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Master thesis | Original study

Peri-operative use of continuous intravenous lidocaine on postoperative pain: A narrative review

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Abstract

Background: **Pain is a common postoperative complication. Lidocaine is a registered drug in Belgium as a local anesthetic and is known to have analgetic and anti-inflammatory properties. Lidocaine has also shown to prevent hypersensitization and hyperanalgesia and it might even prevent the development of chronic pain.**
Objective: **Our objective is to evaluate the efficacy of the use of perioperative intravenous lidocaine on postoperative pain. The primary outcome is to assess a reduced pain score in the early postoperative phase. The secondary outcome is to assess reduced opioid consumption.**
Methods: **The literature search took place between February first and March thirtieth 2023 and was based on PRISMA guidelines. We used both Elicit and Pubmed as research databases. In total seven out of 57 articles were included based on title, abstract and thorough reading.**
Results: **Four out of seven articles described a positive effect of a perioperative intravenous lidocaine infusion on postoperative pain scores during the first four hours after surgery. The patients who benefit most are those undergoing colorectal surgery. Results on reduction of opioid use were inconclusive.**
Discussion: **Most consensus could be found for postoperative pain relieve in the first four hours after surgery. The scale of inconsistency between study protocols provides only low quality of evidence. More homogenous study protocols might present more reliable comparisons and lead to higher quality evidence.**
Conclusion: **The overall consensus is that continuous intravenous lidocaine might reduce postoperative pain in the first four hours after surgery.**

Keywords: **Lidocaine, postoperative pain, opioid consumption.**

Introduction

Pain is a common postoperative complication. As postoperative pain may lead to chronic pain and may contribute to postoperative complications[1], it is our task as anesthesiologist to provide adequate pain relieve during and after surgery. In our facility lidocaine is already widely used during surgery as local infiltration, as part of locoregional and neuraxial anesthesia or in a continuous infusion as part of a multimodal analgesia protocol.

Lidocaine is a registered drug in Belgium as a class one b antiarrhythmic drug as well as a local anesthetic. It is known to have analgetic and anti-inflammatory properties. Lidocaine has also shown to prevent hypersensitization and hyperanalgesia[2,3]. It might even prevent the development of chronic pain[3]. These are all promising characteristics to prevent postoperative pain.

This review aims to provide evidence for the use of continuous intravenous lidocaine as an effective method to relieve pain in the early postoperative phase.

Objectives

Our objective is to evaluate the efficacy of the use of perioperative intravenous lidocaine on postoperative pain. The primary outcome is to assess the effect of lidocaine by the reduction of pain scores in the early postoperative phase. The secondary outcome is to assess postoperative opioid consumption by a reduction in opioid usage.

Methods

Both Elicit and Pubmed were used as search engines to find clinical trials, reviews, systematic reviews and meta-analyses. This literature search took place between February 1th and March 30th 2023 and was based on the PRISMA guidelines. Bias may potentially be present since the inclusion of articles was performed by only one researcher.

a. Elicit

We used "effect of intravenous lidocaine on postoperative pain" as search terms.

The following filters were used: "has PDF" and "published after 2010" . The results were sorted by year, with the newest coming up first. There were no restrictions on type of studies.

Out of 14 results, initially five articles were selected by title and abstract. Abstracts that mentioned specific surgical topics or other outcomes than postoperative pain were excluded. After thorough reading one article was excluded as it was a correspondence. A final selection of four articles was made.

A second search with the terms "continuous lidocaine infusion on postoperative pain" was carried out. The same filters were used: "has PDF" and "published after 2010". We sorted the results by year and made no restrictions on type of studies. Out of seven results, three were excluded based on title and abstract as they mentioned specific surgical topics. Three doubles were also excluded. After thorough reading the remaining article was included.

b. Pubmed

We used the advanced search box with terms: "(intravenous lidocaine[Title/Abstract]) AND (postoperative pain[Title/Abstract])". Several filters were used. We sorted by most recent articles and publication dates during the "last ten years". Our language selection included "English, Dutch, French and German". We excluded "books and documents", which left us with "randomized controlled trials, clinical trials, systematic reviews and meta-analyses". As a final filter "full free text" was used.

This search provided us with 36 results. The articles were screened based on title and abstract.

28 articles were excluded as they mentioned specific surgical topics, locoregional blocks or other outcomes than postoperative pain. Three doubles from the Elicit search were also excluded. From the final five articles, we couldn't access the full text of two articles. They were excluded as well.

After thorough reading two articles were included.

Results

a. Description of the literature study

In total our searches provided us with 57 articles. We selected seven articles for further research.

All articles were written in English. One was partially translated in French[4]. Two articles included originated from the United States of America (USA)[2,3], one from Canada4 and one from the United Kingdom (UK)[5]. The two remaining studies originated from combined the UK with Canada[6] and one from the USA with Denmark, The Netherlands and Germany[1]. Finally the systematic review provided by the Cochrane Library was included[7].

b. Results on primary and secondary outcome

Six results explicitly aim to discuss the roll of intravenous lidocaine on postoperative pain[1,2,4-7]. Gabriel et al summarizes all the possibilities of multi-modal analgesia of which lidocaine is only an minor component[3].

Four articles stated a reduction in pain scores in the early postoperative phase[1,2,4,6]. Chu et al.[2] found a reduction in pain scores until four hours after surgery. Weibel et al.[1] stated a reduction in postoperative pain scores till 24 hours after surgery. Vigneault et al.[4] is the only article that made subdivisions in pain levels: pain in rest, pain while coughing and pain while moving. They found statistically significant reduction in pain scores up to 12 hours after surgery while in rest and while moving in the patient group who received continuous intravenous lidocaine during surgery. For pain control while coughing, reduction of pain scores goes up to 24 hours after surgery.

However no difference in pain scores was seen after 24[4,5] or 48 hours[1].

Despite uncertainty of an overall beneficial effect of continuous intravenous lidocaine on postoperative pain scores, Gabriel et al3 and Paterson et al5 stated a specific benefit for colorectal surgery patients. Weibel et al1 also found an advantage for this group of patients.

Four articles stated a reduction in postoperative opioid usage[1-3,6]. Weibel et al.[1], Chu et al.[2] and Foo et al.[6] declared an overall reduced opioid consumption. However, Gabriel et al.[3] only declared a lower need for postoperative opioids for pain relieve for patients undergoing colorectal surgery. Paterson et al.[5] also stated a possible reduction in opioid consumption in the early postoperative phase for colorectal surgeries.

The Cochrane library review[7] mentioned an uncertainty in reduction of postoperative pain scores and opioid consumption after a perioperative continuous lidocaine infusion due to low grade

Table I. — Study descriptives general results.

Author, Year	Number of subjects	Inclusion criteria	Methods	Outcome measure
Weibel, 2016	45 RCT's, 2802 patients	- RCT's on postoperative pain and recovery, - Surgery on any body part(s) - General anesthesia	- Lidocaine infusion compared to placebo, no treatment or epidural analgesia - Infusion started intraoperatively before incision, continued at least until the end of the surgical procedure or during postoperative period	1. Pain score (VAS, NRS, VRS) 2. Intra- and postoperative opioid requirements
Vigneault, 2011	29 studies, 1754 patients	- RCT's - Efficacy on postoperative outcomes - Adults (>18 years) - General anesthesia	IV lidocaine compared to placebo and usual care and other comparator groups	1. Pain control (VAS or the equivalent) 2. Use of opioids
Paterson, 2018	68 studies, 4525 patients	- RCT's - adults undergoing elective or urgent surgery under general anesthesia	- IV lidocaine infusion compared to placebo/no treatment or epidural analgesia - Infusion started intraoperatively, prior to incision, and continued at least until the end of surgery.	1. Pain score at rest 2. Postoperative opioid consumption
Lovett-Carter, 2021	5 studies, 297 patients	- RCT's - Ambulatory surgery - Postoperative outcomes of either pain scores or opioid consumption	- IV lidocaine intraoperatively compared to normal saline through infusion - Infusion had to continue at least until the end of surgery	1. Postoperative pain scores (NRS) at PACU and at 24hours after surgery 2. Postoperative opioid consumption (IV morphine equivalent) reported at 24h following surgery
Weibel, 2018	68 RCT's, 4525 patients	- RCT's - Adults - Elective or urgent surgery - General anesthesia	- IV lidocaine infusion compared with placebo, no treatment or thoracic epidural analgesia - Infusion intraoperatively, started prior to incision and continued at least until the end of surgery	1. Pain score at rest 2. postoperative opioid consumption
Chu, 2020	10 RCT's, 19 studies	- RCT's - Pharmacokinetics, antinociceptive effects, anti-hyperalgesic effects, anti-inflammatory effects, side effects, and role of intravenous lidocaine in the management of early postoperative pain.	- IV lidocaine compared to placebo or ketamine or combination of lidocaine and fentanyl - Generally ending infusion at the end of surgery or shortly postoperatively	1. Pain scores 2. opioid consumption
Gabriel, 2019	7 articles	/	- IV lidocaine infusion	1. Opioid sparing analgesia
Foo, 2021	8 SR and meta-analyses	/	/	1. Postoperative pain scores at 24hours
RCT = randomized controlled trial, VAS = visual analogue scole, NRS = numeric rating scole, VRS = verbal rating scale, IV = intravenous, SR = systematic review.				

Table II. — Study descriptives specific surgical topics (reviews).

Author, Year	Number of subjects	Inclusion criteria	Methods	Outcome measures
Wei, 2020	10 RCT's, 527 patients	- RCT's - Elective laparoscopic colorectal surgery - Availability of full-text publication	IV lidocaine group and placebo group	1. VAS scores at rest and on movement 2. Total opioid consumption within first 24 hours
Zhao, 2018	5 RCT's, 274 patients	- RCT's - Adult patients who prepared for laparoscopic cholecystectomy	IV infusion of lidocaine to normal saline	1. Pain scores 2. Opioid consumption
Li, 2018	6 RCT's, 354 patients	- RCT's - Diagnosis of symptomatic cholelithiasis and acute cholecystitis who prepared for laparoscopic cholecystectomy	IV lidocaine to normal saline	1. VAS scores 2. Narcotic requirements
Sarakatsianou, 2021	8 studies, 407 patients	- RCT's - Laparoscopic colorectal surgery for benign or malignant pathologies - English	IV lidocaine to placebo infusion	1. Morphine consumption
Boswell, 2021	3 studies	- RCT's - Postoperative pain and recovery in patients after cardiac surgery - From 1980 to present day - English	Topical, IV or other routes of lidocaine administration	1. Postoperative pain scores 2. Postoperative opioid consumption
Waelkens, 2021	31 RCT's, 4 SR,	- RCT's/ SR's of analgesic, anesthetic , operative interventions - Complex spinal surgery - English	/	1. Pain intensity score (NRS or VAS) 2. Analgesic requirements
Haratian, 2021	3 RCT's, 235 patients	- Spine surgery - Postoperative pain and complications - General anesthesia	IV lidocaine in addition to postoperative analgesics with a comparison and control group	1. Postoperative pain scores 2. Postoperative opiate consumption
Lemoine, 2021	35 RCT's, 3 meta-analyses	- RCT's/SR's of analgesic, anaesthetic, operative interventions - English - Pain management for open, laparoscopic or robot-assisted prostatectomy	/	1. Pain intensity (NRS or VAS)

RCT = randomized controlled trial, SR = systematic review, IV = intravenous, VAS = visual analogue scale, NRS = numeric rating scale.

Table III. — Study descriptives specific surgical topics (studies).

Author, Year	Number of patients	Including criteria	Exclusion criteria	Loading dose	Infusion rate	Comparator	Postoperative pain management
Ahn, 2015	55	- 20 - 65 years - Laparoscopic colectomy	- Severe underlying cardiovascular, renal, or hepatic disease - Allergic to local anesthesia - < 45kg or > 100kg - Opioid or NSAID during the prior week or chronically as pain treatment - Previous abdominal surgery	1,5 mg.kg-1	2 mg.kg-1.h-1 during the operation	Saline	- IV patient-controlled analgesia with fentanyl 0,3 µg/kg bolus with a 15 minutes lockout interval - Fentanyl 50 µg when VAS > 3
Ghimire, 2020	64	- Male - 18 - 65 years - ASA I-II - Laparoscopic TEP repair of the inguinal hernia	- Obese - Unable to comprehend the pain assessment scale - Allergic to local anesthetics - On pain medication or anti-arrhythmic drugs - Psychiatric disorders - Cardiac arrhythmia - Hepatorenal disease - Epilepsy	1,5 mg.kg-1	2 mg.kg-1.h-1 until tracheal extubation	0.9% normal saline	- Morphine 1 mg IV bolus when NRS > 3 (PACU) - Tramadol 50 mg IV when NRS > 3 (ward)
Durrani, 2022	100	- Laparoscopic surgery	/	1,5mg.kg-1	2 mg.kg-1.h-1 until the procedure was completed	Saline	2 mg nalbuphine when VAS > 4
Peng, 2021	85	- ASA I-II - Operative hysteroscopy	- < 18 years - Hypersensitivity to lidocaine - Diagnostic hysteroscopy - Chronic abuse of opioid or NSAID - Chronic pain - Mis- or lack of understanding of oral information about the study - Other severe systemic diseases - Serious surgical complications	0,15 mL.kg-1	0,2 mg.kg-1.h-1 until the end of the surgery	0.9% normal saline solution	50 mg flurbiprofen IV when VAS ≥ 6

Table III. — Study descriptives specific surgical topics (studies) - part 2.

Akgul, 2023	40	- ASA I and II - 18 - 65 years - Elective thyroidectomy surgery under general anesthesia	- ASA III and above - Allergy to lidocaine - Severe hepatic and renal impairment - Long history of opioid and non-opioid analgesic use - Gastrointestinal bleeding, peptic ulcer and inflammatory patients, - < 50 kg - Patients who had to discontinue drug therapy for any reason during the study, did not volunteer to participate in the study, could not cooperate, were inadequate in evaluating the postoperative pain score	1,5 mg.kg-1	1,5 mg.kg-1.h-1 during surgery and in the first hour in the PACU	0.9% isotonic solution	1 mg.kg-1 tramadol IV when VAS ≥4
Ibrahim, 2018	44	- >18 years - ASA I, II and III - Spinal fusion surgery (single and double level)	- Previous spine surgery - Morbid obesity (BMI> 40) - Spine metastatic tumor - Allergy to an amide local anesthetic or morphine sulphate - Heart block, renal, or liver dysfunction - Substance abuse disorder or chronic opioid use	2 mg.kg-1	3 mg.kg-1.h-1 until the end of the operation	0.9% sodium chloride infusion	- Ketorolac 30mg IV - Paracetamol 1g injection - Morphine 0,1 mg.kg-1 IV as rescue (VAS ≥ 4 or patient requested additional analgesia)

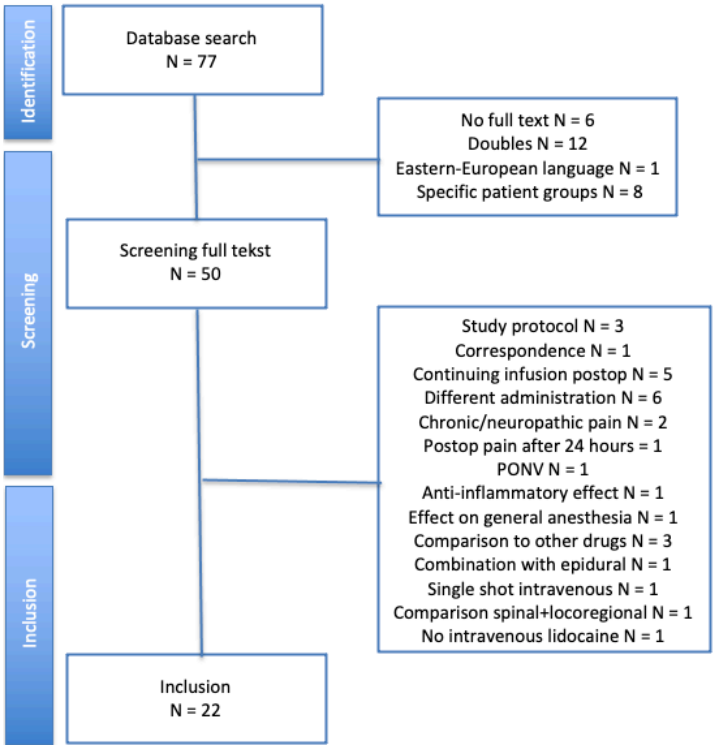

Fig. 1

evidence. The low quality of evidence was also noted by Weibel et al.[1] and Gabriel et al[3].

Discussion

Four out of seven articles[1,2,4,6] described a positive effect of a perioperative intravenous lidocaine infusion on postoperative pain scores. However benefits of such infusion were only seen in the first four hours until 24 hours after surgery. In later postoperative phases no advantages were seen.

Three other articles[3,5,7] could not confirm a benefit from a perioperative lidocaine infusion.

The most beneficial group of patients are those undergoing colorectal surgery[1,3,5].

Results on reduction of opioid use were also inconclusive, with three articles stating a reduction in postoperative opioid use[1,2,6], while other articles could not claim such statements with certainty[5,7]. Two only found a possible beneficial effect on postoperative opioid usage for patients undergoing colorectal surgery[3,5].

A low quality of evidence was also mentioned in three articles[1,3,7].

These ambiguous results do not lead to an easy solution for our objectives in this review. Other questions arise as well while reading through these articles.

Single studies reviewed in these articles mention a broad spectrum of infusion doses, which makes comparison extremely difficult. Only one article in our search makes a recommendation on a safe dosage[6]. This is a loading dose of 1.5 mg.kg-1 infused over ten minutes, followed by an infusion of 1.5 mg.kg-1.h-1. Dosages are based on ideal body weight[6]. Also, few studies mention adverse events, how they monitored possible adverse events and toxicity levels.

Other aspects of study protocols are not clearly described as well, such as postoperative pain protocols. Not all studies researched postoperative opioid use, which may lead to biased outcomes as there may be a high opioid use in the non-lidocaine study groups. Some do not describe the postoperative pain management at all.

Heterogenicity in study protocols and results is the main limitation of our review. This leads to low grade evidence. Therefore we recommend more streamlined study protocols to make comparisons easier and more reliable.

However we need to take into consideration that not all patients are able to undergo locoregional or neuraxial anesthesia with local anesthetics such as lidocaine. This might be due to deformities, previous surgeries or prescribed drugs such as anticoagulants. For this group of patients, perioperative intravenous lidocaine infusion might be a short term solution.

Only two databases were consulted in our research and literature search was only performed by one researcher. Therefore we might have missed other publications. A revision of this review on a larger scale and time frame might be necessary.

Conclusion

The overall consensus is that continuous intravenous lidocaine might reduce postoperative pain in the first four hours after surgery. After 24 hours no advantage was seen. However, quality of evidence is low due to inconsistency and heterogenicity in research protocols. More homogenous protocols in future studies could help in increasing evidence levels. Continuous intravenous lidocaine can safely be used with a loading dose of 1.5 mg.kg-1 infused over ten minutes, followed by an infusion of 1.5 mg.kg-1.h-1. Doses should be calculated based on ideal body weight.

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References

1. Weibel S, Jokinen J, Pace NL, Schnabel A, Hollmann MW, Hahnenkamp K, Eberhart LHJ, Poepping DM, Afshari A, Kranke P. 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.
2. Chu R, Umukoro N, Greer T, Roberts J, Adekoya P, Odonkor CA, Hagedorn JM, Olatoye D, Urits I, Orhurhu MS, Umukoro P, Viswanath O, Hasoon J, Kaye AD, OrhurhuV. Intravenous Lidocaine Infusion for the Management of Early Postoperative Pain: A Comprehensive Review of Controlled Trials. Psychopharmacol Bull 2020;50(4 Suppl 1):216-259.
3. Gabriel RA, Swisher MW, Sztain JF , Furnish TJ, Ilfeld BM, Said ET. State of the art opioid-sparing strategies for post-operative pain in adult surgical patients. Expert Opin Pharmacother. 2019;20(8):949-961.
4. Vigneault L, Turgeon AF, Côté D, Lauzier F, Zarychanski R, Moore L, McIntyre LA, Nicole PC, Fergusson DA. Perioperative intravenous lidocaine infusion for postoperative pain control: a meta-analysis of randomized controlled trials. Can J Anaesth. 2011;58(1):22-37.
5. Paterson HM. Continuous intravenous lidocaine infusion for postoperative pain and recovery in adults. Cochrane Database Syst Rev. 2018;6(6):CD009642.
6. Foo I, Macfarlane AJR, Srivastava D, Bhaskar A, Barker H, Knaggs R, Eipe N, Smith AF. The use of intravenous lidocaine for postoperative pain and recovery: international consensus statement on efficacy and safety. Anaesthesia 2021;76:238–250
7. Weibel S, Jelting Y, Pace NL, Helf A, Eberhart LHJ, Hahnenkamp K, Hollmann MW, Poepping DM, Schnabel A, Kranke P. Continuous intravenous perioperative lidocaine infusion for postoperative pain and recovery in adults (Review). Cochrane Database Syst Rev. 2018;6(6):CD009642.

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