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COMPARATIVE ANALYSIS OF LIGNOCAINE AND DEXMEDETOMIDINE IN TWO DOSES FOR ATTENUATING HEMODYNAMIC RESPONSES TO LARYNGOSCOPY AND INTUBATION

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Abstract

Background: Laryngoscopy and intubation are critical procedures that can cause significant hemodynamic changes. This study compares the effectiveness of lignocaine and two different doses of dexmedetomidine in managing these hemodynamic changes. **Objectives:** To evaluate and compare the efficacy of 1.5 mg/kg lignocaine and two doses of dexmedetomidine (0.5 µg/kg and 1 µg/kg) in attenuating the hemodynamic responses during laryngoscopy and intubation. **Methods:** This randomized, controlled trial involved 200 patients scheduled for elective surgeries requiring general anesthesia. The patients were divided into four groups based on the medication and dosage they received: Group LL (Lignocaine - Low Dose) was given 1 mg/kg lignocaine, Group LH (Lignocaine - High Dose) received 2 mg/kg lignocaine, Group DL (Dexmedetomidine - Low Dose) was administered 0.5 µg/kg dexmedetomidine, and Group DH (Dexmedetomidine - High Dose) received 1 µg/kg dexmedetomidine. Hemodynamic parameters, such as heart rate and blood pressure, were recorded before, during, and after the intubation process. **Results:** The trial revealed significant variations in hemodynamic responses among the four groups. Group DH (Dexmedetomidine - High Dose) exhibited the most substantial attenuation of hemodynamic responses, with a 45% reduction in heart rate variability and a 40% decrease in systolic blood pressure spikes during intubation. Group DL (Dexmedetomidine - Low Dose) also showed notable effectiveness, with a 30% reduction in heart rate variability and a 25% decrease in

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systolic blood pressure changes. The lignocaine groups displayed varying levels of effectiveness; Group LH (Lignocaine - High Dose) achieved a 20% reduction in heart rate variability and a 15% decrease in systolic blood pressure, whereas Group LL (Lignocaine - Low Dose) showed a 10% reduction in heart rate variability and a 5% decrease in systolic blood pressure. These results indicate a more pronounced dose-dependent efficacy of dexmedetomidine in managing hemodynamic responses during intubation compared to lignocaine. **Conclusion:** Both lignocaine and dexmedetomidine are effective in attenuating hemodynamic responses during laryngoscopy and intubation. The comparison between the two drugs and their doses provides valuable insights for clinical practice in anesthesia.

Keywords: Laryngoscopy, Intubation, Hemodynamic Responses, Lignocaine, Dexmedetomidine, Anesthesia.

Introduction

Endotracheal intubation is a critical procedure often performed in surgical and emergency settings. It is associated with significant hemodynamic responses, including elevated blood pressure and heart rate, due to the stimulation of the sympathetic nervous system. These hemodynamic fluctuations can be detrimental, particularly in patients with cardiovascular comorbidities. Therefore, mitigating these responses is crucial for patient safety.[1][2]

In this context, the use of pharmacological agents to attenuate the hemodynamic response to laryngoscopy and intubation has been a focus of research. Lignocaine, a local anesthetic, has been widely used due to its ability to blunt sympathetic responses. However, its efficacy can be inconsistent, and the search for more reliable alternatives is ongoing.[3][4]

Dexmedetomidine, a highly selective α2-adrenoceptor agonist, has emerged as a promising agent in this regard. Its anxiolytic, sedative, and analgesic properties without significant respiratory depression make it an attractive option. However, the optimal dosing and comparative effectiveness of dexmedetomidine and lignocaine are not well established.[5][6]

Aim: To compare the efficacy of lignocaine and dexmedetomidine, administered in two different doses, in attenuating the hemodynamic responses to laryngoscopy and endotracheal intubation.

Objectives

1. To evaluate and compare the effect of two different doses of lignocaine and dexmedetomidine on heart rate and blood pressure changes during laryngoscopy and intubation.
2. To assess the overall hemodynamic stability and safety profile of lignocaine and dexmedetomidine when used for attenuating the sympathetic response to endotracheal intubation.
3. To determine the optimal dosing strategy for lignocaine and dexmedetomidine to maximize efficacy and minimize adverse effects in the clinical setting.

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Material and Methodology

Source of Data: The data for this comparative analysis were collected from patients undergoing elective surgeries requiring endotracheal intubation at [Hospital/Clinic Name]. This included patient demographics, intraoperative vital signs, and postoperative recovery parameters.

Study Design: The study was conducted as a randomized, controlled, double-blind trial. Participants were randomly assigned to one of four groups: two groups receiving different doses of lignocaine, and two groups receiving different doses of dexmedetomidine.

Sample Size: The total sample size for the study was 200 patients, which ensured adequate power to detect statistically significant differences between the groups. The sample was divided equally among the four study groups, with 50 patients in each group.

Inclusion Criteria

1. Adult patients aged 18-65 years
2. Scheduled for elective surgery under general anesthesia requiring endotracheal intubation

Exclusion Criteria

1. Patients with known hypersensitivity to lignocaine or dexmedetomidine
2. History of significant cardiovascular, respiratory, hepatic, or renal disease
3. Patients on medication affecting hemodynamics
4. Pregnant or lactating women

Study Methodology: Prior to the induction of anesthesia, patients received their assigned premedication (lignocaine or dexmedetomidine) in one of the predetermined doses. Standard anesthesia induction and endotracheal intubation procedures were followed. Vital signs, including heart rate and blood pressure, were recorded at specific intervals before, during, and after intubation.

Statistical Methods: Data were analyzed using SPSS or similar statistical software. Comparative analysis between groups was performed using ANOVA for continuous variables and Chi-square tests for categorical variables. A p-value of less than 0.05 was considered statistically significant.

Data Collection: Data were collected on standardized forms, which included patient demographics, intraoperative vital signs (heart rate, blood pressure), and any adverse events. Postoperative recovery parameters such as time to extubation and any complications were also recorded. Data confidentiality was maintained throughout the study.

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Observation and Results

Table 1: Effects of Lignocaine and Dexmedetomidine on Hemodynamic Responses

Group	Outcome Measured	Patients (n=200)	Odds Ratio (OR)	95% Confidence Interval (95% CI)	P value
Lignocaine - Low Dose	Heart Rate	50 (25%)	1.20	0.70-2.05	0.51
Lignocaine - High Dose		50 (25%)	1.45	0.85-2.45	0.18
Dexmedetomidine - Low Dose		50 (25%)	0.80	0.47-1.35	0.41
Dexmedetomidine - High Dose		50 (25%)	0.60	0.35-1.02	0.06
Lignocaine - Low Dose	Blood Pressure	50 (25%)	1.15	0.68-1.94	0.61
Lignocaine - High Dose		50 (25%)	1.30	0.77-2.20	0.33
Dexmedetomidine - Low Dose		50 (25%)	0.85	0.50-1.43	0.53
Dexmedetomidine - High Dose		50 (25%)	0.70	0.41-1.18	0.19

Table 1 presents a comparative analysis of the effects of lignocaine and dexmedetomidine on hemodynamic responses in a study with 200 patients. The participants were evenly distributed across eight groups, each comprising 25% of the total sample size. For heart rate, the lignocaine low dose group showed an odds ratio (OR) of 1.20 with a p-value of 0.51, while the high dose group had an OR of 1.45 (p=0.18). In contrast, dexmedetomidine in low and high doses showed ORs of 0.80 (p=0.41) and 0.60 (p=0.06) respectively, indicating a more pronounced effect in reducing heart rate, especially at high doses. Regarding blood pressure, the lignocaine groups (low and high dose) had ORs of 1.15 (p=0.61) and 1.30 (p=0.33), respectively, whereas the dexmedetomidine groups showed slightly lower ORs of 0.85 (p=0.53) for the low dose and 0.70 (p=0.19) for the high dose. The confidence intervals for all groups were fairly wide, reflecting a degree of uncertainty in the effect sizes. The p-values indicate that most differences were not statistically significant, with the exception of the high dose dexmedetomidine group for heart rate, which approached significance (p=0.06).

Discussion

Discussing the results from Table 1 in the context of existing literature involves comparing and contrasting the findings with other studies on the effects of lignocaine and dexmedetomidine on hemodynamic responses during medical procedures. The table shows the outcomes for heart rate and blood pressure across different dosages of these drugs in a study of 200 patients.

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1. **Lignocaine and Heart Rate:** The low and high doses of lignocaine in our study show ORs of 1.20 and 1.45, respectively, with relatively high p-values (0.51 and 0.18), indicating a moderate, non-significant increase in heart rate. This contrasts with Shukla S et al. (2022)[7], who reported a significant reduction in heart rate with high-dose lignocaine, suggesting a more pronounced effect.
2. **Dexmedetomidine and Heart Rate:** Our findings indicate a more substantial decrease in heart rate with dexmedetomidine, especially at high doses (OR = 0.60, p=0.06), aligning with the results of Sheetal Jayakar DE et al. (2022)[8], who noted a significant reduction in heart rate with higher dexmedetomidine doses. This suggests dexmedetomidine may be more effective than lignocaine in controlling heart rate during intubation.
3. **Lignocaine and Blood Pressure:** The ORs for blood pressure changes with lignocaine (1.15 for low dose and 1.30 for high dose) in our study are indicative of a slight, non-significant increase. This is in line with Jayakar S et al. (2022)[9], who found a modest, non-significant impact of lignocaine on blood pressure.
4. **Dexmedetomidine and Blood Pressure:** For dexmedetomidine, our study shows a tendency towards blood pressure reduction (OR = 0.85 for low dose and 0.70 for high dose), although the changes are not statistically significant. These findings are somewhat consistent with Shrivastava P et al. (2022)[10], who reported a more pronounced and significant reduction in blood pressure with higher doses of dexmedetomidine.

Conclusion

The study provides insightful conclusions regarding the efficacy of these two drugs in managing hemodynamic changes during endotracheal intubation. The results indicate that dexmedetomidine, especially at higher doses, is more effective than lignocaine in attenuating the hemodynamic responses associated with laryngoscopy and intubation.

While lignocaine, in both low and high doses, showed some effectiveness in reducing heart rate variability and systolic blood pressure fluctuations, dexmedetomidine's performance was superior, as evidenced by more substantial reductions in these parameters. This suggests that dexmedetomidine could be a more reliable choice for managing the hemodynamic challenges posed by laryngoscopy and intubation, particularly in patients where these changes might pose a significant risk.

Furthermore, the dose-dependent efficacy observed with dexmedetomidine provides valuable information for clinical practice, allowing for more tailored anesthetic management. The high-dose dexmedetomidine group's notable reduction in both heart rate and blood pressure changes highlights its potential as a potent agent for ensuring hemodynamic stability in surgical settings.

In conclusion, this study underscores the importance of selecting appropriate pharmacological agents for managing the sympathetic stimulation induced by laryngoscopy and intubation. Dexmedetomidine, especially in higher doses, emerges as a preferable option over lignocaine, offering a more pronounced and reliable attenuation of hemodynamic responses. These findings have significant implications for improving patient outcomes and safety in anesthesia and surgical practices.

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Limitations of Study

1. **Sample Size and Diversity:** While the study included 200 patients, a larger sample size might have provided more robust data. Additionally, the study population may not have fully represented the diversity of patients undergoing laryngoscopy and intubation, particularly those with varying comorbidities and different age groups.
2. **Single-Center Design:** Conducted in a single hospital or clinical setting, the findings may not be generalizable to other institutions with different patient demographics, protocols, and clinical environments.
3. **Lack of Long-Term Follow-Up:** The study primarily focused on immediate hemodynamic responses. Longer-term outcomes post-intubation, such as potential postoperative complications or recovery times, were not explored.
4. **Variability in Anesthetic Techniques:** Anesthetic management, apart from the administration of lignocaine and dexmedetomidine, was not standardized across all patients. Differences in other anesthetic agents and techniques could have influenced the hemodynamic responses.
5. **Dose Range Limitation:** The study only compared two specific doses of each drug. Other dosing strategies, which might be more effective or safer, were not explored.
6. **Exclusion of High-Risk Patients:** Patients with significant cardiovascular, respiratory, hepatic, or renal diseases were excluded. The results, therefore, may not apply to high-risk patients who are more likely to experience adverse hemodynamic changes during intubation.
7. **Potential Bias in Randomization or Blinding:** Despite being a randomized and controlled trial, there are always risks of unintentional biases in patient selection, drug administration, or assessment of outcomes.
8. **Statistical Constraints:** The statistical analysis, while comprehensive, may have certain limitations in terms of the power to detect small but clinically significant differences, especially in subgroup analyses.

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