International Journal of Anaesthesia & Research
IJAR, 3(2): 112-115
www.scitcentral.com
ISSN: 2641-399X
Review Article: Open Access

Perioperative Use of Intravenous Lidocaine for Bariatric Surgery

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Received March 09, 2020; Accepted March 30, 2020; Published August 15, 2020

ABSTRACT

A smooth postoperative recovery can be hindered by the adverse effects that often result from the use of opioids, such as respiratory depression, nausea and constipation. Loco-regional anesthesia and analgesia (LRA) is good technique to reduce opioid needs but not all patients may be suited to or benefited by regional anesthesia techniques (e.g. morbidly obese patients undergoing bariatric surgery) so additional options such as intravenous non-opioid analgesic medications that enable a rapid recovery are required. Intravenous lidocaine can be used as an alternative if LRA is not possible. Several studies have looked at the potential for using the non-opioid, lidocaine, as a feature of multimodal management strategies designed to reduce postoperative pain and speed recovery.

The purpose of this review was to consider both the potential benefits and the risks of treating perioperative pain in patients undergoing bariatric surgical procedures with an intravenous infusion of lidocaine.

INTRODUCTION

The global prevalence of obesity is increasing with the World Health Organization estimating that 11 % of adults are obese worldwide [1]. Obesity is usually associated with obstructive sleep apnea (OSA), which is now thought to affect at least 100 million adults [2]. Long-term weight reduction may also be achieved through bariatric surgeries such as Laparoscopic sleeve gastrectomy and Roux en Y gastric bypass surgery. These surgeries will both improve OSA outcomes and glycemic control while reducing cardiovascular and cancer risk [3].

Concerns about opioid risks in the postoperative period has spurred an increased interest in the use of nonopioid analgesic adjuncts. It is well known that the patients with obstructive sleep apnea (OSA) have increased sensitivity to opioid-induced respiratory depression resulting in potential for developing postoperative pulmonary complications. Morbidly obese patients have a high prevalence of both diagnosed and undiagnosed OSA, and the perioperative respiratory disturbances related to OSA may be exacerbated by opioids. The use of multimodal strategies that minimize opioid-related side effects are highly desirable in morbidly obese patients undergoing surgical procedures.

Almost 30 years ago, the well-known 'WHO Step Ladder' was introduced and has since become a widely accepted concept for rational pain management [4]. This introduced the concept of multimodal analgesia which has proved very significant in the development of the current rationale for managing acute pain.

Alvarez et al. recommend multi-modal pharmacological approaches for providing optimal analgesia after abdominal surgery [5]. Multimodal analgesia has been shown to reduce opioids requirements, decrease opioid related side effects and facilitate post-operative recovery after several surgical procedures. It usually combines systematic administration of several non-opioid analgesics, such as acetaminophen and non-steroidal anti-inflammatory drugs, and local anesthetic-based analgesic techniques [6]. These local anesthetic based techniques include epidural analgesia; truncal blocks such as the TAP block continuous intravenous infusion of lignocaine and wound infiltration with local anesthetics.

Intravenous lidocaine has been used as a part of multimodal approach for postoperative analgesia and its use is associated with reductions in post-operative pain, analgesic consumption, nausea, vomiting and length of hospital stay in various surgeries including laparoscopic bariatric procedure.

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Citation: Gupta C. (2020) Perioperative Use of Intravenous Lidocaine for Bariatric Surgery. Int J Anaesth Res, 3(1): 112-115.

PHARMACOLOGY

Lidocaine has analgesic, anti-inflammatory anti-nociceptive as well as immunomodulating properties. The analgesic effects result, it is thought, from the inhibition of Na^+ channels, NMDA and G-protein-coupled receptors which suppress spontaneous impulses from damaged nerve fibers and the proximal dorsal root ganglion. It is anti-inflammatory as it blocks neural transmission form the damaged tissue. Neurogenic inflammation is vitiated by the blockade of neural transmission at the site of tissue injury. The inhibition of the release of interleukin-1 (IL-1) coupled with the decreased release of lysosomal enzymes results in a lessening of the release of pro- and anti-inflammatory cytokines. It is proposed that consequently an anti-hyperalgesia effect [7] arises as peripheral and central sensitization is suppressed. In addition, intravenous lignocaine has been successfully used to treat visceral pain [8] and has been reported to accelerate the return of bowel function after surgery [9].

The concerns for LA toxicity have been raised with continuous intravenous lidocaine infusion. Lidocaine toxicity is more likely to manifest when its plasma concentration reaches 5 μg/mL. It is considered that administering a bolus of between 1 and 2 mg/kg, whether or not followed by a continuous infusion of 1.5 mg/kg, (corresponding to plasma concentrations of 2 μg/ml) is small [10]. The intravenous lidocaine dose less than 5 mg/kg, administered slowly over 30 min, under monitoring, are considered safe [11].

Review of literature for use of intravenous lidocaine for abdominal and bariatric surgery

Rimbäck G et al. [12] published one of the earliest clinical trials with i.e. lidocaine. Having noted that intraperitoneal lidocaine reduced the incidence of postoperative ileus the authors sought to establish whether this was a local or systemic effect of the drug. They gave radio-opaque markers to 30 patients to swallow prior to them undergoing open cholecystectomy. Patients randomized to, i.e., lidocaine treatment (100 mg bolus followed by 3 mg/min for 24 h) demonstrated significant recovery in bowel motility, and this was confirmed by serial radiographs. The patients also experienced less pain, had fewer opioid requirements, and made a speedier recovery. Intravenous lidocaine, it was proposed, was able to reduce ileus and/or enhanced gut function recovery in any of five ways; by its excitatory effect on gut smooth muscle (direct), with reduced pain and opioid requirements (indirect), by blocking sympathetic reflexes, by reducing catecholamine production and through its anti-inflammatory effect.

Lauretti GR [11] reviewed intravenous lignocaine for mechanisms of action that diverge from the classical Na+ channel blockade, the differential action of intravenous lidocaine in central sensitization and the analgesic and cytoprotective actions. They observed that intravenous lidocaine's final analgesic action reflected its multifactorial action. Central hyperexcitability or sensitization was blocked through its peripheral anti-hyperalgic action on somatic pain and central action on neuropathic pain.

Olivera GS et al. [13] compared the effect of systemic intraoperative lidocaine versus placebo in a prospective, randomized, double blind study on the quality of postoperative recovery in patients undergoing laparoscopic bariatric surgery. 50 patients were randomly given either intravenous lidocaine (1.5 mg/kg bolus followed by a 2 mg/kg/h infusion until the end of the surgical procedure) or an identical volume of saline. The primary outcome was the quality of recovery 40 questionnaire at 24 h after surgery. He found that systemic lidocaine improves postoperative quality of recovery. There was a lower opioid consumption among the patients who had received lidocaine which consequently resulted in an improved quality of recovery.

Alvey EN et al. [14] (2016) evaluated the safety and effects of intravenous lidocaine in obese patients undergoing laparoscopic Roux-en-Y gastric bypass (RYGB) surgery in a prospective, double-blinded and placebo-controlled safety study among 20 patients who were separated at random into two groups of ten. The first group received a continuous infusion of lidocaine 2 milligrams per kilogram per hour (mg/kg/hr) intravenously from induction of general anesthesia until the end of the operation. In parallel, the second group was administered a dextrose placebo intravenously. Postoperatively both groups were observed for 24 h with the primary end point being symptoms of lidocaine toxicity observed at 1 h postoperatively. The exploratory outcomes studied were, visual analog scale (VAS) pain scores, the volume of opioid consumed, the time to the first passage of flatus and bowel movement, the duration of the stay in hospital and adverse events. A trend towards less opioid consumption was observed in the group receiving lidocaine but otherwise there was no significant difference between the groups in respect to the adverse effects. Their study was underpowered to detect statistical differences due to pilot study design; addressing safety as the primary outcome measure as opposed to efficacy. The study did find that intravenous lidocaine in RYGB surgery was safe without differences in postoperative pain or adverse effects.

Budiansky AS et al. [15] completed a literature review for acute pain management in morbid obesity and confirmed that multimodal pharmacological approach in morbidly obese patients can improve post-operative pain scores, reduce opioid analgesic consumption and side-effects notably sedation, respiratory depression, nausea and vomiting and that the perioperative use of regional anesthesia and non-opioid adjuvants (ketamine, lidocaine and dexmedetomidine etc.) are important to improve the safety and efficacy of multimodal analgesia regimes.

Gupta C et al. [16] compared intravenous lidocaine and ultrasound guided transversus abdominus plane block for postoperative analgesia in a comparative randomized study in bariatric surgical patients. 58 patients were studied, each with body mass index >35 kg/m^2 and were randomly allocated either to a to Lidocaine group (Group A) or a USG-TAP group (Group B). Those in Group A received intravenous Lidocaine (1.5 mg/kg) bolus followed by (1.5 mg/kg/h) infusion while those in Group B patients received ultrasound-guided bilateral TAP block using 20 cc of 0.375% ropivacaine each side. Their study concluded that obese patients undergoing laparoscopic bariatric surgery who received intravenous Lidocaine as part of multimodal analgesic technique had an improved pain score and reduced opioid requirement when compared with a USG-TAP Block.

CONCLUSION

Perioperative lidocaine infusion results in reduced postoperative pain and a more rapid recovery of bowel function in several types of open abdominal and laparoscopic procedures [7]. It may also be a useful analgesic adjunct in bariatric surgery. Lidocaine infusion resulted in improved pain scores, reduced opioid consumption and a shorter hospital stay, among other outcomes. Perioperative lidocaine infusion may also be considered for other types of surgery where the available evidence suggests that there may be a possible benefit and minimal risk of neurologic and cardiac side effects.

Although accumulation of lidocaine is a concern with continuous infusion, at doses used in the studies cited here, plasma concentrations remain well below the toxic level (5 μg/ml) and no untoward events were attributed to the use of intravenous lidocaine in these studies. It was extremely rare for the use of perioperative lidocaine infusion to be toxic; it may present with tinnitus, perioral numbness and cardiovascular instabilities. The local anesthetic systemic toxicity (LAST) requires immediate management, as it is a life-threatening event. The LA injection must be stopped while help is summoned and preparation made to resuscitate. Management of the airway, breathing and circulation and the early administration of 20% Intralipid emulsion (initial bolus of 1.5 mL·kg^{-1} over 2-3 min followed by 0.25 mL·kg^{-1}·min^{-1} infusion therapy; maximum of 12 mL·kg^{-1} of 20% lipid emulsion), are key priorities, together with swift seizure management, and a considered selection of cardiovascular supportive pharmacotherapy. Prevention should be the priority for reducing the frequency and severity of LAST and consideration should be given to monitoring plasma lidocaine levels in patients with a higher risk of lidocaine toxicity e.g. those with preoperative deranged kidney or liver function tests.

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