

## Continuous Intravenous Lidocaine Infusion: Effective Analgesic Choice in a Complex Critically Ill Patient

Patricia Duque\* and Patricia Piñeiro

Hospital General Universitario Gregorio Marañón, Spain

### Abstract

The need to manage acute pain in older patients is becoming increasingly frequent in postoperative intensive care units. Older population is extremely sensitive to opioid adverse effects. Therefore, intravenous infusion of lidocaine might be a useful tool in this scenario. We present the case of an ICU older patient after urgent abdominal surgery. Pain management with opioid therapy was extremely complex with serious adverse effects. Intravenous lidocaine infusion not only proved to be effective but also allowed an enhanced postoperative recovery.

**Keywords:** Pain; Intensive; Care; Intravenous; Lidocaine; Older

### Background and objectives

Increasingly older patients are undergoing major surgery. Consequently, the need to manage acute pain in this population is becoming more frequent in postoperative intensive care units (ICU). Systemic lidocaine infusion may be a useful analgesic adjunct in the critically ill patient who might be in severe pain not relieved by high-dose opioid therapy [1]. Lidocaine infusion attenuates several complications caused by opioids such as respiratory depression, sedation, and ileus by reducing opioid requirements, which takes on importance particularly in the elderly population.

Intravenous lidocaine blocks polymorphonuclear leukocytes priming if the cells are exposed for hours of infusion at low concentrations (0.1  $\mu$ M Lidocaine). The underlying mechanism appears to be inhibition of intracellular G-protein signaling molecule (Gq). It is time dependent and reversible. However, there is no evidence of benefit with intravenous lidocaine infusion over 24 hours [2], though in enhanced recovery protocols following colorectal surgery may be applied till postoperative day 23.

The goal of an infusion is to reach a steady state concentration within the therapeutic and non-toxic range. 1.33 mg/kg/hour to 3 mg/kg/hour achieved adequate plasma concentrations of 2  $\mu$ g/mL to 5  $\mu$ g/mL as demonstrated in several weight-based lidocaine regimens. Older patients' physiology modifies the pharmacokinetics and could result both in insufficient pain control or inadvertent toxicity. Side effects of lidocaine are mainly neurologic changes (lightheadedness, dizziness and visual disturbances) and cardiac dysrhythmias. Furthermore, critically ill patients may present with fluctuating hemodynamics and organ functions. Currently, the evidence evaluating the use of intravenous lidocaine infusion in ICU patients is very limited. A recent published retrospective study found that intravenous lidocaine appeared to reduce opioid requirements in ICU patients with low-dose regimens (2 mg/min) [1].

We present the case of a septic older patient after urgent abdominal surgery, exceedingly sensitive to opioid adverse effects, in which continuous intravenous lidocaine infusion allowed excellent and enhanced recovery [2].

### Case Report

An 84 year-old-man admitted to Intensive Care Unit after urgent laparotomy for small bowel perforation associated with peritonitis. His past medical history was pertinent for chronic obstructive pulmonary disease (COPD). Surgery was uneventful. On arrival in ICU, he was alert, hemodynamically stable and had a patent airway. Intravenous

infusion of morphine was placed at a rate of 30 milligrams per 24 hours. Nevertheless, he complained of inadequate pain control. Furthermore, on postoperative day 2, he presented with hypercapnic encephalopathy secondary to opioid analgesic overdose. He required orotracheal intubation and on physical examination, he still complained of abdominal pain. Epidural catheter placement was ruled out due to his coagulation profile (INR=1.97, TTPA ratio=1.6) and surgical wound infiltration proved to be ineffective. Therefore, continuous intravenous lidocaine was placed at 1 mg/kg/hour infusion rate for 48 hours. This lidocaine infusion provided adequate pain control with no more opioid requirements. During ICU stay, he developed the already mentioned coagulopathy and mild renal dysfunction related to abdominal sepsis. No toxicity associated with intravenous lidocaine infusion was documented despite kidney impairment. Endotracheal tube was removed two days later and he was discharged successfully to the ward on postoperative day 6 [3-5].

### Conclusion

Intravenous lidocaine could be an effective adjuvant analgesic in older postoperative critically ill patients, which may be with severe pain, in whom high doses of opioids can decrease respiratory drive and consequently, increase mechanical ventilation requirements [2]. In addition, intravenous lidocaine infusion is a promising alternative when neuraxial analgesia is contraindicated.

However, there is a lack of evidence regarding safety and effectiveness of intravenous lidocaine in critically ill patients [1]. A recently published Cochrane review [5] includes 45 trials involving 2802 participants. The authors found evidence of effect for intravenous lidocaine on the reduction of postoperative pain compared to placebo or no treatment at 'early time points (one to four hours)' and at 'intermediate time points (24 hours)' after surgery. However, no evidence of effect was found for lidocaine to reduce pain at 'late time points (48 hours)' after surgery. Furthermore, the authors found evidence of positive effects for lidocaine administration on reduction of length of hospital stay, postoperative nausea, intraoperative and postoperative opioid requirements. Among

\*Corresponding author: Patricia Duque, Hospital General Universitario Gregorio Marañón, Spain, Tel: +34646664465; E-mail: [patriduque@gmail.com](mailto:patriduque@gmail.com)

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all the trials included, there is a scarcity of studies assessing ICU patients. This review highlights the paucity of data concerning optimal dose, timing (including the duration of the administration) and adverse effects of intravenous lidocaine therapy.

Toxicity from intravenous lidocaine infusion is extremely unusual. Classically, it presents with tinnitus, perioral numbness, and cardiac dysrhythmias. Lidocaine is 95% metabolized (dealkylated) in the liver. Congestive heart failure can decrease its volume of distribution. The elimination half-life of lidocaine may be prolonged in patients with hepatic impairment or congestive heart failure. Lidocaine is excreted in the urine. Therefore, caution should be taken in ICU patient in whom congestive heart failure, shock, severe renal impairment, or hepatic disease may be present. To date, there is no data assessing intravenous lidocaine infusion in patients on continuous renal replacement therapy.

We think this patient fulfills all requirements for using intravenous lidocaine as analgesic adjuvant: septic ICU patient, exceedingly sensitive to opioid adverse effects probably due to his advanced age and COPD, requiring mechanical ventilation and with high risk of developing ventilator-associated pneumonia. Pain was inadequately controlled with opioids and neuraxial analgesia was contraindicated. Continuous intravenous lidocaine infusion proved to be an effective and safe alternative to opioids, allowing early extubation and successful discharge to the ward. No suspected adverse reactions related to lidocaine were documented despite mild renal impairment.

In our opinion, this case illustrates how intravenous lidocaine might be a useful analgesic therapy in the critically ill patient. It could be even used as first choice in patients with presumed inadequate response to narcotics, replacing them during the first 24 to 48 hours. Other populations, especially sensitive to opioids as children or cystic fibrosis lung transplant recipients, might also benefit from this opioid sparing (or even free) analgesia. Nonetheless, more evidence is needed with regard to optimal dose, duration of administration and serious adverse effects in these frail populations.

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