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CASE REPORT

The Role of an Ultrasound-Guided Block of the Deep Plane of the Serratus Muscle in a Modified ERAS Protocol for Cardiac Surgery

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Abstract:

To date, the use of multimodal techniques can allow substantial opioid-sparing and can reduce pain by using the local and systemic effects of different types of analgesics. Aims: This case report describes a modified ERAS protocol specific for cardiac surgery with the ultrasound-guided block of the deep plane of the serratus muscle (SAP deep block) in a multimodal opioid-sparing approach. \ Two male patients, aged 62 and 67, undergoing elective mini-invasive off-pump Cardiopulmonary Bypass Grafting (CPB), were treated with an opioid-sparing multimodal anesthesiological approach based on the continuous ultrasound-guided SAP deep block. The continuous ultrasound-guided SAP deep block alone can be used in the case of mini-left thoracotomy off-pump cardiopulmonary bypass grafting implementing a multi-modal opioid-sparing strategy. It seems effective in obtaining good (2 hours) weaning from mechanical ventilation, quick (36 hours) discharge from post-operative intensive care, and good post-operative pain control (NRS < 5) even in elderly and frail patients.

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1. INTRODUCTION

To date, the mainstay for pain treatment in cardiac-surgery is the administration of parenteral opioids even if these drugs are associated with many side effects, including the risk of sedation with respiratory depression, paralytic ileus, nausea and vomiting [1, 2]. Especially in severely ill patients, such as patients candidate to cardiac surgery, there is the necessity to reduce the side effects of opioid administration, and there is growing interest in multimodal opioid-sparing approaches that can adequately address pain through the additive or synergistic effects of different types of analgesics improving patients compliance and reducing the discomfort [3].

In this context, locoregional anesthesia can bring essential advantages in the prevention of cognitive dysfunctions and intraoperative complications.This type of approach allows the fulfillment of opioid-sparing or opioid-free anesthesia, entirely consistent with the minimally invasive surgical evolution, also facilitating rapid postoperative recovery.

Recent studies, the ERAS approach, if applied to cardiac surgery, has shown promising results; however, evidence-based protocols have not emerged yet.

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In this case report, we describe two cases of elective myocardial revascularization using a mini-invasive surgical procedure associated with an opioid-sparing anesthesiological approach based on continuous SAP block.

2. CASES DESCRIPTION

Two male patients were admitted at the cardiac-surgery service of the "San Michele" nursing home in Maddaloni (Caserta, CE) of the after episodes of chest pain and positive stress test for signs and symptoms. The coronary angiography showed total chronic occlusion of the middle part of the anterior interventricular artery and the anterograde attempt to solve it by the percutaneous intervention was not effective. The two patients, aged 62 and 67, affected by hypertension and dyslipidemia, one of them allergic to Paracetamol, received preoperative counseling to define their perioperative analgesia targets.

Both were candidates to elective mini-invasive off-pump Cardiopulmonary Bypass Grafting (CPB), associated with an opioid-sparing anesthesiological approach based on locoregional techniques. The aim of this multimodal opioid-sparing approach was to guarantee a rapid pain-free recovery from the surgical intervention consisting of the harvesting of the skeletrized left internal mammary artery (AMIS) to revascularize the anterior Interventricular Artery (IVA) *via*

mini lateral left thoracotomy. Chest X-ray and chest CT examinations were within normal limits. A blood test was within normal limits. NYHA IV, ASA IV.

On the day of surgery, the patients were premedicated with a single oral dose of gabapentin (1200 mg), 2 hours before surgery, to obtain an anxiolytic, sedative and anti-hyperalgesic effect.

In the operating room before the induction of general anesthesia, the vital signs were continuously monitored recording spO_2, cardiac frequency, respiratory rate, ECG traces, and arterial pressure through the radial artery cannulation. Anesthesia depth was monitored using the Bispectral Index (BIS).

For the induction and maintenance of general anesthesia, TIVA-TCI (totally intravenous anesthesia by target-controlled infusion) was used with Propofol target at the site-effect of 3 μg/ml and Remifentanil target at the site-effect of 3.5 ng/ml. For curing, Rocuronium at 0.6 mg/kg and then in continuous infusion at 0.3 mg/kg/h.

Both patients were intubated with an 8.0 cuffed tube. Intubation was followed by insertion of the bladder catheter for monitoring diuresis and, in asepsis and with ultrasound guidance, cannulation of the right internal jugular vein with PVC monitoring.

Subsequently, the ultrasound-guided SAP deep block was performed.

For the execution of the SAP deep block in complete sterility, were used, an echograph with a linear high-frequency probe (6-12 MHz), a sterile probe-cover, a needle with a Tuohy 17 G ecoreflecting tip, an ultrasound catheter for a continuous peripheral nerve block.

Levobupivacaine (0.375%) 30 ml was injected as a start dose and, after catheter insertion, an elastomeric pump with levobupivacaine (0.125%) was connected to the catheter to obtain a constant infusion of the local anesthetic at 5 ml/h for 48 hours.

No complication occurred during the procedure.

After the execution of the block, the remifentanil infusion was suspended and a bronchial blocker was placed under bronchoscopic guidance to allow left pulmonary exclusion during surgery.

During surgery, the hemodynamic parameters remained stable and the BIS index remained between 40 and 60.

At the end of the surgery, the Rocuronium infusion was interrupted and the patients were transferred to Cardiac surgery intensive care.

The patients, in intensive care, were subjected to chest X-ray and infusion of a postoperative pain therapy consisting of 150 mg of Ketorolac in continuous infusion for 48 h. Pain assessments in ICU, in the intubated patient, was conducted by the Critical Care Pain Observation Tool, Behavioral Pain Scale, and Bispectral Index monitoring.

After an observation period of 2 hours from the end of the surgery, to evaluate the blood losses coming from the surgical drainage placed at the level of the fourth left intercostal space (site also of the surgical incision), the patients were extubated with good EGA values. In the extubated patients, we measured the patients' pain by the Numerical Rating Scale (NRS) from the time of extubation every 8 hours for 48 hours, evaluating static and dynamic analgesia (during cough). As a rescue dose, if the NRS exceeded the value of 5, we would have used Tramadol 100 mg e.v. For both patients, the NRS fluctuated between the values of 0 and 4.

3. DISCUSSION

Although we can not produce a multimodal opioid-sparing pain management definitive protocol, we are almost sure to guarantee that evidence recommends, for Cardiac Surgery (CS) programs, the use of paracetamol, tramadol, dexmedetomidine, and pregabalin (or gabapentin) based on availability.

Non-Steroidal Anti-Inflammatory Drugs are associated with renal dysfunction after CS [4]. Selective COX-2 inhibition is associated with a significant risk of thromboembolic events after CS [5]. The safest nonopioid analgesic may be paracetamol [6 - 8]. Tramadol has high delirium risk and produces a 25% decrease in morphine consumption, decreased pain scores and improved outcome postoperatively [9, 10]. Pregabalin is associated with reduced opioid consumption and is used in postoperative multimodal analgesia if it is administered 1 hour before surgery and for 2 postoperative days improves pain scores compared with placebo [11 - 13]. Gabapentin 600 mg 2 hours before CS is associated with significant pain reduction, opioids and postoperative nausea and vomiting [14]. Dexmedetomidine, an intravenous α-2 agonist, reduces opioid requirements and may reduce AKI after CS [15 - 17]. Ketamine has potential uses in CS owing to its favorable hemodynamic profile, very low incidence of respiratory depression, analgesic properties and reduced delirium incidence; more studies are needed in the CS setting [18 - 20].

In this context, the ultrasound-guided block of the nerve in the thoracic wall may be indicated in cardiac surgery, reducing analgesic drug dosage, request and side effects.

The ultrasound-guided block of the deep plane of the serratus muscle (SAP deep block) if performed, exactly, in the axillary region, in a more lateral and posterior position with respect to the Pecs blocks I and II, between the posterior and middle axillary line, in a compartment between the serrato muscle and the ribs can block the intercostobrachial nerve, the lateral cutaneous branches of the intercostal nerves (T3-T9), the long thoracic nerve and the thoracodorsal nerve, ensuring adequate analgesia in the operations of the anterolateral thoracic wall and, at the same time, providing a less invasive, effective, safe and easy to perform method compared to paravertebral block and peridural anesthesia.

CONCLUSION

The continuous SAP deep block, if performed by expert operators and with an ultrasound-guided technique, represents a relatively simple and safe technique for the superficiality of the target structures and the distance from vessels and pleurae. Complications at the time have not been described, however as

for the TAP block, the need for generous volumes of local anesthetic, especially if performed bilaterally, can lead to high plasma concentrations of local anesthetic, increasing the risk of local anesthetic toxicity.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

Not applicable.

CONSENT FOR PUBLICATION

All patients participated on a voluntary basis and gave their informed consent.

STANDARD OF REPORTING

CARE guidelines and methodology were followed.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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Declared none.

REFERENCES

[1] Engelman DT, Ben Ali W, Williams JB, *et al.* Guidelines for perioperative care in cardiac surgery: Enhanced recovery after surgery society recommendations. JAMA Surg 2019; 154(8): 755-66. [http://dx.doi.org/10.1001/jamasurg.2019.1153] [PMID: 31054241]

[2] White PF, Kehlet H, Neal JM, Schricker T, Carr DB, Carli F. The role of the anesthesiologist in fast-track surgery: From multimodal analgesia to perioperative medical care. Anesth Analg 2007; 104(6): 1380-96. [http://dx.doi.org/10.1213/01.ane.0000263034.96885.e1] [PMID: 17513630]

[3] Wick EC, Grant MC, Wu CL. WuCL. Postoperative multimodal analgesia pain management with nonopioid analgesics and techniques: A review. JAMA Surg 2017; 152(7): 691-7. [http://dx.doi.org/10.1001/jamasurg.2017.0898] [PMID: 28564673]

[4] Qazi SM, Sindby EJ, Nørgaard MA. Ibuprofen—a safe analgesic during cardiac surgery recovery? A randomized controlled trial. J Cardiovasc Thorac Res 2015; 7(4): 141-8. [http://dx.doi.org/10. 15171/jcvtr.2015.31]

[5] Nussmeier NA, Whelton AA, Brown MT, *et al.* Complications of the COX-2 inhibitors parecoxib and valdecoxib after cardiac surgery. N Engl J Med 2005; 352(11): 1081-91. [http://dx.doi.org/10.1056/NEJMoa050330] [PMID: 15713945]

[6] Jelacic S, Bollag L, Bowdle A, Rivat C, Cain KC, Richebe P. Intravenous acetaminophen as an adjunct analgesic in cardiac surgery reduces opioid consumption but not opioid-related adverse effects: A randomized controlled trial. J Cardiothorac Vasc Anesth 2016; 30(4): 997-1004. [http://dx.doi.org/10.1053/j.jvca.2016.02.010] [PMID: 27521969]

[7] Petring OU, Dawson PJ, Blake DW, *et al.* Normal postoperative gastric emptying after orthopaedic surgery with spinal anaesthesia and I.M. ketorolac as the first postoperative analgesic. Br J Anaesth 1995; 74(3): 257-60. [http://dx.doi.org/10.1093/bja/ 74.3.257]

[8] Apfel CC, Turan A, Souza K, Pergolizzi J, Hornuss C. Intravenous acetaminophen reduces postoperative nausea and vomiting: A systematic review and meta-analysis. Pain 2013; 154(5): 677-89. [http://dx.doi.org/10.1016/j.pain.2012.12.025] [PMID: 23433945]

[9] Radbruch L, Glaeske G, Grond S, *et al.* Topical review on the abuse and misuse potential of tramadol and tilidine in Germany. Subst Abus 2013; 34(3): 313-20. [http://dx.doi.org/10.1080/08897077.2012.735216] [PMID: 23844964]

[10] But AK, Erdil F, Yucel A, Gedik E, Durmus M, Ersoy MO. The effects of single-dose tramadol on post-operative pain and morphine requirements after coronary artery bypass surgery. Acta Anaesthesiol Scand 2007; 51(5): 601-6. [http://dx.doi.org/10.1111/j.1399-6576.2007.01275.x]

[11] Sansone P, Passavanti MB, Fiorelli A, *et al.* Efficacy of the topical 5% lidocaine medicated plaster in the treatment of chronic post-thoracotomy neuropathic pain. Pain Manag 2017; 7(3): 189-96. [http://dx.doi.org/10.2217/pmt-2016-0060] [PMID: 28326950]

[12] Joshi SS, Jagadeesh AM. Efficacy of perioperative pregabalin in acute and chronic post-operative pain after off-pump coronary artery bypass surgery: a randomized, double-blind placebo controlled trial. Ann Card naesth 2013; 16(3): 180-5. [http://dx.doi.org/10.4103/0971-9784.114239]

[13] Borde DP, Futane SS, Asegaonkar B, *et al.* Effect of perioperative pregabalin on postoperative quality of recovery in patients undergoing off-pump coronary artery bypass grafting (OPCABG): A prospective, randomized, double-blind trial. J Cardiothorac Vasc Anesth 2017; 31(4): 1241-5. [http://dx.doi.org/10.1053/j.jvca.2016.09.029] [PMID: 27939574]

[14] Menda F, Köner O, Sayın M, Ergenoğlu M, Küçükaksu S, Aykaç B. Effects of single-dose gabapentin on postoperative pain and morphine consumption after cardiac surgery. J Cardiothorac Vasc Anesth 2010; 24(5): 808-13. [http://dx.doi.org/10.1053/j. jvca.2009.10.023]

[15] Khalil MA, Abdel Azeem MS. The impact of dexmedetomidine infusion in sparing morphine consumption in off-pump coronary artery bypass grafting. Semin Cardiothorac Vasc Anesth 2013; 17(1): 66-71. [http://dx.doi.org/10.1177/1089253212463969] [PMID: 23108415]

[16] Alfieri A, Passavanti MB, Di Franco S, *et al.* Dexmedetomidine in the management of awake fiberoptic intubation. Open Anesthesia J 2019; 13 [http://dx.doi.org/10.2174/2589645801913010001]

[17] Cho JS, Shim JK, Soh S, Kim MK, Kwak YL. Perioperative dexmedetomidine reduces the incidence and severity of acute kidney injury following valvular heart surgery. Kidney Int 2016; 89(3): 693-700. [http://dx.doi.org/10.1038/ki.2015.306] [PMID: 26444030]

[18] Fiorelli A, Mazzella A, Passavanti B, *et al.* Is pre-emptive administration of ketamine a significant adjunction to intravenous morphine analgesia for controlling postoperative pain? A randomized, double-blind, placebo-controlled clinical trial. Interact Cardiovasc Thorac Surg 2015; 21(3): 284-90. [http://dx.doi.org/10.1093/icvts/ivv154] [PMID: 26071592]

[19] Hudetz JA, Patterson KM, Iqbal Z, *et al.* Ketamine attenuates delirium after cardiac surgery with cardiopulmonary bypass. J Cardiothorac Vasc Anesth 2009; 23(5): 651-7. [http://dx.doi.org/10.1053/j.jvca. 2008.12.021]

[20] Sansone P, Pace MC, Passavanti MB, Pota V, Colella U, Aurilio C. Epidemiology and incidence of acute and chronic post-surgical pain. Ann Ital Chir 2015; 86(4): 285-92. [PMID: 26343897]