BRITISH JOURNAL OF HOSPITAL MEDICINE

Should lidocaine routinely be used to prevent pain on propofol injection during induction of general anaesthesia or sedation?

Anaesthetists commonly debate whether lidocaine should be added to propofol for anaesthetic induction. The benefits include pain relief and improved patient satisfaction, but disadvantages include the effect on the emulsion itself, the efficacy of propofol once it has been mixed, and the effect on growth of bacteria in the syringe.

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How to cite this article:
Ratanshi NA, Mandour Y. Should lidocaine routinely be used to prevent pain on propofol injection during induction of general anaesthesia or sedation? Br J Hosp Med. 2020. https://doi.org/10.12968/hmed.2020.0473

Introduction

Since its introduction in the late 1900s, propofol has become the most widely used intravenous anaesthetic agent for induction and maintenance of anaesthesia, as well as sedation. However, pain on propofol injection is a common problem in anaesthesia, with the incidence of propofol-induced pain reported as between 28% and 90% in patients receiving propofol alone with no other intervention or medication (Zahedi et al, 2009).

Pain on propofol injection is caused by irritation of the skin, mucous membrane and venous intima. It is attributed to its corrosive phenol group and the activation of the kinin–kallikrein system causing bradykinin-induced vasodilatation and hyperpermeability, which exposes the free nerve endings, leading to increased contact with the propofol.

Lidocaine is a commonly used, cheap local anaesthetic that can reduce pain on propofol injection through both its local anaesthetic effect and a systemic (central analgesic) effect. Anaesthetists have different practices regarding whether or not to use lidocaine to reduce this irritant effect.

Lidocaine should be used

Pain on propofol injection is a frequent problem that can lead to patient anxiety, fear, compromised rapport with the anaesthetist and overall decreased patient satisfaction, because it is an unpleasant experience (Desousa, 2016). Some patients have even complained that it is the most unbearable experience of the perioperative period.

Use of intravenous lidocaine can prevent pain on propofol injection, either by pre-administering it before propofol injection (pre-treatment) or injecting it as an admixture in the same syringe with the propofol. When lidocaine is given before injection of propofol, it is sometimes administered as a mini-Bier's block, using a tourniquet that is released after 30–120 s.

A Cochrane review of 82 studies found that the overall incidence of pain on propofol injection was 64%. This was significantly reduced to 30% with the use of intravenous lidocaine, whether as a pre-treatment before propofol injection or as a lidocaine–propofol admixture, with no significant difference between these two techniques. It also highlighted that adverse effects of lidocaine administration were rare (Euasobhon et al, 2016).

The incidence of pain on propofol injection in children is even higher (experienced by 85%), likely because of the smaller calibre of their veins. Administration of intravenous lidocaine (range from 0.5–2 mg/kg) in these patients can also alleviate the pain with an acceptable safety profile (Lang et al, 2017).

No increase in the propofol dose is needed when inducing general anaesthesia both when 1% lidocaine is injected before propofol or 1% lidocaine is administered as an admixture with propofol 1% in a dose ratio of 10 mg:1 mg (Masaki et al, 2003).

Intravenous injection of lidocaine attenuates the pressor response during laryngoscopy and intubation. Yang et al (2020) demonstrated that, at a dose of 1.5 mg/kg, it reduces airway complications during extubation (including coughing and sore throat).

Lastly, it is well documented that propofol provides a rich environment for bacteria to thrive, and contamination before injection can cause sepsis. Lidocaine has bacteriostatic, bactericidal, fungistatic and fungicidal properties against a wide spectrum of microorganisms, because it disrupts membrane permeability of the microbial cell, causing leakage of cellular components and eventual cellular lysis. Therefore, adding lidocaine to propofol reduces the growth rate of certain microorganisms.

Lidocaine should not be used

Many clinicians are apprehensive about creating an admixture of drugs, for fear of an in-syringe chemical reaction which may alter the drug efficacy, or even create a microscopic precipitation. Adding lidocaine to propofol increased the diameter of the lipid vesicles, making the mix physically and chemically unstable in time, and potentially a risk for pulmonary embolism (Masaki et al, 2003). However, Tan and Hwang (2003) showed that the changes in droplet size with freshly prepared mixtures were unlikely to have clinically significant effects. Tafur-Betancourt (2017) argued that the drug interaction between lidocaine and propofol is not conclusive.

In adults, lidocaine 40 mg is a reasonable dose to prevent pain on propofol injection. Using 4 ml lidocaine 1% would require the addition of a further 4 ml to an already full 20 ml syringe of propofol. The alternative is to use 2 ml of 2% lidocaine, but this causes coalescence of oil droplets and separation of propofol into layers which could lead to a mix which is physically and chemically unstable in time, and increase the risk of pulmonary embolism (Masaki et al, 2003).

Patients have reported unwanted side effects such as dizziness and tinnitus at the higher dose of lidocaine 1.5 ml/kg.

Conclusions

Pain on propofol injection remains a common problem and should not be dismissed, as it can negatively affect a patient's perioperative experience.

An effective method to prevent pain on propofol injection is co-administration of lidocaine (either pre-administration or admixture). There are different formulations of propofol available for clinical use. Preparations with a combination of long and medium-chain triglycerides cause less pain on propofol injection than those with long-chain triglycerides only.

Finally, it should also be recognised that other clinical strategies to prevent pain on propofol injection include using a large calibre vein or slower injection.

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References

Desousa KA. Pain on propofol injection: causes and remedies. Indian J Pharmacol. 2016;48(6):617–623. https://doi.org/10.4103/0253-7613.194845

Euasobhon P, Dej-Arkom S, Siriussawakul A et al. Lidocaine for reducing propofol-induced pain on induction of anaesthesia in adults. Cochrane Database Syst Rev. 2016;2(2):CD007874. https://doi.org/10.1002/14651858.CD007874.pub2

Lang BC, Yang CS, Zhang LL, Zhang WS, Fu YZ. Efficacy of lidocaine on preventing incidence and severity of pain associated with propofol using in pediatric patients: a PRISMA-compliant meta-analysis of randomized controlled trials. Medicine (Baltimore). 2017;96(11):e6320. https://doi.org/10.1097/MD.0000000000006320

Masaki Y, Makoto T, Toshiaki N. Physicochemical compatibility of propofol-lidocaine mixture. Anesth Analg. 2003;97(6):1646–1651. https://doi.org/10.1213/01.ane.0000087802.50796.fb

Tafur-Betancourt LA. The hidden world of drug interactions in anesthesia. Colomb J Anesthesiol. 2017;45(3):216–223. https://doi.org/10.1016/j.rcae.2017.06.004

Tan LH, Hwang NC. The effect of mixing lidocaine with propofol on the dose of propofol required for induction of anesthesia. Anesth Analg. 2003;97(2):461–464. https://doi.org/10.1213/01.ane.0000066357.63011.75

Yang SS, Wang NN, Postonogova T et al. Intravenous lidocaine to prevent postoperative airway complications in adults: a systematic review and meta-analysis. Br J Anaesth. 2020;124(3):314–323. https://doi.org/10.1016/j.bja.2019.11.033

Zahedi H, Nikooseresht M, Seifrabie M. Prevention of propofol injection pain with small-dose ketamine. Middle East J Anesthesiol. 2009;20(3):401–404