Intravenous lidocaine for the treatment of background or procedural burn pain (Review)

Wasiak J, Mahar P, McGuinness SK, Spinks A, Danilla S, Cleland H

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[Intervention Review]

Intravenous lidocaine for the treatment of background or procedural burn pain

Jason Wasiak¹, Patrick Mahar^{2,3}, Siobhan K McGuinness⁴, Anneliese Spinks⁵, Stefan Danilla⁶, Heather Cleland⁷

¹Victorian Adult Burns Service and School of Public Health and Preventative Medicine, Monash University, The Alfred Hospital, Melbourne, Australia. ²School of Medicine, Deakin University, Melbourne, Australia. ³Skin and Cancer Foundation, Melbourne, Australia. ⁴Intensive Care Unit, The Alfred Hospital, Melbourne, Australia. ⁵School of Medicine, Griffith University, Meadowbrook, Australia. ⁶Health Research and Development, Universidad de los Andes, Santiago, Chile. ⁷Victorian Adult Burns Service, The Alfred Hospital, Melbourne, Australia

Contact address: Jason Wasiak, Victorian Adult Burns Service and School of Public Health and Preventative Medicine, Monash University, The Alfred Hospital, Commercial Road, Prahran, Melbourne, Victoria, 3181, Australia. J.Wasiak@alfred.org.au. jwasiak1971@gmail.com.

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ABSTRACT

Background

This is an update of the review on 'Lidocaine for pain relief in burn injured patients' first published in Issue 3, 2007. Pain is a major issue for patients suffering from many different types of wounds, in particular those with burn injuries. Prompt, aggressive use of opioid analgesics such as morphine has been suggested as critical to avert the cycle of pain and anxiety, but side effects are encountered. It is proposed that newer agents such as lidocaine could be effective in reducing pain and alleviating the escalating opioid dosage requirements in patients with burn injury.

Objectives

To assess the safety and effectiveness of intravenous lidocaine as a means of pain relief versus no therapy, placebo, other drugs or two or more of the above therapies in combination in patients exposed to burn injury.

Search methods

We searched the Cochrane Central Register of Controlled Trials (*The Cochrane Library* 2011, Issue 2), MEDLINE (1966 to April 2011 week 4) and EMBASE (1980 to 2011 week 17).

Selection criteria

We included randomised controlled trials (RCTs) and controlled clinical trials (CCTs), published and unpublished, which assessed the efficacy of intravenous lidocaine in varying doses as a single-agent therapy with no therapy, placebo, other analgesics such as opioids, lidocaine plus another drug, or two or more of the above therapies as a means of pain relief in patients exposed to burn injury.

Data collection and analysis

Two review authors independently abstracted data and assessed the risk of bias of the studies identified.

Main results

This update identified one new randomised, double-blind, placebo-controlled, cross-over trial which included 45 participants and compared intravenous lidocaine against placebo as a means of pain relief in those with burns. Subjective pain ratings as measured by the verbal rating scale increased during procedures for both treatment arms, however, the increase was less for the lidocaine treatment arm. There were no significant clinical or statistical differences regarding the effects of lidocaine and placebo on opioid requests and consumption, anxiety or level of satisfaction during a wound care procedure.

Authors' conclusions

As current clinical evidence is based on only one single RCT as well as case series and reports, intravenous lidocaine must be considered a pharmacological agent under investigation in burns care, the effectiveness of which is yet to be determined with further well-designed and conducted clinical trials.

PLAIN LANGUAGE SUMMARY

Lidocaine for pain relief in burn-injured patients

Burns are very common and sometimes fatal, and the pain associated with such injury is one of the most difficult types of suffering to relieve. The use of high-dose opioid medications like morphine is common, but side effects are encountered. Alternative agents such as lidocaine, an anaesthetic, have been proposed. This is an update of the review of the same name first published in Issue 3, 2007. There is currently one relevant randomised controlled trial, involving only 45 participants, but showing a benefit from intravenous lidocaine for pain relief in burns patients. The trial did not show a difference in opioid consumption, patient anxiety or level of patient satisfaction with the use of intravenous lidocaine.

BACKGROUND

Description of the condition

This is an update of the review on 'Lidocaine for pain relief in burn injured patients' first published in Issue 3, 2007 (Wasiak 2007). Burn injuries are a particularly emotive injury with which pain is frequently associated. Burn pain continues to be an ongoing issue of investigation and concern (Dauber 2002; Richardson 2009). Inflammatory reactions pursuant to injured tissue or nerves may result in the overproduction of inflammatory mediators which may result in allodynia and primary hyperalgesia in injured areas and secondary hyperalgesia in surrounding tissue (Meyer 1981; Richardson 2009). Repetitive painful stimuli can cause neuroplastic adaptations throughout the central nervous system (CNS) whereby pain afferent sensory impulses undergo facilitation and amplification to a given stimulus, contributing to the generation and maintenance of chronic pain (Richardson 2009). Pain from burn injuries has been associated with a number of mental health conditions such as depression, anxiety, post-traumatic stress disorder and suicide (Edwards 2007; Summer 2007).

Opioid analgesics, and in particular intravenous opiates, have long been the mainstay of analgesia for procedure-related burn pain. Use of high-dose opiates, however, can be associated with both short-term adverse effects, including respiratory depression and constipation, as well as long-term consequences, such as the development of tolerance and reward-based behaviour to opiate medication.

Description of the intervention

Lidocaine (also named lignocaine) is a local anaesthetic agent of the amide type that has been used for local anaesthesia and systemically as an anti-arrhythmic drug. Intravenous lignocaine has been proposed as a means to alleviate the debilitating effects of various types of pain and is currently used in the management of many acute, chronic and neuropathic pain conditions (Edwards 1999; Ferrante 1996; Koppert 2004; Hand 2000; McLeane 2001). The most common timing of use of analgesia tends to be during debridement. Systemic lidocaine has also been reported to be effective in treating burn injury in numerous case series, case studies and experimental studies (Cassuto 2003; Holthsuen 2000;

Jönsson 1991).

How the intervention might work

Lidocaine reversibly binds to subunits of voltage-gated sodium channels in the nerve membrane, consequently inhibiting nerve conduction. The depression of conduction in afferent nerves secondary to lidocaine administration may act to modify pain in burn patients, and avoid the adverse effects of high-dose opiates during procedures associated with burn management likely to elicit repetitive painful stimuli.

Why it is important to do this review

A number of clinical trials over recent years have attempted to use non-opioid therapies to treat procedural pain with mixed degrees of success (Finn 2004; Harandi 2004; Konstantatos 2009; Zor 2010). Although many burns units employ a number of different therapies, there is still no widely accepted alternative or uniform adjunctive treatment to intravenous opioids for the management of procedural burn pain supported by meta-analysis of randomised controlled trials (RCTs). Given the importance of pain control in acute burn injuries, further evidence should be sought with respect to non-opioid analgesic agents, particularly in the context of procedural pain control. As systemic lidocaine has been shown to be safe and effective for the management of some neuropathic conditions that have been refractory to standard interventions, it is expected that we could establish that systemic lidocaine may help reduce the pain of burns.

OBJECTIVES

The objective of this review was to assess the safety and effectiveness of intravenous lidocaine as a means of pain relief versus no therapy, placebo, other drugs or two or more of the above therapies in combination in patients exposed to burn injury.

METHODS

Criteria for considering studies for this review

Types of studies

We included studies in this review if they were RCTs and controlled clinical trials (CCTs), published and unpublished, that assessed the analgesic efficacy of intravenous lidocaine in patients exposed to burn injury.

Types of participants

We included all adults (> 18 years) with any burn injury who required lidocaine as a means of pain relief. It was expected that studies would be included regardless of the method of burn injury. However, we excluded burn patients requiring pain relief measures for multiple treatment regimes such as skin-grafting procedures.

Types of interventions

We considered administration of intravenous lidocaine of varying doses as a single-agent therapy with no therapy, placebo, other analgesics such as opioids, lidocaine plus another drug, or two or more of the above therapies in combination regardless of the duration of the treatment.

Types of outcome measures

Primary outcomes

Studies were eligible for inclusion if they reported on one or more of the following primary outcome measures: pain measured by a visual or verbal analogue scales (VAS), a numerical rating scale, or other validated assessment tool, categorical rating of pain intensity in circumstances in which numerical ratings may be problematic, time to re-medication and requirements for rescue analgesia.

Secondary outcomes

Studies that reported on secondary outcomes alone such as adverse effects, measures of satisfaction, physical functioning without reference to pain, emotional functioning without reference to pain, patient preference and assessment of quality of life would not be included.

Search methods for identification of studies

The original search for this review was run in March 2007. For this update we searched the Cochrane Central Register of Controlled Trials (*The Cochrane Library* 2011, Issue 2), MEDLINE (1966 to April 2011 week 4) and EMBASE (1980 to 2011 week 17). In MEDLINE, we combined the search strategy with the optimum trial search strategy described in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011). We applied no language restrictions. The search strategies for all databases can be found in [Appendix 1](#).

We adapted the search strategy for other databases. Please see [Appendix 1](#) for the MEDLINE search strategy.

Data collection and analysis

Selection of studies

In the original review, both review authors (JW and HC) reviewed titles and abstracts to identify potentially relevant studies using the selection criteria. We did not review studies that clearly failed to meet the inclusion criteria. Both review authors independently retrieved and reviewed those that could not be excluded in full text. In all instances, we resolved differences of opinion by discussion among the authors. In this update, three independent review authors (JW, PM and SMcG) retrieved, scanned and reviewed records in a similar manner.

Data extraction and management

Three review authors (JW, PM and SMcG) independently extracted data from the eligible studies using standardised forms developed for this review. Data extracted included: study characteristics, participant demographics, intervention and comparison details plus outcome measures and results. We contacted primary authors to provide missing information. In all instances, we resolved differences of opinion by discussion among the review authors.

Assessment of risk of bias in included studies

In this update, we assessed the risk of bias for each study according to the recommendations described in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011). The risk of bias tool incorporates assessment of randomisation (sequence generation and allocation concealment), blinding (of participants, treatment providers and outcome assessors), completeness of outcome data, selection of outcomes reported and other sources of bias. We resolved discrepancies in ratings by discussion.

Measures of treatment effect

If possible, we expressed dichotomous data as risk ratios (RR) and 95% confidence intervals (CIs). We expressed continuous data as mean difference (MD) and 95% CIs. We planned all analyses to be made on data reported for intention-to-treat (ITT) results. However, none of the studies used such analyses.

Assessment of heterogeneity

If possible, we tested statistical heterogeneity using the χ^2 test with significance at $P < 0.10$ and a quantification of the degree of heterogeneity using the I^2 statistic, and planned to carry out further exploration using subgroup analyses.

Subgroup analysis and investigation of heterogeneity

No specific subgroup analyses were pre-specified.

RESULTS

Description of studies

See: [Characteristics of included studies](#); [Characteristics of excluded studies](#).

Results of the search

In the original review (Wasiak 2007), we identified a total of 25 studies from searching the literature. Independent scrutiny of the titles and abstracts identified five potentially relevant studies. Of the five potentially relevant studies, we excluded all because they did not report on primary clinical outcome measures (Holthuisen 2000; Koppert 2004; Mattsson 2000) or used an alternative study design such as a case report (Cassuto 2003) or a case series (Jönsson 1991).

In this update, we identified a total of 406 further references. Independent scrutiny of the titles and abstracts identified no potentially relevant studies. One additional study, undertaken by the review authors (JW, AS and HC) and not yet indexed at time of the search date met the inclusion criteria (Wasiak 2011).

Included studies

We included one cross-over RCT in this review (Wasiak 2011). In Wasiak 2011, 47 patients were initially recruited although only 45 participants with burn injuries (mean % total body surface area (TBSA): 12.96%, range: 3% to 55%) undergoing wound care procedures (i.e. dressing changes and/or debridement) over two consecutive days following split skin graft surgery were randomised to receive lidocaine of 1.5 mg/kg/body weight followed by two boluses of 0.5 mg/kg at five-minute intervals followed by a continuous infusion, whilst during the control condition, 0.9% sodium chloride was administered at an equivalent volume, dose and rate to that of lidocaine. The primary outcomes measured were change in verbal rating scale (VRS) scores measured before, during and after the procedure; time to rescue analgesia; opioid requests and consumption using patient-controlled analgesia (PCA); and overall patient anxiety and level of satisfaction. Subjective pain ratings as measured by the verbal rating scale increased during procedures for both treatment arms, however, the increase was less for the lidocaine treatment arm. Results for the individual study are in a separate table (see 'Table 1').

Excluded studies

In this update, we added no excluded studies. For previous excluded studies, see the 'Characteristics of excluded studies' table.

Risk of bias in included studies

In this update we have used the new 'Risk of bias' tool. The commentary on the individual study is reported in the 'Risk of bias' section of the [Characteristics of included studies](#) table by the authors not involved in the RCT (SMcG, SD). Using the definitions provided by Higgins ([Higgins 2011](#)), the study by [Wasiak 2011](#) described adequate allocation concealment and blinding of both patients, staff and study researchers. Although [Wasiak 2011](#) indicated an intention-to-treat analysis, the study had two patients lost to follow-up as one dressing was done in the outpatient setting and the other stopped due to uncontrolled pain.

Effects of interventions

[Wasiak 2011](#) reported that verbal rating scale (VRS) scores were significantly lower for lidocaine (0.34) compared with placebo (0.70) when measured before, during and after the procedure (difference (95% CI) = 0.36 (0.17 to 0.55), P value < 0.001). Rescue analgesia was required during six wound care procedures, all involving the removal of staples. During the six procedures, all participants had required intravenous ketamine during dressing procedures prior to rescue analgesia; four participants during the lignocaine arm, one during the placebo arm and one during both. Comparison of opioid demand and consumption showed no significant clinical or statistical differences between lidocaine and placebo arms. Measures of overall anxiety and satisfaction levels showed no appreciable difference between the groups. There were no significant clinical or statistical differences between the lidocaine and placebo arms with regard to anxiety scores prior to or after the wound care procedures.

DISCUSSION

This review aimed to assess the safety and effectiveness of intravenous lidocaine as a means of pain relief versus no therapy, placebo, other drugs or two or more of the above therapies in combination in patients exposed to burn injury.

Intravenous lidocaine has been a well-documented treatment for other clinical conditions such as cardiac arrhythmias and neuropathic pain. In recent times and in the setting of burns pain, there has been growing evidence in the form of case reports or series to suggest that lidocaine can improve the analgesic efficacy, alleviate the deleterious effect of opioid administration, and minimise the necessity of escalating opioid dosages in patients with thermal injury ([Cassuto 2003](#); [Edwards 1999](#); [Jönsson 1991](#)) although these were excluded from our original search.

Several mechanisms have been proposed for this action, namely that systemic lidocaine can depress conduction in afferent nerves,

inhibit dorsal horn neural transmission and modify the cerebral perception of pain ([Abelson 2002](#); [Attal 2000](#)). More so, it has been postulated that burn injury is likely to trigger the release of inflammatory agents such as histamine, serotonin and prostaglandins which in turn could trigger nociceptive impulses, making lidocaine's potent anti-inflammatory properties integral to the suppression of pain ([Edwards 1999](#)).

We included only one study ([Wasiak 2011](#)) involving the addition of lidocaine infusions to patient-controlled analgesia (PCA) morphine as compared to placebo involving 45 randomised burn-injured patients. Outcomes included pain intensity as measured by verbal rating scale (VRS), time to rescue analgesia, opioid requests and consumption, and overall anxiety and level of satisfaction. There were statistically significant differences in VRS score which was lower in lidocaine patients as compared to placebo; however, there were no statistically significant differences with respect to other primary outcomes. Significantly, lidocaine administration did not result in a significantly lower demand by patients for opioids. The study was conducted in a burns centre in Melbourne, Australia where the authors of the trial acknowledge that the standard opioid-based pain management regimes of the unit usually lead to a high degree of satisfactory pain control. In this context, it may have been difficult to improve upon an already established baseline of pain control and this limits generalisability of this trial to clinical practice in burn centres where opioid-based pain management has not been optimised or is contra-indicated in certain patients.

Whilst the included study failed to show a reduction in opioid consumption or demand, or a difference in degree of patient satisfaction whilst the adjuvant use of intravenous lidocaine for pain relief during burn wound dressing changes was administered, the use of intravenous lidocaine as a form of pain relief at other stages during burn wound management remains unexplored in the form of randomised controlled trials (RCTs). Given that a number of RCTs in a non-burn context and case series involving burn patients highlight that intravenous lidocaine may lead to a reduction in participants' procedural and background pain levels, lead to less opiate requirements and consequently fewer associated complications, there is a need for ongoing RCTs to assess the utility of intravenous lidocaine in burn patients.

AUTHORS' CONCLUSIONS

Implications for practice

As this review update now includes one study, the conclusions have changed since the original publication. The findings of this review update indicate that the use of intravenous lidocaine as an adjunctive analgesic agent in combination with morphine (patient-controlled analgesia), although appearing to be well-tolerated, confers little benefit on opioid consumption and demand, patient anx-

iety and satisfaction or time to rescue analgesia. These findings, however, are based on one single institution study where the intervention was implemented during procedural dressing changes. For this reason, it is impossible to draw any meaningful conclusions about the effect of intravenous lidocaine on burn-associated pain at other stages in burn management, such as for pain control during the acute stages of presentation, or in the management of chronic pain.

Implications for research

In order to evaluate better the effect of intravenous lidocaine as

an analgesic agent in burn-related injuries in a procedural context, more research in the form of clinical randomised controlled trials (RCTs) should be undertaken with greater sample sizes and across multiple institutions. Future RCTs assessing the clinical effectiveness and safety should be undertaken at different stages of presentation in burn-injured patients. Examples might include early in the patient's admission to a burns centre and, where possible, before initiation of high-dose opiate medications or for the treatment of chronic pain refractory to opiates or anti-neuropathic medications.

REFERENCES

References to studies included in this review

Wasiak 2011 {published data only}

Wasiak J, Spinks A, Costello V, Ferraro F, Paul E, Konstantatos A, et al. Adjuvant use of intravenous lidocaine for procedural burn pain relief: a randomized double-blind, placebo-controlled, cross-over trial. *Burns* 2011;**37**(6): 951–7.

References to studies excluded from this review

Cassuto 2003 {published data only}

Cassuto J, Tarnow P. Potent inhibition of burn pain without use of opiates. *Burns* 2003;**29**:163–6.

Holthuesen 2000 {published data only}

Holthuesen H, Irsfeld S, Lipfert P. Effect of pre- or post-traumatically applied i.v. lidocaine on primary and secondary hyperalgesia after experimental heat trauma in humans. *Pain* 2000;**88**(3):295–302.

Jönsson 1991 {published data only}

Jönsson A, Cassuto J, Hanson B. Inhibition of burn pain by intravenous lignocaine infusion. *Lancet* 1991;**338**(8760): 151–2.

Koppert 2004 {published data only}

Koppert W, Brueckl V, Weidner C, Schmelz M. Mechanically induced axon reflex and hyperalgesia in human UV-B burn are reduced by systemic lidocaine. *European Journal of Pain* 2004;**8**(3):237–44.

Mattsson 2000 {published data only}

Mattsson U, Cassuto J, Tarnow P, Jonsson A, Jontell M. Intravenous lidocaine infusion in the treatment of experimental human skin burns - digital colour image analysis of erythema development. *Burns* 2000;**26**(8): 710–5.

Additional references

Abelson 2002

Abelson KS, Hoglund AU. Intravenous administered lidocaine in therapeutic doses increases the intraspinal release of acetylcholine in rats. *Neuroscience Letter* 2002;**317**(2):93–6.

Attal 2000

Attal N, Gaude V, Brasseur L. Intravenous lidocaine in central pain: a double blind, placebo-controlled, psychophysical study. *Neurology* 2000;**54**(3):564–74.

Dauber 2002

Dauber A, Osgood PF, Breslau AJ. Chronic persistent pain after severe burns: a survey of 358 burns survivors. *Pain Medicine* 2002;**3**:6–17.

Edwards 1999

Edwards AD. The role of systemic lidocaine in neuropathic pain management. *Journal of Intravenous Nursing* 1999;**22**(5):273.

Edwards 2007

Edwards RR, Smith MT, Klick B, Magyar-Russell G, Smit M, Weichman P. Symptoms of depression and anxiety as unique predictors of pain-related outcomes following burn injury. *Annals of Behavioural Medicine* 34;**3**:313–22.

Ferrante 1996

Ferrante F, Michael MD, Paggioli J, Cherukuri S, Richard AG. The analgesic response to intravenous lidocaine in the treatment of neuropathic pain. *Anesthesia and Analgesia* 1996;**82**(1):91–7.

Finn 2004

Finn J, Wright J, Fong J, Mackenzie E, Wood F, Leslie G, et al. A randomised crossover trial of patient controlled intranasal fentanyl and oral morphine for procedural wound care in adult patients with burns. *Burns* 2004;**30**(3):262–8.

Hand 2000

Hand PJ, Stark RJ. Intravenous lignocaine infusions for severe chronic daily headache. *Medical Journal of Australia* 2000;**172**(4):157–9.

Harandi 2004

Harandi AA, Esfandani A, Shakibaei F. The effect of hypnotherapy on procedural pain and state anxiety related to physiotherapy in women hospitalized in a burn unit. *Contemporary Hypnosis* 2004;**21**(1):28–34.

Higgins 2011

Lefebvre C, Manheimer E, Glanville J on behalf of the Cochrane Information Retrieval Methods Group. Chapter

6: Searching for studies. In: Higgins JPT, Green S, editors. *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0 [updated March 2011]. The Cochrane Collaboration, 2011. Available from www.cochrane-handbook.org.

Konstantatos 2009

Konstantatos A, Angliss M, Costello V, Cleland H, Stafrace S. Predicting the effectiveness of virtual reality relaxation on pain and anxiety when added to PCA morphine in patients having burns dressing changes. *Burns* 2009;**35**(4):491–9.

McLeane 2001

McLeane G. Intravenous infusion of lidocaine is not associated with changes in cardiovascular parameters: a study of 15 patients. *The Pain Clinic* 2001;**13**(1):83–6.

Meyer 1981

Meyer RP, Campbell JN. Myelinated nociceptive afferent account for hyperalgesia that follows a burn to the hand. *Science* 1981;**213**:1527–9.

Richardson 2009

Richardson P, Mustard L. The management of pain in the burns unit. *Burns* 2009;**35**:921–36.

Summer 2007

Summer GJ, Puntillo KA, Miakowski C, Green PG, Levine JD. Burn injury pain: the continuing challenge. *Journal of Pain* 2007;**8**(7):533–48.

Zor 2010

Zor F, Ozturk S, Bilgin F, Isik S, Cosar A. Pain relief during dressing changes of major adult burns: ideal analgesic combination with ketamine. *Burns* 2010;**36**(4):501–5.

References to other published versions of this review

Wasiak 2007

Wasiak J, Cleland H. Lidocaine for pain relief in burn injured patients. *Cochrane Database of Systematic Reviews* 2007, Issue Issue 3. [DOI: 10.1002/14651858.CD005622.pub2]

* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by study ID]

Wasiak 2011

Methods	Randomised, double-blind, placebo-controlled cross-over study. Allocation concealment stated; method of randomisation stated; patients, staff and outcome assessors blind to treatment assignment and medication administration
Participants	45 participants with burns (mean %TBSA: 12.96%, range: 3% to 55%) undergoing wound care procedures (i.e. dressing changes and/or debridement) on 2 consecutive days following split skin graft surgery. Participants were aged between 16 to 68 years
Interventions	Lidocaine dose of 1.5 mg/kg/body weight followed by 2 boluses of 0.5 mg/kg at 5-minute intervals followed by a continuous infusion. For the control condition, 0.9% sodium chloride was administered at an equivalent volume, dose and rate to that of lidocaine
Outcomes	Verbal rating scale (VRS) scores measured before, during and after the procedure; time to rescue analgesia; opioid requests and consumption using patient-controlled analgesia (PCA); and overall patient anxiety and level of satisfaction
Notes	%TBSA: percentage of total surface area

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Authors state "subjects were randomized to one of two treatment sequence groups i.e. treatment A or treatment B, using block randomization"
Allocation concealment (selection bias)	Low risk	Authors state "Allocation of treatment regime was done using the opaque sealed envelope technique, in which envelopes with cards detailing which treatment regime were allocated to patients on the morning of each dressing"
Blinding (performance bias and detection bias) All outcomes	Low risk	Authors state "Subjects, staff and researchers were blinded to treatment assignments with all study medications identical in appearance. During the infusion, research staff administering the study medication was blind to the outcome assessments and the patient and research assistant were blinded to the study medication administration"

Wasiak 2011 (Continued)

Incomplete outcome data (attrition bias) All outcomes	Low risk	The authors did not report any loss to follow-up patients for the primary outcome measures
Selective reporting (reporting bias)	Unclear risk	Authors did not provide overall patient satisfaction and anxiety scores
Other bias	Unclear risk	Not stated

Characteristics of excluded studies [ordered by study ID]

Study	Reason for exclusion
Cassuto 2003	Case report
Holthsuen 2000	Did not report on relevant primary outcome measures
Jönsson 1991	Case series
Koppert 2004	Did not report on relevant primary outcome measures
Mattsson 2000	Did not report on relevant primary outcome measures

DATA AND ANALYSES

This review has no analyses.

ADDITIONAL TABLES

Table 1. Results of individual study

Study ID	Dose of lidocaine	Comparator	Numbers in trial	Withdrawals	Efficacy	Adverse events (intervention)	Adverse events (placebo)
Wasiak 2011	Initial bolus dose of 1.5 mg/kg/body weight followed by 2 boluses of 0.5 mg/kg/body weight at 5-minute intervals and an infusion run at 2 mg/minute throughout duration of dressing	0.9% NaCl (normal saline) at equivalent dose, rate and volume as intervention	45	The authors reported no loss to follow-up of patients for primary outcome measures	Verbal rating scale (VRS) scores lower for lidocaine compared with placebo. No difference between groups in time to rescue analgesia; opioid requests and consumption using patient-controlled analgesia (PCA); and overall patient anxiety and level of satisfaction	Pre-dressing: twitchiness 1/45 and nausea/vomiting 8/45, Dressing: twitchiness 1/45 and nausea/vomiting 5/45 Post-dressing: nausea/vomiting 8/45	Pre-dressing: nausea/vomiting 2/45 Dressing: nausea/vomiting 4/45 and severe pain 1/45 Post-dressing: nausea/vomiting 4/45

APPENDICES

Appendix 1. MEDLINE search strategy

via OVID for this update in 2011:

1. exp Burns/
2. burn*.mp.
3. thermal injur*.mp.
4. 1 or 2 or 3
5. Lidocaine/
6. (lidocaine or lignocaine).mp.
7. 5 or 6
8. 4 and 7

mp = protocol supplementary concept, rare disease supplementary concept, title, original title, abstract, name of substance word, subject heading word, unique identifier

via Ovid for the original review in 2007:

1. exp BURNS/
2. (burn or burns or burned).mp
3. (burn\$ or burns\$ or burned\$).au
4. burn.ti. or burn.ab. or burns.ti. or burns.ab. or burned.ti. or burned.ab.) and (burn\$ or burns\$ or burned\$).au
5. 2 not 3
6. 4 or 5
7. burn.ti. or burn.ab. or burns.ti. or burns.ab. or burned.ti. or burned.ab.
8. 2 not (1 or 3 or 7)
9. 6 or 8
10. 1 or 9
11. thermal injur\$.mp
12. 10 or 11
13. Lidocaine/
14. (lidocaine or lignocaine).mp
15. 13 or 14
16. 12 and 15

In addition we checked the reference lists of the relevant trials and reviews. We did not contact current researchers in the field for unpublished data and ongoing trials.

Appendix 2. CENTRAL search strategy

- #1 MeSH descriptor Burns explode all trees
- #2 burn*
- #3 thermal injur*
- #4 (#1 OR #2 OR #3)
- #5 MeSH descriptor Lidocaine, this term only
- #6 lidocaine or lignocaine
- #7 (#5 OR #6)
- #8 (#4 AND #7)

Appendix 3. EMBASE search strategy

1. exp burn/
2. burn*.mp.
3. thermal injur*.mp.
4. 1 or 2 or 3
5. lidocaine/
6. (lidocaine or lignocaine).mp.
7. 5 or 6
8. 4 and 7

key

mp = title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer

WHAT'S NEW

Last assessed as up-to-date: 2 April 2012.

Date	Event	Description
27 June 2012	Amended	Contact details updated.

HISTORY

Protocol first published: Issue 1, 2006

Review first published: Issue 3, 2007

Date	Event	Description
29 May 2012	Amended	The contact details of Patrick Mahar were amended for this update review conducted in April 2011
4 August 2011	New citation required and conclusions have changed	This update includes one new study by Wasiak 2011 involving 45 participants. Previous readers of this review would benefit from re-reading this review as there is now one small study included
4 August 2011	New search has been performed	This review was brought up to date to April 2011; the original review was published in Issue 3, 2007
24 September 2010	Amended	Contact details updated.
30 October 2008	Amended	Converted to new review format.

CONTRIBUTIONS OF AUTHORS

Jason Wasiak: designed and co-ordinated the review. Extracted data and checked quality of data extraction. Undertook and checked quality assessment. Performed statistical analysis, interpreted data and checked the analysis. Completed first draft of the review update and advised on subsequent drafts. Made an intellectual contribution to the review and approved the final review prior to submission. Will be responsible for future updates of this review.

Heather Cleland: designed the review. Completed the first draft of the review and advised on subsequent drafts. Made an intellectual contribution to the review and approved the final review prior to submission. Performed previous work that was the foundation of the current review.

Patrick Mahar: extracted data and checked quality of data extraction. Made an intellectual contribution to the review and approved the final review prior to submission.

Siobhan McGuiness: extracted data and checked quality of data extraction. Made an intellectual contribution to the review and approved the final review prior to submission.

Stefan Danilla: provided burns expertise and content to the review. Checked quality of data extraction and approved the final review prior to submission.

For the first version of this review in 2007:

JW: principal author, conception, guarantor of the review, responsible for updating future version of this review.

HC: co-author, burn surgeon, content expert.

DECLARATIONS OF INTEREST

Mr Jason Wasiak and Miss Heather Cleland were co-authors of the included study evaluated in this review article ([Wasiak 2011](#)).

INDEX TERMS

Medical Subject Headings (MeSH)

Analgesia [methods]; Anesthetics, Intravenous [*administration & dosage]; Anesthetics, Local [*administration & dosage]; Burns [*complications; therapy]; Lidocaine [*administration & dosage]; Pain [*drug therapy; etiology]; Pain Management [methods]; Randomized Controlled Trials as Topic

MeSH check words

Humans