

Original Article

Attenuation of the stress response to the endotracheal intubation: Intravenous Fentanyl versus analgesic dose of ketamine.

Zubeydi Leyla 1, Alasdi Jalel 1*, Al Zubaidi Saif², Alasdi Sama³, Al Zubaidi Sara⁴.

 Department of anaesthesiology, Al Emadi Hospital, Doha, Qatar.
Yeovil District Hospital Somerset NHS Foundation trust, United Kingdom.
College of medicine Karbala University, Iraq
College of medicine Kurdistan Hewler, Iraq
Correspondence to:
Alasdijalel@gmail.com
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Abstract

Background

Laryngoscopy and endotracheal intubation can provoke a cardiovascular stress response. This study aimed to compare the effects of intravenous fentanyl and ketamine on attenuating this response.

Methods

A total of forty-five adult patients undergoing elective surgery with endotracheal intubation were randomized to receive either fentanyl or ketamine intravenously prior to induction. Heart rate and blood pressure were measured at baseline and five minutes after intubation.

Results

Fentanyl significantly decreased heart rate and mean arterial pressure compared to baseline. Ketamine reduced mean arterial pressure but did not significantly affect heart rate. Patients receiving ketamine had higher heart rates than those given fentanyl after intubation.

Conclusions

Intravenous fentanyl provided superior attenuation of the cardiovascular response to laryngoscopy and intubation compared to ketamine, effectively reducing heart rate and blood pressure. Further research with larger sample sizes and longer follow-up is needed to confirm these findings and explore optimal dosing strategies.

Key words

cardiovascular system; stress; endotracheal intubation; response.

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Introduction

Laryngoscopy and endotracheal intubation are stressful stimuli that cause significant hemodynamic responses mediated by sympathetic activation of the cardiovascular system [1,2]. These reflex variations include an increase in heart rate, arterial blood pressure, intracranial pressure, and central venous pressure [3]. The aim of this study was to compare the effect of fentanyl vs analgesic dose of ketamine on cardiovascular reactions to endotracheal intubation.

Material and Methods

This randomized single blind comparative study included forty-five patients (18-60 years) with American Society of Anesthesiologists (ASA) status I and II, scheduled to undergo elective surgical procedures under general anesthesia requiring endotracheal intubation. Patients presenting with cardiovascular and respiratory diseases, vital organs impairment, neurological deficits, drugs allergy, morbid obesity (BMI>35 kg/m2), pregnancy and with medication affecting heart rate or blood pressure were excluded.

Informed consent was obtained from each participant. Confidentiality and data protection regulations were respected. The ethics committee approved the study protocol. Samples size calculation was based on an expected effect variation of five units with a standard deviation of ten units. A significance level p< 0.05 was chosen, corresponding to a 95% confidence interval. Thirty-two participants were needed to achieve the desired significance level. Experienced anesthesiologists followed a standardized rapid sequence induction and intubation technique. Intubation was performed 60 seconds after administration of neuromuscular blockers. Direct laryngoscopy was performed using curved blade of appropriate size and duration was limited to 10 seconds. Patients were randomly allocated using a computergenerated randomization sequence into two groups receiving: fentanyl 2 mcg/kg vs ketamine 0.5 mg/kg intravenously, 5 minutes prior to. Study drugs were prepared in identical syringes by an anesthesiologist not involved in the study. The primary endpoint was the attenuation of cardiovascular response, as determined by changes of heart rate and blood pressure during intubation when compared to baseline values. Statistical analysis was performed using IBM SPSS Statistics version 21.0 (IBM Corp., Armonk, NY, USA). Continuous data were presented as mean ± standard deviation (SD) and analyzed using repeated measures ANOVA and unpaired t-tests, as appropriate. Categorical data were presented as frequencies and percentages and analyzed using the Chi-square test.

Results

Demographic data in different groups showed no significant differences in age, gender distribution, body mass index (BMI), and baseline systolic blood pressure (table 1).

Table1:	Demographic	Characteristics of	Participants in	Fentanyl and	Ketamine	Groups.

	fentanyl (n=20)	ketamine (n=25)	Р
Age	39.2+/-12.31	33.6+/-11.43	0.411
Sex (M/F)	8/20(40%)	13/25(52%)	0.42
BMI	24.27+/-3.00	25.84+/-2.79	0.64
Systolic pressure	129.00+/-7.13	125.3+/-6.01	0.63

Fentanyl significantly decreased heart rate and mean arterial pressure compared to baseline values (p<0.001). ketamine did not affect heart rate. However, it significantly decreased mean arterial pressure (p<0.001). The lack of change in heart rate limited its impact on cardiovascular response attenuation control compared to fentanyl(table2).

Table2: Cardiovascular parameters before and after drugs administration.

Parameters	Before Fentanyl	After Fentanyl	Ρ
Heart rate (mean+/-SD)	96.15+/-4.14	88.55+/-4.18	<0.001
Mean arterial pressure	98.75+/-4.51	80.9+/-4.98	<0.001
Parameters	Before Ketamine	After Ketamine	р
Parameters Heart rate	Before Ketamine 94.92+/-4.78	After Ketamine 94.2+/-5.17	р 0.3

Statistical comparison of heart rate and mean arterial pressure between patients administered fentanyl and those administered ketamine following endotracheal intubation demonstrated that fentanyl significantly (p,0.05) reduced both heart rate and mean arterial pressure compared to ketamine. This may suggest that fentanyl provides more effective attenuation of the cardiovascular stress response associated with these procedures. ketamine effectively decreased mean arterial pressure, it did not significantly impact heart rate, which might be advantageous in maintaining hemodynamic stability for patients where heart rate preservation is critical(figure).



Figure: Cardiovascular parameters fentanyl vs ketamine.

Discussion

Post intubation blood pressure variations may increase mortality in susceptible patients [4]. This study aimed to assess the attenuation of the cardiovascular response to endotracheal intubation observed with intravenous fentanyl versus ketamine. Results demonstrated that fentanyl significantly decreased heart

Citation: Zubeydi L, Alasdi J, Al Zubaidi S, Alasdi, Al Zubaidi S. Attenuation of the stress response to the endotracheal intubation: Intravenous Fentanyl versus analgesic dose of ketamine. Jr. med. res. 2025; 7(1):6-8. Zubeydi et al © All rights are reserved. Submit your manuscript: www.jmedicalresearch.com rate and arterial pressure compared to baseline values. However, ketamine did not affect heart rates and reduced significantly mean arterial pressure. Patients receiving ketamine exhibited non-significant higher heart rates compared to those given fentanyl during endotracheal intubation. These observations aligned with recent research studies that demonstrated fentanyl's effectiveness in hemodynamic responses control during endotracheal intubation [5-7]. Moreover, the prominent vascular resistance system and the stroke volume minimization by fentanyl administration is concordant with the experimental data that proves fentanyl's ability to mitigate sympathetic activity and to maintain cardiovascular stability [8,9]. These effects may be related to fentanyl opioid action (production of analgesia and sedation) and reduction of sympathetic nervous system activity. Fentanyl's fast action and short duration may allow physicians to manage crucial parameters concerns during critical procedures [10].

Current research showed that ketamine may decrease mean arterial pressure. Concordant results were found in some other recent reports. Ketamine significantly stabilized the hemodynamic parameters without altering the heart rate [11-13].

Ketamine effects may be related to its NMDA receptor blocker property which modulate the action on pain and stress relief during intubation. Accordingly, ketamine could be applied to relieve the pressure on the heart during stressful procedures [14]. Recent meta-analysis about ketamine used in critically ill patients suggested that ketamine may decrease opioid consumption postoperative pain, and mortality compared to other approaches [15]. Fentanyl groups in several previous studies presented with lower significant cardiovascular stimulation and lower stroke volume [16-19].

Several comparative studies have explored the combined use of fentanyl and ketamine have found no significant alteration in postinduction hemodynamics. The combination may not offer additional benefits compared to individual low doses administration [20].

This study has several limitations that should be acknowledged. First, the small sample size may limit the generalizability of our findings and increase the risk of Type II errors. A larger cohort would provide more robust data and potentially reveal subtler differences between the effects of fentanyl and ketamine. Second, the study was conducted in a controlled clinical environment with specific inclusion criteria, which may generate some bias. Third, we did not assess long-term outcomes or potential delayed effects of the medications, as our follow-up period was limited to the immediate post-intubation findings. Future studies should consider longer follow-up periods to evaluate any lasting impacts on cardiovascular stability. Additionally, exploring different dosing regimens and combinations with other adjunctive therapies could provide insights into optimizing hemodynamic control during intubation.

Conclusions

This study demonstrates that intravenous fentanyl provides superior attenuation of the cardiovascular response induced by endotracheal intubation compared to ketamine. Fentanyl significantly reduced heart rate and blood pressure, offering satisfactory hemodynamic stability. In contrast, ketamine selectively decreased blood pressure while preserving heart rate, which may be advantageous in specific cases.

Conflict of interest: None

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