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Continuous Intravenous Lidocaine for Acute Pain Management Post Laparotomy Surgery: A Case Series

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ABSTRACT

Introduction: Acute post-operative pain can lead to prolonged use of opioids and progress to chronic pain. Multimodal analgesic approaches have replaced the use of opioid monotherapy, but opioid use continues and contributes to inadequate acute pain management. Intravenous lidocaine has analgesic, anti-hyperalgesic, and anti-inflammatory effects. This study aims to describe post-operative pain management using intravenous lidocaine. **Case presentation:** There were two cases. The first was a 32-year-old female patient with suspected interrupted ectopic pregnancy who underwent emergency laparotomy under spinal anesthesia and, after 2 hours, was converted to general anesthesia. Postoperatively, the analgesic lidocaine was given as a 52 mg intravenous bolus followed by a continuous 36 mg/hour/syringe pump. The patient's VAS scale was initially 2/10, and on the third day, 1/10 continued treatment. In the second case, an 18-year-old male patient with suspected acute appendicitis underwent a midline incision laparotomy appendectomy with spinal anesthesia. Postoperatively, lidocaine was given a slow bolus of 75 mg intravenously, finished in 5 minutes, then 50 mg/hour/intravenously. The patient's VAS scale was initially 2-3/10 until on the third day. He was transferred to a room with a VAS of 1-2/10. **Conclusion:** Lidocaine is an effective intravenous analgesic to treat acute pain after laparotomy surgery. Administration of relatively low doses can achieve post-operative analgesia without concern for toxicity.
Keywords: acute pain, intravenous, lidocaine, laparotomy, post-operative pain.

Introduction

During the perioperative period, disturbances of hemodynamic, endocrine, metabolic, and immune responses occur. The inflammatory process is important in the recovery or repair of tissue damaged by surgical wounds structurally and functionally. Conversely, overstimulation of the inflammatory response can lead to tissue damage, chronic pain, acute respiratory distress syndrome (ARDS), systemic inflammatory response syndrome (SIRS), and multi-organ failure.[1] The most common post-operative problems are acute pain, nausea and vomiting, hypercoagulation, paralytic ileus, and cognitive dysfunction. Prompt treatment is carried out to prevent or reduce these complications so that recovery can take place more quickly.[2-4]

Suboptimal acute pain management can lead to many negative consequences, including increased morbidity, impaired physical function and quality of life, and delayed recovery. Post-operative pain can trigger prolonged use of opioids during and after hospital discharge and may progress to chronic pain. Based on the literature, persistent pain occurs in 10-60% of post-operative patients. Furthermore, inadequate pain management results in a prolonged length of stay, time to hospital discharge, number of re-admissions, and time before ambulation, which can increase costs.[3-5]

Post-operative pain is a mixture of inflammatory pain and neuropathic pain, and there is often an increased sensitivity to pain.[1,2] Anesthesiologists can choose one of a variety of methods to manage post-operative pain, but it is evident that different interventions also have different effects on the outcome post-operative.[6]

Opioids have been used as post-operative pain therapy but are often associated with side effects such as nausea, vomiting, respiratory depression, chest wall stiffness, drowsiness, pruritus, urinary retention, immunomodulation, constipation, hyperalgesia, and addiction, so their use should be limited.[7] The multimodal approach to analgesia has shifted the use of opioid monotherapy, but the continued belief in opioids as a post-operative pain therapy may contribute to inadequate acute pain management.[5]

Epidural analgesia was initially considered as a strategy to improve outcomes after major surgery. It is hoped that it will reduce the catabolic stress response and ensure the adequacy of pain therapy by reducing the need for opioids. However, not all patients are comfortable and serious neurological complications often occur. Hence, epidural anesthesia is restricted to thoracotomy and major abdominal surgery.

Several years ago, intravenous administration of lidocaine was only used as an anesthetic adjuvant. But recently, the use of intravenous lidocaine has begun to attract attention, and it is known that it has analgesic, anti-hyperalgesic, and anti-inflammatory effects.[8,9] The results of a meta-analysis showed that systemic lidocaine provides analgesic effects in the perioperative period and also provides fast recovery, reduced hospitalization, improved gastrointestinal motility, and reduced chronic post-operative pain. In addition, it provides security and an alternative for patients who refuse or cannot do an epidural. Administration of systemic (intravenous) lidocaine at the recommended dose causes the plasma level of lidocaine to be in the range of 0.5-5 mcg/ml. In most cases, lidocaine is given as a bolus of 1.5-2 mg/kgBW followed by an infusion of 1.5-3 mg/kgBW. When measured, plasma Lidocaine concentrations were in the range of 0.5-5 g/ml, which is comparable to concentrations after epidural administration of lidocaine.[1,9-12] This study aims to describe post-operative pain management using intravenous lidocaine.

Case Presentation

Case-1

A 32-year-old female patient with complaints of bleeding from the birth canal for a week since one month ago. Past medical history showed that the patient had a history of curettage since 1 month ago. On physical examination, he appeared compos mentis with Glasgow Coma Scale (GCS) E: 4 V: 5 M: 6, weight was 35 kg, and vital signs showed blood pressure: 100/70 mmHg, pulse rate 82 x/minute, respiratory rate 16 x/minute and a temperature of 36.5°C, and looks anemic accompanied by tenderness in the abdominal area.

Laboratory results on February 17, 2021 showed hemoglobin 6.3 g/dL, hematocrit 20.2%, white blood cells 4280 / uL, platelets 439000 / uL, clotting time 9 seconds, and bleeding time 1 minute 15 seconds, accompanied by a negative plano test. After February 18, 2021, he found a hemoglobin of 11.7 g/dL and a hematocrit of 36%. Ultrasound examination showed a suspected disturbed ectopic pregnancy with a hematoma in the left adnexa, a doubled cavity (+) cyst on the distal anterior wall of the uterus, with a differential diagnosis of a left adnexal complex mass (+), a blighted ovum on the distal anterior wall of the uterus. The patient was diagnosed as suspected of having an interrupted ectopic pregnancy, and an emergency laparotomy was performed.

The intraoperative procedure on the patient was spinal anesthesia, mini-laparotomy with a midline incision, adhesions were found in the abdominal cavity, and the incision was

extended upwards through the central area. After the operation lasted more than 2 hours, the patient began to feel pain, so the anesthesia was converted to general anesthesia by intubation, and after surgery, the patient was extubated and transferred to the intensive care room. The patient was given post-operative analgesics, namely Paracetamol 500 mg/6 hours/intravenous, Ibuprofen 400 mg/8 hours/intravenous, and Lidocaine 52 mg bolus intravenously followed by a continuous 36 mg/hour/syringe pump.

Monitoring the first day after surgery, the patient said she had no pain throughout the night with vital signs in the normal void and VAS 2/10, he continued the previous therapy, but the administration of lidocaine was reduced to 22 mg/hour/syringe pump. On the second day, the patient had no complaints, with vital signs within normal limits and VAS 1/10 receiving continued Paracetamol and Ibuprofen injection therapy, but the administration of lidocaine was discontinued. After the third day, the patient was able to move into the room without any complaints, and the physical examination was entirely within normal limits.

Case-2

A male patient aged 18 years and weighing 50 kg was admitted to the ER with right abdominal pain a week before admission to the hospital. On physical examination, he was conscious of compos mentis with Glasgow Coma Scale (GCS) E: 4 V: 5 M: 6, weighed 50 kg, and vital signs were blood pressure 120/70 mmHg, pulse rate 96x/minute, respiratory rate 16x /minute, and the temperature is 36.5ºC. On abdominal examination, it was found that there was tenderness in the right lower abdomen, and peristalsis was normal. The results of laboratory tests showed hemoglobin 13.1 g/dl, hematocrit 38.8%, white blood cells 17900 / uL, and platelets 359000 / uL. The patient was diagnosed with suspicion of acute appendicitis and would receive a midline incision laparotomy appendectomy.

In intraoperative spinal anesthesia, mini-laparotomy with a midline incision, appendix perforation was obtained, and appendectomy was performed. After the operation was completed, the patient was transferred to the ICU and given post-operative analgesic therapy, namely Paracetamol 750 mg/6 hours/intravenous, Ibuprofen 600 mg/8 hours/intravenously, and Lidocaine slow bolus 75 mg intravenously discharged in 5 minutes, then 50 mg/day/hours/intravenous.

Monitoring the first day after surgery, the patient did not feel pain throughout the night with a blood pressure of 100/60 mmHg and VAS 2-3/10 received further therapy with the dose of lidocaine reduced to 30 mg/hour/syringe pump. On the second day, there were no

complaints, with vital signs within normal limits and VAS 1-2/10 and peristaltic examination of the abdomen showed a normal impression of receiving continued Paracetamol and Ibuprofen injection therapy, but the administration of lidocaine could be stopped. After the third day, the patient was able to move into the room without any complaints, and the physical examination was entirely within normal limits.

Discussion

Acute pain control is an important point in post-operative management. Inadequate pain management can result in several negative implications, including increased morbidity, impaired wound healing, psychological effects, prolonged length of stay, and increased costs. Collaboration between professions such as doctors, nurses, pharmacy, and physiotherapy is needed. In the post-operative period, nurses play an important role in observing the patient's degree of pain.[13]

Intravenous lidocaine is an effective non-opioid therapy option in the post-operative period. Patients with chronic pain conditions, such as CRPS or phantom limb pain, may also benefit from Lidocaine therapy. Lidocaine infusion protocols for inpatient management are gaining popularity and are starting to be used during treatment in surgical wards.[14]

In this patient, who was in the post-laparotomy period, we administered a continuous infusion of lidocaine with a bolus dose first to achieve therapeutic levels. It appears that our patient had a low pain score with multimodal analgesia without opioid administration. From the autoanamnesis and alloanamnesis, there were no complaints about pain, and the patient felt comfortable during the post-operative period. Observations are carried out regularly to assess the possibility of toxicity. In our patient, there were no signs of toxicity, either CNS or cardiovascular manifestations of toxicity.

Lidocaine shows an analgesic effect at doses below the toxic threshold, and the effect is prolonged several hours after discontinuation. This suggests that sodium channel block alone does not play a role in the quality of pain therapy. The mechanism of procedure is thought to include interaction with PMN granulocytes, interruption of inflammatory pain pathways, and prevention of central sensitization. For these patients, we suspected that the combination of anti-inflammatory and inhibitory effects on central sensitization led to improved gastrointestinal function. Because of this mechanism, lidocaine can be used in patients with opioid wean, but we did not do this in our patients.

Another positive effect of using lidocaine is a reduction in post-operative ileus and a faster recovery of gastrointestinal function (first-time flatus and bowel movements). On auscultation of this patient, bowel movements were heard normally on the first post-operative day. So we can say that the patient's gastrointestinal function recovered quickly.

Rimback et al. conducted a study of 30 patients who underwent cholecystectomy surgery. Post-operative patients were given intravenous lidocaine bolus followed by continuous. They found that there was a rapid recovery in gastrointestinal motility, which was confirmed by serial radiological examinations. These patients also experience less pain, decreased need for opioids, and faster recovery.[5,13]

Groudin conducted a study on patients undergoing radical prostatectomy who were given Lidocaine 1.5 mg/kgBW as a bolus, followed by continuous administration of 3 mg/minute 30 minutes after the wound was closed. They confirmed the safety of the dose of lidocaine given by checking the plasma concentration, which was found to be in the range of 1.3-3.7 mcg/ml. They also reported a decreased need for opioids, decreased pain scores with higher comfort levels, and a more rapid return to normal gastrointestinal activity.[5]

Herroeder conducted a randomized, double-blind study of patients undergoing colorectal surgery. They gave Lidocaine 1.5 mg/kg bolus, followed by 2 mg/min by continuous infusion. It was found that the hospitalization period was shorter, and gastrointestinal function improved more quickly. They also got a decrease in various inflammatory cytokines. This study shows that lidocaine not only has an analgesic effect but also has an anti-inflammatory effect. The decrease in inflammatory mediators has an effect not only on faster gastrointestinal function but also reduces the incidence of thrombosis, myocardial infarction, and sepsis.[8]

Koppert, in his study, found that patients after major abdominal surgery required lower doses of morphine when bolus administration of lidocaine at a dose of 1.5 mg/kgBW was followed by a continuous infusion of 1.5 mg/kgBW/hour.[15]

Conclusion

Lidocaine is an effective intravenous analgesic to treat acute pain after laparotomy surgery so that it can be used as a safe post-operative pain modality. Administration of relatively low doses of lidocaine can achieve post-operative analgesia without any concern for its toxicity.

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