the rats. When the breaking-strength measurements were evaluated, was found a significant difference between the control and the study groups ( $p < 0.05$ ). In the intergroup comparison the difference between groups L(1.25) and L(3.75) was statistically significant ( $p < 0.05$ ). In all of the levobupivacaine groups the levels of hydroxyproline were higher compared to the control group. Also significant differences were observed between groups L(1.25) and L(2.5) and groups L(1.25) and L(3.75) ( $p < 0.05$ ). The levels of tissue fibrotic index were higher in all of the levobupivacaine groups compared to the control group ( $p < 0.05$ ) and also a difference was observed between groups L(1.25) and L(3.75) in terms of tissue fibrotic index ( $p < 0.05$ ). It was concluded that levobupivacaine used in clinical doses have a significant effect on the fastening of wound healing and this effect increases with an increase in the concentration of the levobupivacaine. It is believed that levobupivacaine will be more widely preferred in the near future in the postoperative analgesia (1).

1. Dere K, Sen H, Teksoz E, Ozkan S, Dagli G, Sucullu I, Filiz AI, Ipcioglu OM, Kucukodaci Z. The comparison of the effects of different doses of levobupivacaine infiltration on wound healing. *J Invest Surg.* 2009 Mar-Apr;22(2):112-6.

### **EMLA Vs. Lidocaine Wound Analgesia**

EMLA cream (eutectic mixture of local anesthetics) has been shown to penetrate intact skin and provide analgesia of superficial layers. There are no studies on the effects of topical application of EMLA cream for postoperative pain relief after inguinal hernia repair. This randomized, double-blind, placebo-controlled study compared the efficacy of topical application of 5% EMLA cream before surgery, with wound infiltration with 1% lidocaine for postoperative analgesia in children. Ninety children, aged 4 to 12 years, undergoing elective inguinal hernia repair under general anesthesia were enrolled in the study. Patients were randomly assigned to receive either placebo cream (group 1), 5% EMLA cream (group 2), or placebo cream followed by 0.5 mL/kg 1% lidocaine (group 3) in the wound after induction of anesthesia. The anesthetic technique and monitoring were standardized, and postoperative pain was assessed using a 10-point objective pain scale. Fentanyl was used as rescue analgesic in immediate postoperative period, and acetaminophen was administered for postoperative pain in surgical ward. The number of patients requiring fentanyl in the immediate postoperative period was significantly less in the study groups compared with the placebo group. Sixty-seven percent of patients in the placebo group required more than 1 dose of acetaminophen in the first 6 hrs compared with 23% (EMLA group) and 20% (lidocaine group). Four patients (two in the lidocaine group, one in the EMLA group, and one in the control group) developed subcutaneous infection at the site of incision 10 to 15 days postoperatively. Topical application of EMLA (5%) provides postoperative analgesia comparable to infiltration with 1% lidocaine after inguinal hernia repair in children (1).

1. Usmani H, Pal Singh S, Quadir A, Chana RS. A comparison between EMLA cream application versus lidocaine infiltration for postoperative analgesia after inguinal herniotomy in children. *Reg Anesth Pain Med.* 2009 Mar-Apr;34(2):106-9.

### **Local anesthetics after total knee arthroplasty: intraarticular or extraarticular administration?**

High-volume local infiltration analgesia with additional intraarticular and wound administration of local anesthetic has been shown to be effective after knee replacement, but the optimum site of administration of the local anesthetic (i.e. intraarticular or extraarticular) has not been evaluated. 32 patients undergoing total knee replacement with high-volume (170 mL) 0.2% ropivacaine infiltration analgesia were randomized to receive injection

of 20 mL ropivacaine (0.2%) intraarticularly plus 30 mL saline in the extraarticular wound space 24 hours postoperatively or to receive 20 mL ropivacaine (0.2%) intraarticularly plus 30 mL ropivacaine (0.2%) in the extraarticular wound space 24 hours postoperatively. Pain intensity at rest and with mobilization was recorded for 4 hours after administration of additional local anesthetics. Intensity of pain at rest, during flexion, or straight leg lift was not statistically significantly different between the two groups, but there was a tendency of improved analgesia with administration of additional local anesthetic in the extraarticular wound space. The optimal site of administration of local anesthetic in total knee arthroplasty cannot be determined from the present study. However, the insignificant analgesic effect from additional administration of extraarticular local anesthetic may have been due to the relatively low pain scores observed 24 h postoperatively, confirming the efficiency of the high-volume infiltration analgesia technique. Further studies are required to define the optimal site of administration of local anesthetic following knee replacement surgery (1).

1. Andersen LØ, Kristensen BB, Husted H, Otte KS, Kehlet H. Local anesthetics after total knee arthroplasty: intraarticular or extraarticular administration? A randomized, double-blind, placebo-controlled study. *Acta Orthop* 2008 Dec; 79(6): 800-5

### **"Heal Not Hurt"**

All wounds have the potential to cause pain, and the nature of the pain varies with the type of wound. Many factors may exacerbate wound pain, including infection, trauma at dressing changes and poor technique when applying compression therapy. Failure to assess wound pain or inadequate pain assessment can cause the patient further anguish and extended suffering. Nurses caring for patients with painful wounds need to identify the source of the pain and exacerbating factors, and determine whether it has nociceptive and/or neuropathic elements in order to optimize pain management for the individual patient. Young (1) examines the assessment of wound pain and introduces an initiative that has been developed to improve the assessment process. The 'Heal not Hurt' initiative is an excellent example of the profession and industry working together to implement best practice guidance in patient-centered pain-free wound care in clinical care.

1. Young T. Assessment of wound pain: overview and a new initiative. *Br J Community Nurs.* 2007;12(12 Suppl):5-8.