



# Colombian Journal of Anesthesiology

*Revista Colombiana de Anestesiología*

www.revcolanest.com.co

OPEN

 Wolters Kluwer

## Interfascial intercostal nerves block: alternative to epidural analgesia in open gastrectomy? Report on 4 clinical cases

### Bloqueo interfascial de los nervios intercostales: ¿alternativa a la analgesia epidural en gastrectomía abierta? Reporte de cuatro casos clínicos

**Keywords:** Gastrectomy, Nerve Block, Analgesia, Epidural, Ultrasonography, Pain

**Palabras clave:** Gastrectomía, Bloqueo Nervioso, Analgesia Epidural, Ultrasonografía, Dolor

María Teresa Fernández-Martin<sup>a</sup>, Servando López-Álvarez<sup>b</sup>,  
Mario Fajardo-López<sup>c</sup>

<sup>a</sup> Department of Anaesthesia, Hospital Medina del Campo, Valladolid, Spain

<sup>b</sup> Department of Anaesthesia, Hospital Abente y Lago, A Coruña, Spain

<sup>c</sup> Department of Anaesthesia, Hospital Universitario de Móstoles, Madrid, Spain.

#### Abstract

The ultrasound-guided intercostal nerves (cutaneous branches) block in the mid-axillary line at the level of the 8th rib (modified BRILMA) is an analgesic technique described back in 2015. Four patients undergoing open gastrectomy (who are not candidates for epidural analgesia) are discussed. The patients underwent the above-mentioned bilateral block, with the administration of 15 mL of levobupivacaine 0.5% into the fascial plane, between the serratus anterior muscle and the external intercostal muscle, with the aim of blocking the intercostal nerves T6 to 11. Postoperative pain control was adequate, with low levels of opioids used. There were no complications associated with the technique.

#### Resumen

El bloqueo ecoguiado de los nervios intercostales (ramas cutáneas) en la línea media axilar a nivel de la 8 costilla (BRILMA modificado) es una técnica analgésica descrita en 2015. Se

presentan cuatro pacientes sometidos a gastrectomía abierta (sin posibilidad de administrar la analgesia epidural), a los que se realizó este bloqueo de manera bilateral. Se depositaron 15 ml de levobupivacaína 0,5% en el plano fascial entre el musculo serrato anterior y el intercostal externo, con el objetivo de bloquear los nervios intercostales T6–11. El control postoperatorio del dolor en los pacientes fue adecuado, con escaso consumo de opioides. No hubo complicaciones asociadas a la técnica.

#### Introduction

Open gastrectomy causes moderate-to-severe postoperative pain. Epidural analgesia has proven to be the technique of choice to control this pain.<sup>1</sup> However, there are some contraindications or limitations for the insertion of an epidural catheter (coagulation disruptions, deformities of the thoracic spine, patient refusal), which mandates searching for an analgesic alternative. The introduction of

How to cite this article: Fernández-Martin MT, López-Álvarez S, Fajardo-López M. Interfascial intercostal nerves block: alternative to epidural analgesia in open gastrectomy? Report on 4 clinical cases. Rev Colomb Anesthesiol. 2018;46:257–261.

Read the Spanish version of this article at: <http://links.lww.com/RCA/A36>.

Copyright © 2018 Sociedad Colombiana de Anestesiología y Reanimación (S.C.A.R.E.). Published by Wolters Kluwer. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Correspondence: Hospital Medina del Campo, Carretera de peñaranda 24, Medina del Campo, Valladolid, Spain. E-mail: Maitefm70@hotmail.com

Rev Colomb Anesthesiol (2018) 46:3

<http://dx.doi.org/10.1097/CJ9.0000000000000057>

ultrasound, as a work tool, has enabled the development of new regional anesthetic techniques for postoperative pain control. In this setting, the serratus-intercostal interfascial block or of the cutaneous branches of the intercostal nerves at the middle axillary line (modified BRILMA) was described in 2015, as an analgesic technique in patients undergoing open cholecystectomy.<sup>2</sup> With the administration of the local anesthetic at the level of the 8th rib, into the fascial space between the anterior serratus muscle and the external intercostal muscle, it is possible to block the intercostal nerves T6 to 11, which are responsible for the innervation of the upper abdominal wall. Using an anesthetic-analgesic multimodal strategy with opioids, non-steroidal anti-inflammatory agents (NSAIDs), coadjuvants, and local anesthetics, the result is adequate control of postoperative pain, enabling an early recovery of patients. Patients undergoing open gastrectomy in whom a bilateral serratus-intercostal block was performed exhibited similar results to those of the immediate open cholecystectomy postoperative period.

### Clinical cases

All patients described signed the informed consent prior to the administration of the anesthetic-analgesia technique in the series of cases (modified BRILMA). This fascial block is performed under ultrasound vision (M-Turbo portable equipment; Sonosite, Bothell, WA), using a 6 to 15-Hz high-frequency linear probe and an 80-mm Ultra-plex 360 needle (B. Braun, Melsungen, Germany). With the patient in supine decubitus, the probe is placed in the sagittal plane of the mid-axillary line (Fig. 1), to identify the fascial plane between the anterior serratus muscle and the external intercostal muscle. The needle is introduced from caudal to cephalic until the tip is placed at the level of the eighth rib, where 15 mL of levobupivacaine are administered into the fascial space, making sure that the agent is properly scattered (Fig. 2).



Figure 1. Patient position, probe, and entry plane.  
Source: Authors.

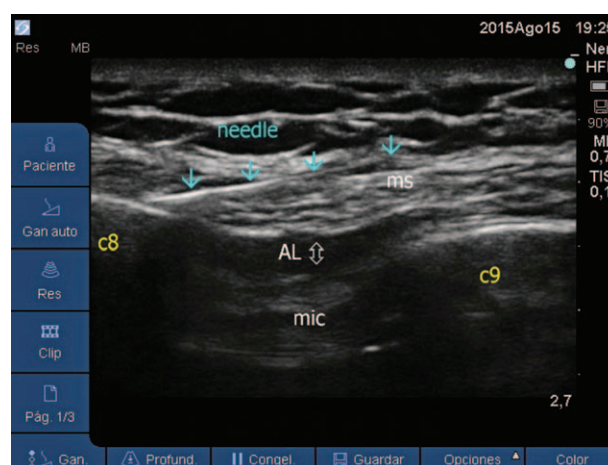


Figure 2. Sonoanatomy image: AL=local anesthetic; c8=8th rib; mic=intercostal muscle; ms=serratus muscle.  
Source: Authors.

### Case 1

A 62-year-old woman, American Society of Anesthesiologists (ASA) I, with a history of umbilical hernia repair, scheduled for laparoscopic gastrectomy. At her arrival to the operating room/operating theatre, the standard monitoring procedures were conducted (electrocardiography (ECG), pulse oximetry, and non-invasive blood pressure measurement), in addition to the Bispectral index (BIS; BIS VISTA monitoring system; Aspect Medical System Inc., Norwood, MA) to maintain an adequate depth of anesthesia. The patient was pre-medicated with 1 mg of midazolam and general anesthesia was induced with propofol 1.5 mg/kg, fentanyl 150 µg, and rocuronium 0.6 mg/kg intravenous (IV) to facilitate orotracheal intubation. For maintenance of anesthesia, the necessary concentration of sevoflurane was used to maintain BIS values of 40 to 60. Due to the technical impossibility of introducing the laparoscopy trocars because of adhesions that developed following an old surgery, the surgical team decided to perform an open gastrectomy.

During the intraoperative period, the analgesia requirements were met with fentanyl boluses (500 µg in total). Before awakening, 50 mg of dexketoprofen were administered and the bilateral modified BRILMA block was performed.

The postoperative analgesic regime was set at 1 g of paracetamol and 50 mg of IV dexketoprofen every 8 hours and a rescue dose of 3 mg of morphine in IV bolus in the presence of moderate-to-severe pain. Pain was assessed using the verbal numerical scale (VNS) with 0 (no pain) to 10 (the worst pain ever imagined), both at rest and dynamically (cough, deep breathing, moving). Moderate-to-severe pain was rated in VNS as greater than 5.

Once the patient was awake, she was transferred to a postanesthesia care unit (PACU). The initial evaluation

showed a score of 9 in Aldrete scale and a VNS value of 1. A period of 2 hours after admission to the PACU, the VNS score was 0 at rest and 2 in movement. At 8 hours, her assessment was VSN 1 at rest and 3 when breathing deeply. She required no rescue analgesia with opioids during her PACU stay and the patient was able to sit and ambulate over the first 48 hours.

### Case 2

A 70-year-old male ASA II, programmed for partial gastrectomy. The anesthetic-analgesia management in the OR was similar to that of the previous case. Some complications experienced during surgery required converting the laparoscopic approach to an open technique. An amount of 600 µg of fentanyl was administered intraoperatively. Before awakening, an ultrasound-guided bilateral fascial blockade of the serratus-intercostal plane was performed, to complement the multimodal intravenous strategy. The postoperative analgesia regime was identical to that of the previous patient. During the patient's stay in the PACU, pain was assessed according to VSN. At the time admission, the VSN score was 1 at rest; after 2 hours, the VSN at rest was 2 and 4 with deep breathing. After 24 hours, when the patient tried to stand up, he experienced a VSN pain of 6, so 3 mg of intravenous morphine was administered. The patient did not require any more opioid supplementation during his admission.

### Case 3

A 41-year-old male, ASA I, with a history of neoadjuvant therapy for gastric cancer. The patient was programmed for laparoscopic gastrectomy which was performed uneventfully. During the immediate postoperative period in the PACU, the patient became hemodynamically unstable and the computerized tomography scan (CT scan) confirmed hemoperitoneum, which led to reintervention with a midline laparotomy. The pain analysis showed a significant drop in hemoglobin, concurrent with coagulopathy. The OR protocol followed the guidelines previously described, except for a modified BRILMA block before the surgical incision. The analgesic demands were met with 300 µg of fentanyl. At admission to the PACU, once the surgery was completed, the VSN score was 0 at rest and in movement; therefore, no complementary analgesia with morphine was required.

### Case 4

A 76-year-old male, programmed for stomach laparoscopic surgery. The anesthetic approach was similar to that of cases 1 and 2 patients. The procedure was converted to open surgery because of significant bleeding. Over the 4 hours of the surgical procedure, fentanyl analgesia was administered on demand, up to a total of 600 µg. When the

surgical procedure was over, and before the patient woke up, 50 mg of intravenous dexketoprofen was administered and the bilateral intercostal fascial nerves block was performed. The postoperative analgesic approach was similar to the previous cases. At admission to the PACU, the VSN at rest was 0 at rest. Pain intensity after 2 hours was 2 at rest, and 3 moving. However, after 8 hours, the patient complained of severe pain (VNS 6), so 3 mg of intravenous morphine were administered. No additional opioid supplements were required during the postoperative period, and the patient was able to sit on a chair after 24 hours of surgery.

## Discussion

The most frequent problems following open gastrectomy are postoperative pain, the occurrence of nausea and vomiting, GI transit disruptions, cognitive dysfunction during the postop, and coagulation disorders/hypercoagulability.<sup>3</sup> The search for an anesthetic-analgesic method allowing for a multimodal rehabilitation, that avoids these problems, has led to the design of a strategy that includes techniques based on the administration of local anesthetics, whether epidural, at the level of the fascial spaces, or into the surgical wound, with or without opioid supplementation.

Epidural analgesia has been the analgesic technique of choice to control pain following supraumbilical midline laparotomy, despite its contraindications or limitations, the proportion of failures, or the potential complications.<sup>4</sup> Hence, in open gastrectomy, epidural analgesia is the best analgesic choice, superior to fascial blocks.<sup>5</sup> Some alternatives have been assessed when the epidural cannot be administered, including intravenous lidocaine infusion; however, a Cochrane review failed to show superiority versus the epidural approach.<sup>6</sup>

The scientific evidence supports the use of multimodal analgesia as the technique of choice for abdominal surgery with midline incision.<sup>7</sup> Each component of this strategy intends to raise the safety and effectiveness requirements. The analgesic approach must be performed taking into consideration that abdominal postsurgical pain has 2 components: somatic and visceral.

The skin, the muscles, and the parietal peritoneum of the anterior abdominal wall are innervated by the last intercostal nerves (T7–T11), the subcostal nerve (T12) and the first branches of the lumbar plexus (ilioinguinal and iliohypogastric nerves). The various techniques described in the literature for blocking of these nerves follow their anatomical path.<sup>8</sup> Each intercostal nerve runs in anterolateral direction, supplying a muscle branch, a subcostal ramus, and cutaneous rami, 1 lateral for the lateral segment of the thorax (T2–T6), and another 1 cutaneous anterior (between the internal oblique muscle of the abdomen and the transverse muscle) which ends in the posterolateral aspect of the rectus abdominis muscle and

expresses the sensitivity of the anterior segment of the abdomen, innervated by the intercostal nerves T6 to T11. As the primary anterior divisions of the seventh to eleventh nerves run like the intercostal nerves until they pass behind the costal cartilages, it is then feasible to block 1 or several intercostal nerves along their path, to achieve analgesia of the upper abdominal segment.

The introduction of ultrasound has lowered the risk of blocks, increasing their effectiveness and adopting new approaches. The ultrasound-guided block of the transversus abdominis plane (TAP)<sup>9</sup> was described in 2007, and its use in upper and lower abdominal surgery has grown since then. Subsequently, the same author introduces a change to the subcostal TAP. This is a fascial block in which the anesthetic is administered between the abdominis and transversus planes (subcostal TAP) to provide analgesia of the last thoracolumbar nerves. Although some trials show the superiority of epidural versus TAP<sup>10</sup> in open gastrectomy, others fail to show any differences in the VNS at 72 hours, between both techniques, in supraumbilical surgery.<sup>11</sup>

There is a strong debate with regard to the dissemination and the maximum level achieved by the local anesthetic when administered as a single injection. The studies in this regard are not very conclusive, but point to the fact that the type of approach as a significant factor affecting the dissemination of the injected anesthetic, as the pharmacodynamics is disrupted, leading to differences in analgesia.<sup>12</sup> A more posterior approach may lead to a sensitive blockade of higher dermatomes (T8) than the TAP (T10), in addition to a longer lasting analgesia, probably because of the blockade of the sympathetic ganglion inside the thoracic paravertebral space. Moving along with this theory, in supraumbilical surgery, the oblique subcostal approach would be the most appropriate, or the fascial blockade herein discussed, with an axillary midline approach.

As the intercostal nerves blockade (T2–T6) in the external fascial serratus anterior-intercostal space is effective for breast surgery, and the analgesia for open gastrectomy needs to reach a level below T6, in these cases of supraumbilical laparotomy we decided to do a blockade of the intercostal nerves at a more caudal level (T6–T11).

The intercostal nerves block into the serratus-intercostal space (BRILMA) is an interfascial blockade of the lateral and anterior cutaneous branches of the intercostal nerves in the axillary midline originally described under ultrasound in 2012.<sup>13</sup> In this approach, the local anesthetic is administered to the plane between the medial aspect of the anterior serratus muscle and the external intercostal muscle, introducing a needle in plane, and placing the tip of the needle over the 4th rib. We introduced a change in 2015 which was the fascial blockade of the intercostal nerves T6 to 11 (modified BRILMA) as analgesic therapy in patients undergoing open cholecystectomy.<sup>2</sup> This analgesic technique blocks the anterior cutaneous branches of

the nerves T6 to 11, which although they are intermingled with the adjacent nerves, causing overlap of the innervation, this blockade is able to anesthetize the skin and the musculature of the abdominal wall. Visceral pain is managed with NSAIDs and paracetamol. Encouraged by the good results in these cases, we decided to use the technique in our 4 patients undergoing superior midline laparotomy.

There are no trials comparing this technique against epidural analgesia in open abdominal surgery, but there are studies on paravertebral blockade and blockade of the serratus-intercostal space in breast surgery<sup>14</sup> where the technique offers an alternative to central blockade.

The results obtained have been evaluated as satisfactory in terms of pain control and low use of opioids, when doing the interfascial block of the intercostal nerves T6 to 11 (modified BRILMA) in open gastrectomy. This is an easy-to-perform blockade, with a smooth learning curve and few complications. However, well designed clinical trials are needed to compare this analgesic technique against epidural anesthesia, to be able to suggest it as an alternative in open gastric surgery.

## Ethical disclosures

**Protection of human and animal subjects.** The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki).

**Confidentiality of data.** The authors declare that they have followed the protocols of their work center on the publication of patient data.

**Right to privacy and informed consent.** The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

## Funding

The authors have no funding to disclose.

## Conflicts of interest

The authors have no conflicts of interest to disclose.

## References

1. Werawatganon T, Charuluxanun S. Patient controlled intravenous opioid analgesia versus continuous epidural analgesia for pain after intra-abdominal surgery. *Cochrane Database Sys Rev* 2013;CD004088.
2. Fernández Martín MT, López Álvarez S, Mozo Herrera G, et al. Ultrasound-guided cutaneous intercostal branches nerves block: A good analgesic alternative for gallbladder open surgery. *Rev Esp Anestesiol Reanim* 2015;62:580–584.
3. Austrup ML, Korean G. Analgesic agents for the postoperative period. *Opioids Surg Clin North Am* 1999;79:253–273.

4. Cook TM, Counsell D, Wildsmith JA. Major complications of central neuraxial block: report on the Third National Audit Project of the Royal College of Anaesthetist. *Br J Anaesth* 2009;102:179–190.
5. Niraj G, Kelkar A, Jeyapalan I. Comparison of analgesic efficacy of subcostal Transversus Abdominis Plane Block with epidural analgesia following upper abdominal surgery. *Anaesthesia* 2011; 66:465–471.
6. Swenson BR, Gottschalk A, Wells LT, et al. Intravenous lidocaine is as effective as epidural bupivacaine in reducing ileus duration, hospital stay, and pain after open colon resection: a randomized clinical trial. *Reg Anesth Pain Med* 2010;35:370–376.
7. Bonnet F, Marret E. influence of anaesthetic and analgesic techniques on outcome after surgery. *Br J Anaesth* 2005;95:52–58.
8. Rozen WM, Tran TM, Asthon MW, et al. Refining the course of the thoracolumbar nerves: a new understanding of the innervation of the anterior abdominal wall. *Clin Anat* 2008;21:325–339.
9. Hebbard PD, Barrington MJ, Vasey C. Ultrasound-guided continuous oblique subcostal transversus abdominis plane blockade: description of anatomy and clinical technique. *Reg Anesth Pain Med* 2010;35:436–441.
10. Wu Y, Liu F, Tang H, et al. The analgesic efficacy of subcostal transversus abdominis plane block compared with thoracic epidural analgesia and intravenous opioid analgesia after radical gastrectomy. *Anesth Analg* 2013;117:507–513.
11. Niraj G, Kelkar A, Jeyapalan I, et al. Comparison of analgesic efficacy of subcostal transversus abdominis plane blocks with epidural analgesia following upper abdominal surgery. *Anaesthesia* 2011;66:465–471.
12. Ripollés J, Mezquita SM, Abad A, et al. Analgesic efficacy of the ultrasound-guided blockade of the transversus abdominis plane; a systematic review. *Braz J Anesthesiol* 2015;65:255–280.
13. Diéguez García P, Fajardo Pérez M, López Álvarez S, et al. Ultrasound-assisted approach to blocking the intercostal nerves in the mid-axillary line for non-reconstructive breast and axilla surgery. *Rev Esp Anesthesiol Reanim* 2013;60:365–370.
14. Pérez Herrero MA, López Alvarez S, Fabrique Fuentes A, et al. Quality of postoperative recovery after breast surgery. General anaesthesia combined with paravertebral versus serratus-intercostal block. *Rev Esp Anesthesiol Reanim* 2016;63: 564–571.