

Esmolol Compared to Fentanyl for Hemodynamic Attenuation during Intubation: A Scoping Review

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Purpose

The purpose of this DNP project is to determine the effectiveness of esmolol compared to fentanyl in attenuating the hemodynamic response associated with direct laryngoscopy and endotracheal intubation.

Specific Aims

- Analyze the existing research surrounding esmolol and fentanyl to better identify a safe and effective solution
- Compare the effects of fentanyl to esmolol on patient mean arterial pressure
- Compare the effects of fentanyl to esmolol on patient heart rate

Background

Endotracheal intubation and laryngoscopy potentiate the cardiovascular response in the form of hypertension, tachycardia, and ventricular arrhythmias.

- Typically, an increase of 40-50% in the mean arterial blood pressure and 20% in the heart rate is seen following intubation.
- These changes are greatest at one minute following intubation and last for five to ten minutes.
- These changes can lead to cardiac arrhythmias, myocardial ischemia, acute left ventricular failure, and cerebrovascular accidents.
- Suppression of the adrenergic response to endotracheal intubation is necessary to ensure patient safety.

Anesthetists employ many methods to attenuate the sympathetic response seen following intubation.

- Fentanyl, a synthetic opioid agonist, in doses greater than or equal to 5 mcg/kg, has been reported in research to be effective attenuating increases in blood pressure and heart rate.
- Esmolol, a cardio-selective beta-blocker, may also be used to attenuate increases in heart rate, but has variable effectiveness in the recommended dose.

There are no established guidelines for anesthesia providers to follow.

- A scoping review was conducted in order to analyze the existing research surrounding these medications to better identify a safe and effective solution.

Methods

- **Search**
 - Data collection began in August of 2021.
 - Search results include the years 2011-2022.
 - There was no limitation on the country of publication.
 - The MeSH were "intubation," "esmolol," "fentanyl," and "hemodynamics."
- **Selection of Sources of Evidence**
 - Studies measuring the efficacy of Fentanyl and Esmolol in attenuating hemodynamic response to direct laryngoscopy and tracheal intubation were included.
 - A synthesis table was created to assure the studies were applicable and met criteria.
 - Articles were omitted if published before 2011 due to outdated medical practices and medication dosages.
 - Ten articles were selected for this scoping review.
- **Data Charting Process**
 - Author's name, title of article, year of publication, article type, methodology used, outcome assessed, population, and specific results for each study were obtained from each article.
 - The information was placed into a table and organized for each article.
- **Data**
 - **Data items:** patient age, patient gender, medical history, body weight
 - **Additional data items:** type of surgery, medication received (fentanyl or esmolol), time of medication administration, medication dose, baseline hemodynamics, time of induction, hemodynamic response after intubation (illustrated by changes in HR and BP), hemodynamic response 3 minutes, 5 minutes, and 10 minutes after intubation, and presence of intraoperative and postoperative adverse outcomes.
 - **Qualitative data:** increase, decrease, or no change in HR or BP were collected and documented for each article

Results

- **Of the articles reviewed, the majority concluded fentanyl was the better choice to administer before induction for attenuating hemodynamic responses to intubation**
 - 5 of the 10 articles reviewed claimed that fentanyl was superior to esmolol when attenuating hemodynamic responses.
 - Specifically, fentanyl was found to further attenuate hypertensive episodes than with esmolol.
- **There was evidence to support the use of esmolol to attenuate the hemodynamic response as well**
 - 4 of the articles claimed that esmolol was the superior drug for attenuation.
 - These articles claimed prevention of tachycardia was the most significant when using esmolol for intubation.
- **Two of the studies evaluated the effects of using both fentanyl and esmolol in combination**
 - These studies showed that using both drugs did result in heart rate and blood pressure reduction.
 - However, using these drugs in combination leads to increased rates of hypotension, and should be used with caution.

	1 (Alsem et al., 2012)	2 (Alsan et al., 2021)	3 (Bhaloo et al., 2017)	4 (Gogus et al., 2014)	5 (Gupta & Tank, 2015)	6 (Kumar et al., 2018)	7 (Ongene & Bol, 2019)	8 (Singh et al., 2022)	9 (Shalaja & Srikanta, 2013)	10 (Teong et al., 2020)
Outcome #1 Esmolol HR control	NE	✓	✓	✓	✓	NE	NE	✓	✓	NE
Outcome #2 Fentanyl HR control	↑	NE	✓	✓	✓	↑	✓	NE	NE	↑
Outcome #3 Esmolol BP control	NE	✓	✓	✓	✓	NE	NE	↑	✓	NE
Outcome #4 Fentanyl BP control	✓	NE	✓	✓	✓	✓	✓	NE	NE	✓
Outcome #5: Esmolol and Fentanyl combined HR control	NE	NE	✓	NE	NE	NE	NE	NE	✓	NE
Outcome #6: Esmolol and Fentanyl combined BP control	NE	NE	✓	NE	NE	NE	NE	NE	✓	NE

SYMBOL KEY
↑ = Increased, ↓ = Decreased, — = No Change, NE = Not Examined, NR = Not Reported, ✓ = applicable or present

LEGEND
HR= heartrate; BP= blood pressure

Implications for Practice

- **Patient safety**
 - Using fentanyl or esmolol can attenuate hemodynamic responses to endotracheal intubation.
 - If hemodynamic responses aren't attenuated, this can lead to:
 - Cardiac arrhythmias
 - Myocardial ischemia
 - Acute left ventricular failure
 - Cerebrovascular accidents
- **Determination of which drug to use should be patient-specific**
 - The individual need of each patient is highly regarded as the decision-making aspect of each case.
 - Fentanyl is the preferred agent for overall hemodynamic stability.
- **Further research is needed**
 - These findings suggest further evaluations regarding patient individualization are needed when choosing the appropriate drug for attenuating the hemodynamic response to intubation.

References

- To view our references, please scan QR code below.

