Comparison of Magnesium Versus Lidocaine and Their Efficacy in Preventing Sympathetic Nervous System Response to Direct Laryngoscopy

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Abstract

Induction of general anesthesia followed by direct laryngoscopy and intubation is associated with temporary elevations in heart rate and blood pressure which may be detrimental to some patients. As a preventative measure, anesthesia providers often administer medications to help prevent this sympathetic response. This systematic review will integrate results from several studies comparing the effects lidocaine and magnesium sulfate on prevention of the sympathetic response to direct laryngoscopy and intubation.

Introduction

Tactile stimulation of the oropharynx during direct laryngoscopy increases heart rate, blood pressure, and oxygen demand potentially leading to:

- Stroke
- Heart attack
- Ischemia
- Hypoxia
- Increase morbidity & mortality

Lidocaine is a commonly used medication prior to intubation which blocks voltage-gated sodium channels preventing propagation of action potentials along the efferent nerve fibers which elicit a stress response.

Magnesium works as a vasodilator and sympatholytic by blocking voltage-gated calcium channels. Catecholamine release is inhibited from adrenergic nerve endings which provides a systemic vasodilation by reduction of circulating epinephrine.

The Stetler Model of Research Utilization reflects a practitioner-oriented approach to evidence-based practice and was used as a guide for the research.

Materials & Methods

Participants

This systematic review included adult participants ages 18-65.

All participants were:

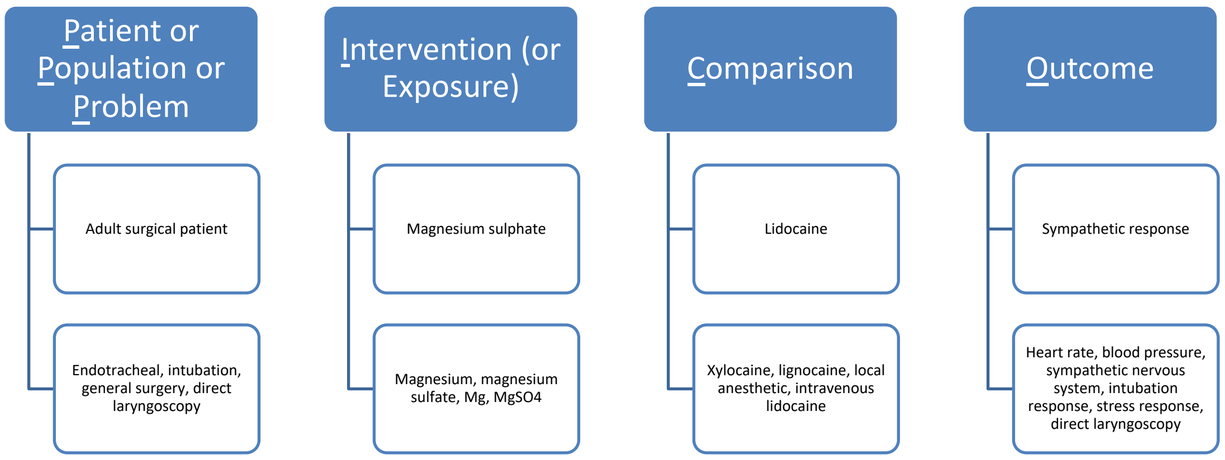
- ASA Class I or II
- Scheduled for elective surgery
- Lacking any substantial cardiac or renal disease process
- No previous history of difficult intubation
- BMI less than 35

Methods

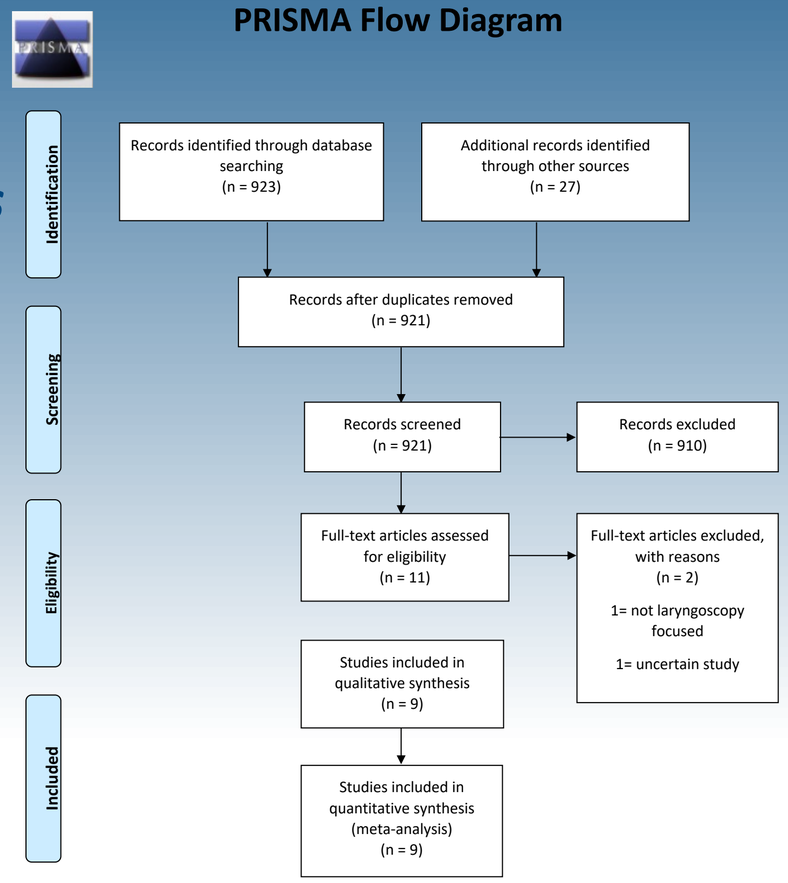
An exhaustive search of the relevant literature was completed to include articles published after January 2016 to September 2021 utilizing the following databases: CINAHL, E Journals, Medline, OVID, ProQuest, and Science Direct. Search terms were identified and used to gather articles specific to the research question, see the PICO search strategy below. The search yielded 923 articles with an additional 27 articles identified through Google search. After duplicates were removed, 921 articles were screened for relevancy. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) was utilized to screen the 921 articles. Nine articles were critically appraised and were included in the systematic review.

PICO Search Strategy Chart

During direct laryngoscopy does prophylactic administration of Magnesium Sulfate, compared to Lidocaine, better attenuate the stress response to endotracheal intubation as evidenced by decreased heart rate and blood pressure?



PRISMA Flow Diagram



Results

Types of studies included were Randomized Controlled Trials, 8 in total, and 1 Cohort Study

- **Bhalerao et al (2017):** The lignocaine group showed multiple points of hypotension after induction of anesthesia and intubation. The magnesium sulfate group was associated with better control of adrenergic response.
- **Bulle & Bande (2017):** Both the magnesium and lidocaine groups demonstrated a rise in heart rate after direct laryngoscopy and intubation. However, the magnesium group showed better control of hypertension when compared to lidocaine which indicated no attenuation of the sympathetic response.
- **El Kassim Rashwan & Mahmoud (2019):** Hemodynamic stability was maintained and sympathetic response to direct laryngoscopy was attenuated when magnesium was given 15 minutes prior to induction of anesthesia and endotracheal intubation.
- **Kumar et al. (2021):** The lignocaine group showed elevations in heart rate post tracheal intubation while the magnesium group showed a decrease in heart rate immediately after intubation.
- **Mendonca et al. (2017):** Comparison of magnesium sulphate and lidocaine proved to be efficacious in hemodynamic stability throughout laryngoscopy and intubation. Magnesium sulphate is a sufficient alternative to lidocaine for attenuation of hemodynamic response in endotracheal intubation.
- **Misganaw et al. (2021):** Magnesium sulphate demonstrated a more favorable response for attenuation of hemodynamic response to laryngoscopy and endotracheal intubation.
- **Ranjan et al (2019):** Magnesium sulfate was more effective at controlling hemodynamic responses following direct laryngoscopy and intubation when compared to lidocaine.
- **Vaghela et al. (2021):** Participants in the lignocaine group had a greater increase in heart rate and slower return to baseline when compared to the magnesium sulphate group.
- **Zaghloul et al. (2019):** This study involved the comparison of lidocaine, magnesium sulphate, and verapamil. The study suggested any of the three drugs could be used to abolish the stress response related to intubation. However, the addition of an opioid would be needed to decrease the reflex tachycardia seen in the magnesium sulphate group.

Conclusion

While magnesium sulfate appears to have greater control of sympathetic response to direct laryngoscopy and intubation, there is some inconsistency in magnesium sulfate dose for desired effects. Seven of the nine studies included had superior hemodynamic control utilizing the magnesium sulfate dose of 30 mg/kg. It should also be noted that magnesium is associated with some instances of hypotension and/or bradycardia. However, research concludes that magnesium provides a better prevention of the stress response from endotracheal intubation when compared to lidocaine.

Limitations

- Lack of variety of studies
- Patient population relatively healthy with low acuity
- Relatively small population sizes within the studies
  - Largest study = 112 patients
- Some studies ruled out due to unavailability of English translation

References

Acknowledgements