Effective method in reducing pain related to intravenous potassium chloride infusion for patients with hypokalaemia: a systematic review report

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Hypokalaemia

• The normal range of serum potassium is 3.5meq/L to 5meq/L.

• Hypokalaemia is defined when the serum potassium level is less than 3.5meq/L and severe hypokalaemia is defined when the serum potassium level is less than 2.5meq/L.4

• Hypokalaemia reflects a disruption in normal homeostasis and occurs among 20% of hospitalized patients.5
Hypokalaemia in acute setting

- Hypokalaemia is one of the most common electrolyte abnormalities in clinical settings.\(^4\)

- The most common cause of hypokalaemia is the depletion of potassium ions (K\(^+\)) due to gastrointestinal or urinary losses caused by vomiting, diarrhoea, or diuretic therapy.

- Patients receiving diuretics are at a higher risk of developing hypokalaemia.
The consequences of hypokalaemia

The symptoms of hypokalaemia generally are not obvious until the serum potassium is below 3.0meq/L.\(^4\)

The consequences include:

- Generalized weakness
- Lack of energy
- Muscle cramps
Intravenous KCL infusion to treat hypokalaemia

- In the clinical setting, oral replacement is often restricted by a patient's inability to take medications orally and their gastrointestinal absorption capacity.\(^4\)

- Therefore, intravenous potassium chloride infusion is often used

- Used in about 20% of the hospitalized patients who developed hypokalaemia.\(^5\)
Issues with KCL replacement

• Intravenous infusion of potassium chloride can cause severe acute pain at the infusion site when the administration of infusion is via a peripherally inserted catheter.\textsuperscript{9,10,11,12}

• The exact aetiology of pain associated with peripheral infusion of potassium chloride is not known.\textsuperscript{12}

  ➢ is known to be a non-neoplastic irritant agent.\textsuperscript{13}
  ➢ associated with higher chances on getting phlebitis, thrombosis, infiltration and extravasation.
Issues with KCL replacement

• One of the reasons for patients to refuse intravenous KCL replacement.\textsuperscript{9,10,11,12}

• Refusal of treatment could greatly impact on the continuity of supportive treatment and on treatment outcome.

• Discomfort experienced by patients may give rise to patients' dissatisfaction.

• Affecting patient and nurse relationship.
Preliminary literature review

- Use of Lidocaine
- Use of different types of diluents
Objective Of Review

The scope of the review has focused on identifying effective methods in alleviating pain at the infusion site while infusing intravenous potassium chloride.
PICO: Types of participants

• All adult patients treated in the hospital setting

• Are the recipients of peripheral potassium chloride infusion

• Adult patients are defined as all participants older than 18 years old
Types of outcomes

This review has considered studies that include measurement of pain score by using any validated pain scale described by the primary researchers. Examples of validated pain scales including:

1. pain perception measured by verbal rating scale (VRS) on a scale of 0 to 10
2. visual analogue scale (VAS) that requires a patient to physically mark or indicate on a printed scale
3. Wong-Baker Faces Scale which is designed for use with older patients
4. Behavioural pain assessment scale which is suitable for use with uncommunicative patients.\textsuperscript{16}
Types of intervention(s)

Intravenous Lidocaine in any dosage including:
• 1. 1% Lidocaine in 3mls diluent
• 2. 50mg as a single dose
• 3. 10mg Lidocaine as a single dose
• 4. or any other forms

Diluents of Lidocaine in any form including:
• 1. 0.9% saline
• 2. 0.45% saline
• 3. 5% dextrose in water
• 4. 5% dextrose in 0.9% saline
• 5. 5% dextrose in 0.45% saline
• 6. or any other types of diluents

Frequency of Lidocaine administration including:
• 1. in a single dose with any point of infusion
• 2. as a continuous infusion
• 3. as in a single dose prior to infusion
• 4. as a single dose given in the midst of infusion
• 5. as a single dose given at the end of infusion
• 6. or any other types of frequencies as described by the primary researchers is effective in alleviating pain for peripheral intravenous potassium chloride infusion.
Search strategy

Both published and unpublished studies.

• A three-step search strategy was utilized
• An initial limited search of MEDLINE and CINAHL followed by analysis of the text words contained in the title and abstract, and of the index terms used to describe article.
• A second search using all identified keywords and index terms was undertaken across all included databases.
• Thirdly, the reference list of all identified reports and articles were searched for additional studies.
Search strategy

- Studies published in English were considered for inclusion in this review.
- Published studies from 1980-2013 were considered in the review.

- There is no prior systematic review on this topic.
- Any potential study that could have been conducted in the past 30 years.
Search strategy

The databases to be searched include:

- MEDLINE
- CINAHL
- EMBASE
- Web of Science
- Cochrane Central Register of Controlled Trials
- The search for unpublished studies will include:
  - ProQuest Dissertations and Theses
  - US National Institutes of Health, clinical trials
  - Mednar
- Initial keywords: potassium chloride, pain and hypokalaemia
Proces of review

PRISM A FLOW CHART

Number of records identified through a systematic search (N=1978)

Number of additional records identified through other records (N=0)

Number of records after duplicates removed (N=1974)

Number of records screened (N=14)

Number of record excluded (N=1960)

Number of full-text articles assessed for eligibility (N=5)

Number of articles excluded on full-text (N=2)

Number of articles assessed for quality (N=4)

Number of articles excluded on critical appraisal (N=1)

Number of articles included (N=3)
Methodological quality

Table 1: Summary table - Critical appraisal for included studies

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<thead>
<tr>
<th>Citation</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
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Data synthesis: meta-synthesis

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<td>Total (95% CI)</td>
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</table>

Heterogeneity: Chi² = 1.72, df = 2 (P = 0.42); I² = 0%
Test for overall effect: Z = 5.07 (P < 0.00001)
Results

• There was not significant heterogeneity among the three trials ($I^2 = 0\%; \text{Chi}^2=1.72, P = 0.42$)

• As compared with placebo group, intravenous lidocaine has significantly reduced pain, as it resulted in a reduction of pain score by approximately 3

• With the mean difference $= -2.84$, $95\% \text{ CI} [-3.76, -1.93$, $P<0.0001$)
• This systematic review supports that the use of intravenous lidocaine is effective in reducing pain and discomfort associated with intravenous potassium chloride infusion.

• Careful considerations are needed when adding lidocaine to intravenous potassium chloride infusion because of its potential side effects (especially its cardio toxic effects).

• It is recommended that there is constant and close monitoring on patients’ heart rate, rhythm and blood pressure when infusing intravenous potassium chloride added with lidocaine.\(^{14}\)
Implication for future research

- More RCTs with larger sample size and calculated power analysis have to be conducted in evaluating the effectiveness of intravenous lidocaine in reducing pain related to intravenous potassium chloride infusion.

- More RCTs have to examine the various methods of adopting intravenous lidocaine as primary research, looking into the dosage, timing and methods of instituting lidocaine.

- Other less invasive methods in application of lidocaine should be explored, such as using topical lidocaine cream and patch.
Reference

5. Macklin, D. Phlebitis: a painful complication of peripheral IV catheterization that may be prevented. AJN. 2003; 103(2), 55-60.