PERIODICUM BIOLOGORUM
VOL. 113, No 2, 213–216, 2011

UDC 57:61
CODEN PDBIAD
ISSN 0031-5362

Original scientific paper/new guidelines

Quality of analgesia with multi-versus two few-hole catheters in patients after colorectal surgery

STELA MARIĆ[1]
LJILJA ŠTEFANČIĆ[1]
LJILJANA POPOVIĆ[1]
MIROSLAV BANOVIĆ[2]
KATA ŠAKIĆ[3]

[1]University Hospital Center »Sestre Milosrdnice«, Department of Anaesthesiology and Intensive Care, Zagreb, Croatia

[2]University Hospital Center »Sestre milosrdnice«, Department of Transfusion Medicine, Zagreb, Croatia

[3]Clinical Hospital »Sveti Duh«, Department of Anaesthesiology and Intensive Care, Zagreb, Croatia

Correspondence:
Stela Marić
University Hospital Center »Sestre milosrdnice«, Clinic for Tumors, Ilica 197, 10000 Zagreb, Croatia
E-mail: smaric5@yahoo.com

Key words: regional anaesthesia, infiltration anaesthesia, pain, colorectal surgery

Abstract

Background and Purpose: *Continuous wound infusion with local anaesthetics is an effective method in multimodal postoperative pain therapy after colorectal surgery. The choice of optimal type of wound catheter, few- or multi-hole is still controversial. The aim is to evaluate the analgesic potential of these two catheter types.*

Materials and Methods: *Forty patients undergoing colorectal surgery were randomized to intraoperative placement of two epidural catheters (Group EC) or multi-hole catheter (Group WC) in the wound above the fascia. Patients received 0.25% levobupivacaine (Group WC) with 10 mL bolus through the wound catheter followed by an infusion of 6 mL/h during 48 h, or the same protocol with equally divided levobupivacaine doses through two epidural catheters (Group EC). Simultaneously, patient-controlled analgesia provided intravenous morphine. Pain was evaluated postoperatively with 4-point verbal scale (VRS) for the first 2 h, with Visual Analogue Scale at rest (VAS r), and during coughing (VAS c) every 6 h for the first 48 h.*

Results and Conclusions: *No significant difference in morphine consumption was observed between groups. There were no significant differences in VRS scores between the groups ($p = 0{,}756$). VAS scores were significantly lower in Group WC in rest (rWC, $p = 0{,}007$) and coughing (cWC, $p = 0{,}018$) for the 6 h, 12 h, and 24 h postoperatively. In the period 30–48 h there was no difference between groups. We conclude that levobupivacaine infusion through multi-hole catheter provides better quality of postoperative analgesia compared with two epidural catheters for the first 24 h.*

Received March 16, 2011.

INTRODUCTION

Continuous wound infusion (CWI) with local anaesthetics is an effective method in multimodal postoperative pain therapy for a variety of surgical procedures without any major side effects *(1)*. Originally described in 1935, this technique has been experimented with throughout the 20th century and has been found to be safe and effective in several settings *(2, 3, 4)*. Cochrane Review has confirmed the efficacy of this technique in a variety of settings including abdominal surgery *(5)*. Baig *et al.* reported dramatic reduction in narcotic use in patients undergoing colectomy *(6)*. Reduction of narcotic usage is one of the principles of fast track programs, so it would be reasonable to incorporate wound pumps into fast track protocols, especially in patients who do not have epidural catheters *(7, 8, 9)*.

There is no universal agreement where wound catheters should be placed to achieve best pain relief after colorectal surgery. There are still controversies about optimal site of local anaesthetic administration, above or below the fascia *(10, 11)*.

To achieve the best quality of analgesia with this technique it is important to find out which factors determine the spread of local anaesthetic (LA) in the surgical wound. The choice of the type of catheter could also have impact on quality of analgesia. It seems rational that use of the multiholed catheter will ensure better delivery of the local anaesthetic to a larger area of the wound. A comparison of these two types after total hip arthroplasty has shown that the spread of LA bolus injection through a 15 cm multiholed catheter to a triple orifice epidural catheter was similar *(12)*. Unfortunately, that case can be solely found in one study focusing on the diffusion of the LA in preperitoneal position in a single patient who underwent a computer tomography 24 hours after colorectal surgery *(10)*. There have been no clinical studies evaluating the analgesic potential of the various types of catheters in continuous wound infusion technique after colorectal surgery.

The aim of our study was to evaluate the quality of analgesia with CWI technique with levobupivacaine in patients that underwent colorectal surgery with two types of catheters; multiholed wound catheter or two triple-orifice epidural catheters.

MATERIAL AND METHODS

Forty ASA physical status I and II patients undergoing open resection of malignant colorectal tumors through a midline incision were divided in two equal groups. They were included in a prospective study during one year period 2009–2010. The Ethics Committee of the University Hospital for Tumors approved the investigation. Patients with a history of inflammatory bowel disease, preoperative cognitive dysfunction, clinically significant, hepatic, renal, neurological, psychiatric, metabolic disease or chronic pain were excluded from the study.

All patients were premedicated by midazolam 7, 5 mg orally 1 h before the scheduled surgery. Upon arrival in the operating room, patients were randomly allocated to receive two triple orifice epidural catheters or multiholed wound catheter placed by the surgeon in the wound at the end of the surgery. Levobupivacaine was delivered through the wound/ or epidural catheters and postoperative management was strictly identical for all patients.

After IV cannulation anaesthesia was induced with fentanyl 1–2 mg/kg IV and propofol 2 mg/kg until loss of eyelash reflex. Tracheal intubation was performed after muscle relaxation with vecuronium 0.1 mg/kg, and anaesthesia was maintained with 1–2% sevoflurane in 33% mixture of oxygen-air. Surgical relaxation was maintained with IV vecuronium. Mechanical ventilation was used in a low flow system to maintain an end-tidal CO_2 4,5–5,5 kPa. The urinary bladder was catheterized. Sevoflurane concentration was adjusted to maintain adequate anaesthetic depth as assessed with Bispectral index method (BIS), and IV fentanyl was given intermittently as an analgesic when required. Residual neuromuscular blockade was reversed, if needed, with a mixture of atropine and neostigmine.

On completion of operation after closure of transversalis fascia, a two multiorifice 20-gauge epidural catheters (B. Braun, Melsungen, Germany) were placed by the surgeon above the fascia (Group EC), so that the tip of one catheter was at the point 3 cm under the upper edge of the surgical wound and the tip of another catheter was at the midpoint of the wound. Each catheter was secured on the skin with sterile tape. When the wound was closed, a 5 mL bolus of 0.25% levobupivacaine was administered through each catheter. Catheters were aseptically connected to two electric infusion devices (Braun, Germany) which were programmed to deliver 3 mL/h 0.25% levobupivacaine through each catheter for 48 hours postoperatively. In Group WC multiholed (72 holes) wound catheter 24.5cm long with (Moog, USA) was placed by the surgeon along the full length of the wound above the fascia and connected to the electric infusion device (Braun, Germany) to deliver 6 mL 0.25% levobupivacaine after 10 mL 0.25% levobupivacaine bolus was given for 48 h. All patients received diclofenac 75 mg IV and morfine 0.1 mg/kg IV, 30 minutes before the conclusion of the surgical procedure. Pain was assessed in the PACU for the next two hours, and those patients with pain greater than 2 on a 4-point Verbal Rating Scale (VRS) received intravenous boluses of 1 mg morphine as titration, with 5-min intervals, until pain decreased to a maximum verbal rating scale of 1 (0 – no pain, 1 – mild pain, 2 – moderate pain, and 3 – severe pain). A patient-controlled analgesia (PCA) device (Curlin Medical 6000 CMS, USA) was then connected to an intravenous infusion and set to deliver a 1 mg dose of morphine with a 10-min lockout interval. All patients received diclofenak 75 mg IV every 12 hours during 48 h postoperatively. Pain was assessed for the next 42 hours every 6 hours at rest and for the coughing with VAS.

Nasogastric tube was left in place for 24 h after surgery. Oral fluids and enteral nutrition were administered 24 h after surgery and solid meals were given the day after. All side effects were recorded.

Data were analyzed using Paired t-test and Mann-Whitney Rank Sum test. Statistical significance was accepted at P value less then 0.05.

RESULTS

All enrolled patients did not successfully complete the study, because four patients in Group EC had a technical problem with delivering levobupivacaine through the one of the epidural catheters. Sixteen patients in Group EC and twenty patients in Group WC were included in the main analysis. Study groups were comparable and did not differ in demographic data.

There was no significant difference in morphine consumption during 48 h between the two groups, Group

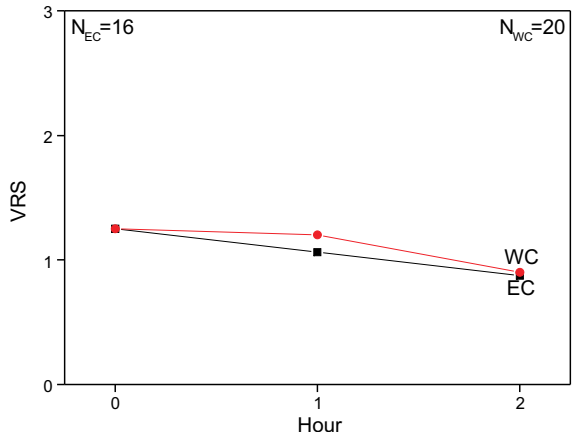

Figure 1. *Pain intensity during first two postoperative hours assessed using VRS, t = –0.352, df = 106, p = 0.756*

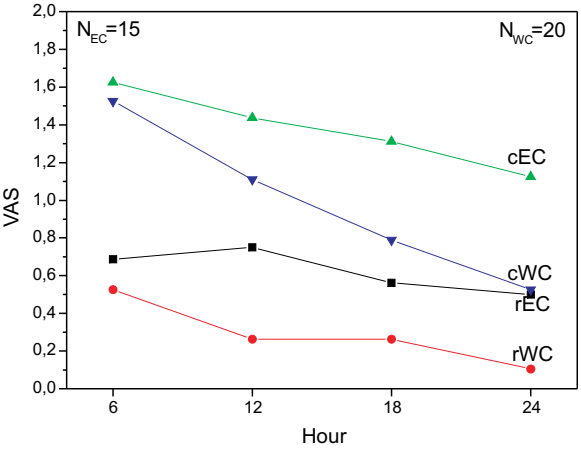

Figure 2. *Pain intensity at rest and coughing during 6–24h in Group EC and WC, t-test rEC/rWC t = 2.726, df = 138, p = 0.007; cEC/cWC t = 2.399, df = 138, p = 0.018.*

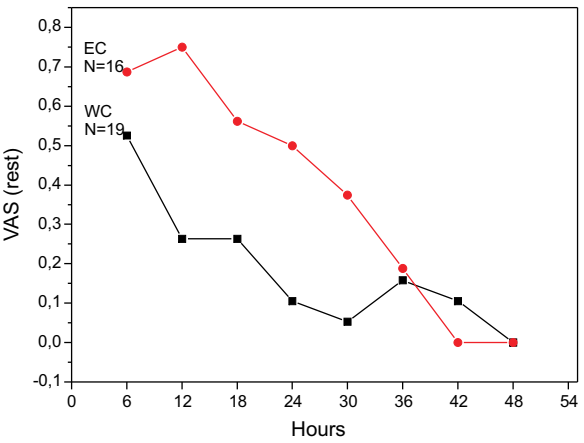

Figure 3. *Pain intensity at rest assessed using VAS 6–48h, t-test: p = 0.118.*

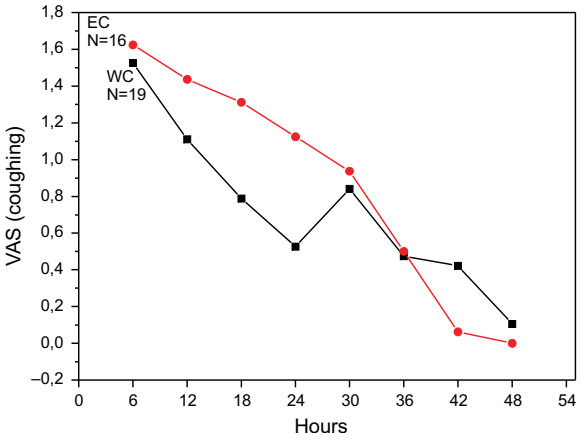

Figure 4. *Pain intensity at coughing assessed using VAS 6–48h, t-test: p = 0.586.*

WC 18.85 ± 14 mg and Group EC 17.75 ± 15 mg (p = 0.756).

During the first two postoperative hours pain intensity was assessed with VRS, there was no significant difference between the groups, paired t-test; t = –0.352, df = 106. p = 0.756.

Pain intensity assessed with VAS was significantly reduced in Group WC at rest and coughing during the postoperative period 6–24 hours, t-test rEC/rWC t = 2.726, df = 138, p = 0.007 and cEC/cWC t = 2.399, df = 138, p = 0.018 (Figure 2).

During the period 30–48 h postoperatively there were no significant differences between both groups at rest t-test:p = 0.544 and in coughing t-test: p = 0.757 (Figure 3, 4).

During the whole postoperative period 6–48h there was no significant statistical difference between Groups EC and WC in pain intensity during coughing assessed with VAS, t-test: p = 0.586 (Figure 3.) and at rest t-test: p = 0.118 (Figure 4).

DISCUSSION

CWI is effective in postoperative pain management, but the optimal technique for postoperative administration of local anaesthetics in the wound should be evaluated. The spread of local anaesthetic is one of main factors which determine good quality of CWI analgesia. We suppose that the type of catheter plays the most important role. In this context, catheters with multiple holes may provide larger wound spread compared with triple orifice epidural catheters. The choice of catheter, multihole versus few holes is without any documentation for larger wound spread or improved analgesia. Only one study Anderson L. *et al.* has been published about the comparison of the analgesic efficacy between different types of catheters for CWI. Andersen L. *et al.* demonstrated similar spread with postoperative bolus injections through triple orifice epidural or multiholed catheters in total hip arthroplasty *(12)*. In their study, Beaussier M. *et al.* injected radiopaque contrast through preperitoneal wound catheter; the local anaesthetic remained in close contact with abdominal wound incision, between the in-

jured parietal peritoneum and the muscular layer *(10)*. Information should be interpreted with due diligence due to the fact that there was only one case and that diffusion may not reflect the exact diffusion of local anesthetic.

In our study we performed CWI above the fascia and, unfortunately, we did not document the spread of local anaesthetic with any visualization method. The site for optimal catheter placement has not been sufficiently evaluated in procedure specific trials *(11)*. The quality of analgesia in both groups was satisfactory. We analyzed analgesia quality between groups during the first 2 h postoperatively, pain intensity was evaluated with VRS and there was no significant difference between the groups. VAS was analyzed during 48h of postoperative period, and results showed that there was no significant difference between the groups in VAS rest, nor coughing. Despite that fact, there was significant difference between the groups in the period 6–24 h. Pain intensity (VAS) at rest and coughing was significantly lower in Group WC. For the next period of 30–48 h there was no difference in VAS at rest and coughing between the groups. We conclude that the type of catheter plays a more important role in providing better analgesia for the first 24 hours. It seems logical that larger spread of local anaesthetics through more catheter holes provides better analgesia. In the first 24 h pain is more intense than following that critical period. We emphasize that VAS 6–24 h was in the clinically acceptable range between 0–2 in both groups.

In four Group EC patients, who were excluded from the study, there were technical problems with epidural catheters because of partial blockade or catheter displacement. Compared to the original wound catheters, these technical problems seem that they could have been avoided.

The question also lies in the pumps, elastomeric or electronic? In our study we used electronic pumps because of lower price and good clinical experience. Elastomeric pumps are strongly recommended by wound catheter producers but Remerand *et al.* have published that elastomeric pumps may deliver inappropriate amounts of local anaesthetics with inaccuracy higher than 15% and failure to deflate is also not uncommon *(13)*.

In conclusion, the efficacy of CWI with both catheter types after open colorectal surgery has been confirmed in our study. The difference in analgesia quality between catheters was obvious for the first 6–24 hours postoperatively. Wound catheters are more expensive than epidural ones, and usage of disposable elastomeric pumps are more expensive than usage of electronic ones. In an era of cost containment, cost efficacy analyses need to be done. More studies are necessary to evaluate these catheters in patients undergoing open colorectal operative procedure before any recommendations can be made.

REFERENCES

1. KEHLET H, WILMORE D W 2002 Multimodal strategies to improve surgical income. *Am J Surg183*: 630–641
2. CAPELLE W 1935 Die bedentung des wundschmerzes und seiner ausschaltung fur dan ablauf der atmung bei laparotomierte. *Dtsch Z Chir 246*: 466–485
3. PATEL J M, LANZAFAME R J, WILLIAMS J S *et al.* 1983 The effect of incisional infiltration of bupivacaine hydrochloride upon pulmonary functions, atelectasis and narcotic need following elective cholecystectomy. *Surg Gynecol Obstet 157*: 338–34
4. LIU S S, RICHMAN J M, THRILBY R C, WU C L 2006 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 203(6)*: 914–932
5. CHEONG W K, SEOW-CHOEN F, EU K W, TANG C L, HEAH S M 2001 Randomized clinical trial of local bupivacaine perfusion versus parenteral morphine infusion for pain relief after laparotomy. *Br J Surg 88*: 357–359
6. BAIG M, ZMORA O, DERDEMEZI J, WEISS E, NOGUERAS J, WEXNER S 2006 Use of the ON-Q pain management system is associated with decreased postoperative analgesic requirement: Double blind randomized placebo pilot study. *J Am Coll Surg 202*: 297–305
7. WHITE P F, KEHLET H, NEAL J M, SCHRICKER T, CARR D B, CARLI F 2007 The role of the anesthesiologist in fast-track surgery: from multimodal analgesia to perioperative medical care. *Anesth Analg 104(6)*: 1380–1396
8. KEHLET H, WILMORE D W 2008 Evidence-based surgical care and the evolution of fast-track surgery. *Ann Surg 248(2):* 189–198
9. LIU S 2004 Anesthesia and analgesia for colon surgery. *Reg Anesth Pain Med 29*:52–7
10. BEAUSSIER M, EL' AYOUBI H, SCHIFFER E, ROLLIN M *et al.* 2007 Continuous preperitoneal infusion of ropivacaine provides effective analgesia and accelerates recovery after colorectal surgery: a randomized, double blind, placebo controlled study. *Anesthesiology 107*: 461–468
11. HAFIZOGLU M C, KATIRCIOGLU K, OZKALKANLI M Y, SAVACI S 2008 Bupivacaine infusion above or below the fascia for postoperative pain treatment after abdominal hysterectomy. *Anesth Analg 107*: 2068–2072
12. ANDERSEN L, KRISTENSEN B B, MADSEN J L, OTTE K S, HUSTED H, KEHLET H 2010 Wound spread of radiolabeled saline with multi-versus few-hole catheters. *Reg Anesth Pain Med 35*: 200–202
13. REMMERAND F, VUITTON A S, PALUD M *et al.* 2008 Elastomeric pump reliability in postoperative regional anesthesia: a survey of 430 consecutive devices. *Anesth Analg 107*: 2079–2084