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Review Article

The Importance of Intravenous Perioperative Lidocaine as an Adjuvant to Acute Post Operative Pain Control: A Narrative Review Article

Katayoun Haryalchi[1], Sepehr Olangian-Tehrani[2], Parisa Kasmaei[3], Sedighe Bab Eghbal[1], Abtin Heidarzadeh[4], Fardin Mehrabian[3], Tohid Karami[5]

[1]*Reproductive Health Research Center, Department of Obstetrics and Gynecology, Al-Zahra Hospital, School of Medicine,Guilan University of Medical Sciences, Rasht, Iran.*

[2]*School of Medicine, Iran University of Medical Sciences, Tehran, Iran.*

[3]*Research Center of Health and Environment, Department of Health Education and Promotion, School of Health, Guilan University of Medical Sciences, Rasht, Iran.*

[4]*Department of Community Medicine, School of Medicine, Guilan University of Medical Sciences, Rasht, Iran.*

[5]*Department of Anesthesiology, School of Medicine, Urmia University of Medical Sciences, Urmia, Iran.*

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ABSTRACT

Background: Nowadays perioperative adjuvants become popular, and they can decrease post-operative opioid consumption gradually, Lidocaine is one of those. It is sodium channel blocker and has a multimodal effect. It is a local anesthetic that has analgesic, antiarrhythmic, anti-hyperalgesic, anti-inflammatory, and anti-neuropathic effect. With these descriptions, can decreases hospital staying period, ameliorate pain scores with post-operative analgesia with opioid-sparing effect, and finally has cost efficiency. It is available, inexpensive, simple, safe, and its' consumption is easy, making faster bowel habits return and better rehabilitation after the surgeries. This narrative review has been written to evaluate these properties of Lidocaine.

Methods: The aim of this narrative review was assess the significance of peri-operative lidocaine as an adjuvant to manage acute postoperative pain. The manuscript has been presented as a comprehensive search that was conducted across several major databases, included: PubMed, Scopus, Web of Science, and Google Scholar. The search focused on studies published between 1990 and 2024 to provide a broad perspective on both historical and current evidence.

Results: This review has reported the results of several articles. It can be obvious perioperative Lidocaine consumption as an adjuvant reduce post-operative pain perception, improve returning bowel habits, and post-surgical better rehabilitation and pain control.

Conclusion: Review of these articles illustrated;perioperative systemic lidocaine as an adjuvant with efficiency of reducing post-operative pain perception, has an opioid-sparing effect, improving intestinal activity and decreasing post-operative recovery period. Finally bring more comfort for patients and accompanying, less pressure on staff and most importantly is economical for both sides.

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*Corresponding author.
E-mail address: K_haryalchi@yahoo.com

Introduction

With the progress of science, no human has the right to be in pain. Postoperative pain alleviation and other perioperative consequences are always in disagreement between clinicians. The most popular drugs to alleviate pain are Opioids but have some adverse effects unfortunately [1-4]. Nowadays perioperative adjuvants become popular with opioid-sparing effects, can reduce intraoperative and postoperative opioid consumption gradually [5].

Lidocaine is one of the adjuvants utilized as preventive agents to manage pain [6]. It has been seen preoperative intra-vascular lidocaine infusion can ameliorate pain scores, have a post-operative analgesic effect, and decreases hospital staying period [7]. Lidocaine has been proven as a local anesthetic with analgesic, antiarrhythmic, anti-hyperalgesic, anti-inflammatory, and anti-neuropathic effects [8]. The sodium channel blocker effect of Lidocaine has analgesic and antihyperalgesic effects. Lidocaine has a multimodal effect on NMDA receptors [9]. Lidocaine infusion is effective to manage recalcitrant chronic pain. Its consumption will be easy, available, inexpensive, simple, and safe [10].

It has a neural conductivity effect, so this property can lead to anti-inflammatory and anti-neuropathic effects, especially in laparoscopy [11]. Indeed, its' infusion has anti-nociceptive, anti-hyperalgesic, and anti-inflammatory effect. But unfortunately, there is a narrow window between remedy and toxic efficacy. Infusion has more benefits than other type of methods like as opioids or epidural catheter infiltration [12].

The aim of this narrative review was to evaluate the significance of perioperative lidocaine infusion to enhance post operative pain management and its' impact on various clinical outcomes. Improved postoperative pain management with lidocaine may lead to better gastrointestinal motility, renal, immune and coagulation system activity, muscle tone, sleep, psychological well-being, reduced risk of chronic neuropathic pain, and higher patient satisfaction [12]. The review focuses on assessing lidocaines' effectiveness in reducing opioid consumption, alleviating pain, and potentially shortening hospital staying period, while also comparing its benefits and limitations relative to traditional pain management methods.

Methods

The aim of this narrative review was to assess the significance of peri-operative infusion of lidocaine as an adjuvant to manage acute postoperative pain. This comprehensive search is conducted across multiple major databases, included: PubMed, Scopus, Web of Science, and Google Scholar. The review included relevant peer-reviewed articles. We utilized keywords such as "perioperative lidocaine infusion," "acute postoperative pain," "pain management," "opioid-sparing," and "adjuvant analgesia." The search focused on studies published between 1990 and 2024 to provide a broad perspective on both historical and current evidence.

Results

The review uncovered substantial evidence supporting the influence of perioperative lidocaine infusion too manage acute post operative pain.

Weibel and colleagues conducted this systematic review to evaluate the influence and safety of infusion lidocaine in post surgical pain during the recovery period. Their analysis, which included 45 trials, presented lidocaine decreased post operative pain significantly (VAS 0-100) at 1-4 hours (MD -0.84, 95% CI -1.10 to -0.59) and 24 hours' post-operation (MD -0.34, 95% CI -0.57 to -0.11). However, there was no decreased in pain at 48 hours significantly (MD -0.22, 95% CI -0.47 to -0.03) [13].

A gastrectomy study compared two groups: one receiving lidocaine (1.5 mg/kg) twenty minutes before incision, followed out by continuous infusion (1.5 mg/kg/hr) until the finish of the operation, and the other receiving saline. The lidocaine group required significantly fewer supplemental opioids within 72 hours' post-surgery [pethidine 150 (75-200) mg vs. 50 (50-150) mg, P=0.039] [14].

Foo and colleagues investigated intravenous lidocaine for efficacy and safety in postsurgical pain management. They proposed intravenous lidocaine can be a high-risk medication at doses exceeding 1.5 mg/kg, it can be beneficial at doses below 1.5 mg/kg for up to 24 hours [12].

Samimi et al. compared intravenous (IV) and intraperitoneal (IP) lidocaine with a placebo for postsurgical pain control. Both IV and IP lidocaine resulted in lower VAS scores significantly compared to the placebo (P=0.001). Additionally, total morphine consumption (P=0.001) and time to first analgesic use (P=0.001) were lower in the lidocaine groups [15].

Yue et al. studied lidocaine infusion for postsurgical pain control in patients who had intra spinal tumor resection. They found that VAS scores and opioid usage were less in the lidocaine group versus the control one. Two days post-surgery, the VAS scores were 1.0 ± 2.0 in the lidocaine group and 1.8 ± 2.2 in the control one, with a significant difference statistically (P<0.05) [16].

Baral et al. assessed preoperative lidocaine infusion for postsurgical pain perception. The lidocaine group had a longer period to need the first analgesic dose (60.97 ±

1.76 minutes) compared to the placebo group significantly (15.73 ± 7.46 minutes, P<0.001) [17].

Li and colleagues conducted a meta-analysis on the efficacy of intraoperative lidocaine for pain alleviation, finding that lidocaine infusion decreased pain and opioid utilization in 6 RCTs involving laparoscopic cholecystectomy [18].

Zengin et al. compared oral gabapentin and parenteral lidocaine for pain management. Pain scores and morphine consumption were lower in the lidocaine group compared to the gabapentin one significantly (P<0.05) [19].

Lauwick et al. studied systemic lidocaines' effects on functional walking post-laparoscopic prostatectomy. Both groups presented a 60% decline in 2MWT on average (P<0.01), but the reduction was 26 meters less in the lidocaine group (P=0.009) [20].

Ndikontar et al. examined perioperative lidocaine infusion as an adjuvant for postsurgical pain control. The lidocaine group had lower fentanyl utilization significantly (P<0.001), a shorter recovery period (P=0.0044), and reduced immediate postoperative pain perception (P=0.012) [21].

A study investigating lidocaine infusions' impact on postoperative pain management and recovery showed less pain number at rest and throughout cough movements, along with decreased opioid requirements [22].

Another study explored the effect of intra-operative lidocaine infusion to reduce post-operative pain and opioid utilization. Lidocaine infusion for 72 hours' post-surgery resulted in better pain control [103.1 ± 72.0 mg vs. 159.0 ± 73.3 mg, P<0.05] [23].

A study on postoperative pain management in laparoscopic colon surgery illustrated the lidocaine group had less pain during the 24 hours after the surgery significantly (P=0.047) [24].

A comparison between intraoperative lidocaine infusion and esmolol showed lidocaine group had less post-operative opioid utilization, though not significantly (P=0.27) [25].

A study on plasma lidocaine levels during colorectal surgeries reported a mean level of 40 ng/ml, with higher levels that reached to 46 ng/ml and lower levels at 32 ng/ml [26].

A study investigating lidocaine infusion during surgery for postsurgical analgesia and immediate function found that the lidocaine group had less pain perception than control one (VAS 4/3.7 at rest vs. 4.5/4.2) [27].

Ates et al. reported that postsurgical pain number were lower in lidocaine group at multiple time periods (30 min/ 1/ 2/ 4/ 8/ 12 and 24 hours' after the surgery, P<0.05). However, it has been presented, there was no difference in intra-operative opioid consumption between the groups (P>0.05) [28].

A meta-analysis on perioperative lidocaine infusion illustrated a reduction in pain perception at 6 hours after the surgery significantly (95% CI) and a reduction in drug consumption by 8.44 mg (95% CI: 11.32 to 5.56) in the lidocaine group [29].

An original study on lidocaine infusion during surgery reported significantly lower opioid consumption in tlidocaine group (142.50 ± 37.80 mg vs. 185.00 ± 41.31 mg, P<0.001) [30].

Omot et al. conducted a narrative review on postsurgical pain control and concluded that lidocaine provides greater patient satisfaction and better pain control [31].

A study on pain control and opioid consumption after lumbar surgery found significantly lower opioid consumption in the lidocaine group (P<0.05) [32].

In a study on mastectomy patients, lidocaine infusion showed no significant difference in opioid consumption (P=0.188 and P=0.758). Pain scores at rest and during activity were also not significantly different (P=0.348 and P=0.810, respectively) [33].

Farag and colleagues investigated peri-operative intravenous lidocaine for spinal surgeries and found lidocaine group had experience a greater decline in mean verbal response numbers versus to the control one (P<0.001) [34].

A research on presurgical lidocaine infusion for abdominal hysterectomy showed that preemptive lidocaine 1% reduced postoperative pain at 2 hours [50.1 ± 27.9 vs. 70.6 ± 22.6, P=0.043] and at 5 hours [42.5 ± 25.2 vs. 53.3 ± 30.3, P=0.031] [35].

McCarthy et al. found that recovery time and postoperative pain scores were significantly reduced, with opioid consumption decreasing by 85% in patients receiving lidocaine [36].

Sekhavat et al. reported that opioid requirements were lower in patients receiving local lidocaine for cesarean section (P=0.001) [37].

Kessous et al. found there were not differences between two groups in terms of: parity, maternal age, or gestational age in a study on lidocaines' effects significantly [38].

In a study on laparoscopic colectomy, postoperative VAS number was lower in the lidocaine group versus control group significantly [39].

A study that has been done on perioperative efficacy of intravenous lidocaine found that patients were satisfied with its' use for up to 72 hours' post-surgery [40].

Yazici et al. studied perioperative systemic lidocaine in cancer gynecologic surgeries and found it was efficient to pain control under epidural anesthesia [41].

Chang and colleagues investigated systemic perioperative lidocaine to manage acute and chronic pain after breast surgeries. However, there was no effect for

acute pain, significantly. lidocaine decreased the risk of chronic pain following breast surgeries [42].

Kaba and colleagues illustrated systemic lidocaine simplify acute rehabilitation post laparoscopic colectomy, improving postoperative pain, fatigue, and bowel function, and reducing hospital stay duration [43].

Wolfgang and colleagues study on the preventive efficacy of systemic lidocaine for postsurgical pain and opioid use after major abdominal surgeries. They presented; lidocaine was particularly efficient to prevent hyperalgesia and reducing postsurgical pain perception in intestinal and bowel surgeries [23].

Discussion

Post-operative pain control is a critical aspect of patient care. In recent years, adjuvants have become increasingly popular for reducing postoperative opioid consumption, Lidocaine is one of the prominent agents. Lidocaine serves as a preventive measure for pain control due to its' multiple therapeutic properties, including analgesic, antiarrhythmic, antihyperalgesic, anti-inflammatory, and antineuropathic pain effects. It is classified as a local anesthetic, and researches have presented; lidocaine can effectively contribute to enhanced postoperative pain control, reducing the risk of chronic neuropathic pain [23,25].

As a sodium channel blocker, lidocaine is recognized for its ease of usage, availability, cost-effectiveness, simplicity, and safety. Despite these benefits, there is a narrow therapeutic window between its' effective and toxic dosages [12,16].

The evidence suggests that lidocaine offers superior postoperative pain management, improving gastrointestinal motility, renal physiology, immune response, coagulation system function, muscle tone, sleep, and psychological well-being. As a result, lidocaine contributes to higher postoperative satisfaction and potentially prevents the development of chronic pain [1-2,25].

Several studies have explored the effect of systemic perioperative lidocaine in decreasing post-operative pain. Weibel et al. demonstrated the health and effect of intravenous lidocaine to control postsurgical pain, advocating for its use as an adjuvant during the perioperative period under general anesthesia [13]. Similarly, Kang and colleagues found that low-dose lidocaine infusions reduced opioid use and shortened hospital stays, indicating a promising role for lidocaine in enhanced recovery protocols [14]. Additionally, research by Eipe et al. highlighted that continuous lidocaine infusion during surgery effectively prevented and mitigated postoperative pain [44].

However, despite the general effectiveness of lidocaine in postoperative pain control, certain precautions are necessary. Chu R. and colleagues cautioned about the potential adverse effects of lidocaine infusion, including hypertension, headaches, vomiting, arrhythmias, cardiovascular block, hypersensitivity, and neuroexcitability [7]. It is vital to administer lidocaine carefully within the therapeutic window to avoid such complications and maximize its benefits [43].

In summary, this narrative review underscores the importance of peri-operative lidocaine or intravenous infiltration for post-operative pain management. The documents illustrated that lidocaine contributes to higher pain control, reduces opioid requirements, and had an opioid-sparing efficacy, potentially leading to better rehabilitation outcomes, decreased postoperative complications, reduced strain on healthcare personnel, and cost-effectiveness. Ultimately, lidocaine utilization may help minimize the risk of chronic postoperative pain, making it a valuable component of multimodal analgesia strategies [13-16, 32-33,39,41].

Conclusion

By reviewing these articles, we came to this conclusion that perioperative systemic lidocaine can be efficient to reduce postoperative pain, improving intestinal activity and postoperative recovery period. Of course, it is known more researches and articles will be needed to confirm these results.

References

[1] Haryalchi K, Abedinzade M, Khanaki K, Ghanaie MM, Zadeh FM. Whether preventive low dose magnesium sulphate infusion has an influence on postoperative pain perception and the level of serum beta-endorphin throughout the total abdominal hysterectomy. Rev Esp Anestesiol Reanim (English Edition). 2017; 64(7):384-90.

[2] Haryalchi K, Ghanaie MM, Yaghoubi Y, Milani F, Faraji R. An assessment of changes in the magnesium level during gynecological abdominal surgeries. J Basic Clin Reprod Sci. 2013; 2(2):110-4.

[3] Taheri A, Haryalchi K, Mansour Ghanaie M, Habibi Arejan N. Effect of Low-Dose (Single-Dose) Magnesium Sulfate on Postoperative Analgesia in Hysterectomy Patients Receiving Balanced General Anesthesia. Anesth Res Pract. 2015; 2015(1):306145.

[4] Mansourghanaei M, Haryalchi K, Asgari SA, Salamat F, Zoghi M. An Assessment on Post Cesarean Pain Relief in Preeclampsia Parturient who Received Magnesium Sulfate. Journal of Arak University of Medical Sciences. 2016; 18(11):75-82.

[5] Lang C, Makic MBF. Managing Postoperative Pain: Rethinking Adjuvant Therapies. J Perianesth Nurs. 2020; 35(2):212-4.

[6] Naderi Nabi B, Haryalchi K, Farzi F, Atrkar Roshan Z, Ghamatzadeh G, seddighnezhad A. Comparing the

Effect of Normal Saline and Sodium Bicarbonate on Duration of Anesthesia Following Epidural Anesthesia by Lidocaine 2% in Patients with Femoral Fracture. J Guilan Univ Med Sci. 2005; 14(54):46-52.

[7] Chu R, Umukoro N, Greer T, Roberts J, Adekoya P, Odonkor CA, et al. Intravenous lidocaine infusion for the management of early postoperative pain: a comprehensive review of controlled trials. Psychopharmacol Bull. 2020; 50(4 Suppl 1):216.

[8] Heath C, Hii J, Thalayasingam P, von Ungern-Sternberg BS, Sommerfield D. Perioperative intravenous lidocaine use in children. Pediatric Anesth. 2023; 33(5):336-46.

[9] Tonev D. Intravenous Lidocaine in Non-Opioid Multimodal Perioperative Pain Management: Current Controversy and Future Perspectives. Pain Management-From Acute to Chronic and Beyond: IntechOpen. 2023.

[10] Malhotra N, Joshi M, Dey S, Sahoo R, Verma S, Asish K. Recent trends in chronic pain medicine. Indian J Anaesth. 2023; 67(1):123-9.

[11] Kopustinskiene DM, Bernatonyte U, Maslii Y, Herbina N, Bernatoniene J. Natural herbal non-opioid topical pain relievers—comparison with traditional therapy. Pharmaceutics. 2022; 14(12):2648.

[12] Foo I, Macfarlane A, Srivastava D, Bhaskar A, Barker H, Knaggs R, et al. The use of intravenous lidocaine for postoperative pain and recovery: international consensus statement on efficacy and safety. Anaesth. 2021; 76(2):238-50.

[13] Weibel S, Jokinen J, Pace N, Schnabel A, Hollmann M, Hahnenkamp K, et al. Efficacy and safety of intravenous lidocaine for postoperative analgesia and recovery after surgery: a systematic review with trial sequential analysis. Br J Anaesth. 2016; 116(6):770-83.

[14] Kang JG, Kim MH, Kim EH, Lee SH. Intraoperative intravenous lidocaine reduces hospital length of stay following open gastrectomy for stomach cancer in men. J Clin Anesth. 2012; 24(6):465-70.

[15] Samimi S, Taheri A, Tanha FD. Comparison between intraperitoneal and intravenous lidocaine for postoperative analgesia after elective abdominal hysterectomy, a double-blind placebo-controlled study. J Fam Reprod Health. 2015; 9(4):193.

[16] Yue H, Zhou M, Lu Y, Chen L, Cui W. Effect of intravenous lidocaine on postoperative pain in patients undergoing intraspinal tumor resection: study protocol for a prospective randomized controlled trial. J Pain Res. 2020:1401-10.

[17] Baral BK, Bhattarai BK, Rahman TR, Singh SN, Regmi R. Perioperative intravenous lidocaine infusion on postoperative pain relief in patients undergoing upper abdominal surgery. Nepal Med Coll J. 2010; 12(4):215-20.

[18] Li J, Wang G, Xu W, Ding M, Yu W. Efficacy of intravenous lidocaine on pain relief in patients undergoing laparoscopic cholecystectomy: A meta-analysis from randomized controlled trials. Int J Surg(London, England). 2018; 50:137-45.

[19] Zengin SU, Saracoglu A, Eti Z, Umuroglu T, Gogus FY. The effects of preoperative oral pregabalin and perioperative intravenous lidocaine infusion on postoperative morphine requirement in patients undergoing laparatomy. Pain Res Manag. 2015; 20(4):179-82.

[20] Lauwick S, Kim D, Mistraletti G, Carli F. Functional walking capacity as an outcome measure of laparoscopic prostatectomy: the effect of lidocaine infusion. Br J Anaesth. 2009; 103(2):213-9.

[21] Ndikontar R, Bengono Bengono RS, Amengle AL, Tochie JN, Jemea B, Metogo Mbengono J, et al. Adjuvant Perioperative Intravenous Lidocaine is Effective and Safe for Postoperative Pain Management and Rehabilitation in Gynecology Surgery: A Randomized, Single-Blind, Placebo-Controlled Trial. Hosp Pract Res. 2022; 7(4):131-7.

[22] McCarthy GC, Megalla SA, Habib AS. Impact of intravenous lidocaine infusion on postoperative analgesia and recovery from surgery: a systematic review of randomized controlled trials. Drugs. 2010; 70:1149-63.

[23] Koppert W, Weigand M, Neumann F, Sittl R, Schuettler J, Schmelz M, et al. Perioperative intravenous lidocaine has preventive effects on postoperative pain and morphine consumption after major abdominal surgery. Anesth Analg. 2004; 98(4):1050-5.

[24] Tikuišis R, Miliauskas P, Samalavičius N, Žurauskas A, Samalavičius R, Zabulis V. Intravenous lidocaine for post-operative pain relief after hand-assisted laparoscopic colon surgery: a randomized, placebo-controlled clinical trial. Tech Coloproctol. 2014; 18:373-80.

[25] Bajracharya JL, Subedi A, Pokharel K, Bhattarai B. The effect of intraoperative lidocaine versus esmolol infusion on postoperative analgesia in laparoscopic cholecystectomy: a randomized clinical trial. BMC Anesth. 2019; 19:1-9.

[26] Greenwood E, Nimmo S, Paterson H, Homer N, Foo I. Intravenous lidocaine infusion as a component of multimodal analgesia for colorectal surgery—measurement of plasma levels. Perioper Med.. 2019; 8:1-5.

[27] Yardeni IZ, Beilin B, Mayburd E, Levinson Y, Bessler H. The effect of perioperative intravenous lidocaine on postoperative pain and immune function. Anesth Analg. 2009; 109(5):1464-9.

[28] Ates İ, Aydin ME, Ahiskalioglu A, Ahiskalioglu EO, Kaya Z, Gozeler MS. Postoperative analgesic efficacy of perioperative intravenous lidocaine infusion in patients undergoing septorhinoplasty: a prospective, randomized, double-blind study. ur Arch Otorhinolaryngol. 2020; 277:1095-100.

[29] Khan JS, Hodgson N, Choi S, Reid S, Paul JE, Hong NJL, et al. Perioperative pregabalin and intraoperative lidocaine infusion to reduce persistent neuropathic pain after breast cancer surgery: a

multicenter, factorial, randomized, controlled pilot trial. J Pain. 2019; 20(8):980-93.
[30] Wang Q, Ding X, Huai D, Zhao W, Wang J, Xie C. Effect of intravenous lidocaine infusion on postoperative early recovery quality in upper airway surgery. Laryngoscope. 2021; 131(1): E63-E9.
[31] Omote K. Intravenous lidocaine to treat postoperative pain management: novel strategy with a long-established drug. Anesthesiology. 2007; 106(1):5-6.
[32] Kim KT, Cho DC, Sung JK, Kim YB, Kang H, Song KS, et al. Intraoperative systemic infusion of lidocaine reduces postoperative pain after lumbar surgery: a double-blinded, randomized, placebo-controlled clinical trial. Spine J. 2014; 14(8):1559-66.
[33] Terkawi AS, Durieux ME, Gottschalk A, Brenin D, Tiouririne M. Effect of intravenous lidocaine on postoperative recovery of patients undergoing mastectomy: a double-blind, placebo-controlled randomized trial. Reg Anesth Pain Med. 2014; 39(6):472-7.
[34] Farag E, Ghobrial M, Sessler DI, Dalton JE, Liu J, Lee JH, et al. Effect of perioperative intravenous lidocaine administration on pain, opioid consumption, and quality of life after complex spine surgery. Anesth. 2013; 119(4):932-40.
[35] Lowenstein L, Zimmer EZ, Deutsch M, Paz Y, Yaniv D, Jakobi P. Preoperative analgesia with local lidocaine infiltration for abdominal hysterectomy pain management. Eur J Obstet Gynecol Reprod Biol. 2008; 136(2):239-42.
[36] Sekhavat L, Behdad S. Preoperative analgesia with local lidocaine for cesarean delivery pain relief. J Matern Fetal Neonatal Med. 2011; 24(7):891-3.
[37] Kessous R, Wiznitzer A, Polachek H, Weintraub AY, Zlotnik A, Pariente G, et al. Preoperative analgesia with local lidocaine infiltration for post cesarean delivery pain management. J Matern Fetal Neonatal Med. 2012; 25(7):1131-4.
[38] De Oliveira Jr GS, Fitzgerald P, Streicher LF, Marcus R-J, McCarthy RJ. Systemic lidocaine to improve postoperative quality of recovery after ambulatory laparoscopic surgery. Anesth Analg. 2012; 115(2):262-7.
[39] Chou R, Gordon DB, de Leon-Casasola OA, Rosenberg JM, Bickler S, Brennan T, et al. Management of Postoperative Pain: a clinical practice guideline from the American pain society, the American Society of Regional Anesthesia and Pain Medicine, and the American Society of Anesthesiologists' committee on regional anesthesia, executive committee, and administrative council. J Pain. 2016; 17(2):131-57.
[40] Xu Y, Ye M, Hong Y, Kang Y, Li Y, Xiao X, et al. Efficacy of perioperative continuous intravenous lidocaine infusion for 72 hours on postoperative pain and recovery in patients undergoing hepatectomy: study protocol for a prospective randomized controlled trial. J Pain Res. 2021:3665-74.
[41] Yazici KK, Kaya M, Aksu B, Ünver S. The effect of perioperative lidocaine infusion on postoperative pain and postsurgical recovery parameters in gynecologic cancer surgery. Clin J Pain. 2021; 37(2):126-32.
[42] Chang YC, Liu CL, Liu TP, Yang PS, Chen MJ, Cheng SP. Effect of perioperative intravenous lidocaine infusion on acute and chronic pain after breast surgery: A meta-analysis of randomized controlled trials. Pain Pract. 2017; 17(3):336-43.
[43] Kaba A, Laurent SR, Detroz BJ, Sessler DI, Durieux ME, Lamy ML, et al. Intravenous lidocaine infusion facilitates acute rehabilitation after laparoscopic colectomy. Anesthesiology. 2007; 106(1):11-8.
[44] Eipe N, Gupta S, Penning J. Intravenous lidocaine for acute pain: an evidence-based clinical update. BJA Educ. 2016; 16(9):292-8.