Esmolol Compared to Fentanyl on Hemodynamic Effects: A Scoping Review

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Purpose

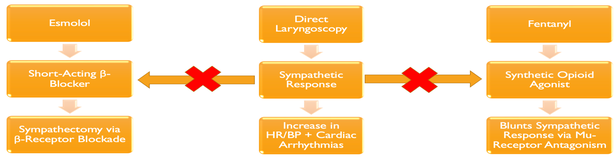
The purpose of this DNP project is to compare the efficacy of esmolol to fentanyl in attenuation the hemodynamic response associated with direct laryngoscopy.

Specific Aims

- Compare the effects of esmolol to fentanyl on patient heart rate during laryngoscopy
- Compare the effects of esmolol to fentanyl on patient mean arterial pressure during laryngoscopy

Background

- **Sympathetic Response the Direct Laryngoscopy**
  - Characterized by an increase in heart rate and/or blood pressure, as well as disturbances to cardiac rhythm.
- **Consequences**
  - Sympathetic response to endotracheal intubation may occur in up to 40% of critically ill patients (Hashemian et al., 2018).
  - Patients suffering from cardiovascular disease and coronary artery disease may experience decreased ventricular filling, increased peripheral vascular resistance, myocardial ischemia, and possible death (Vaishnav & Chaudhari, 2016).



Results

- **Characteristics of 15 articles and sources of evidence:**
  - Four= Level I
  - Nine= Level II
  - Two= Level IV

X (copy symbol as needed)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Level I: Systematic review or meta-analysis										x	x	x		x	
Level II: Randomized controlled trial	x	x		x	x		x	x	x				x		x
Level III: Controlled trial without randomization															
Level IV: Case-control or cohort study			x			x									
Level V: Systematic review of qualitative or descriptive studies															
Level VI: Qualitative or descriptive study, CPG, Lit Review, QI or EBP project															
Level VII: Expert opinion															

1 = Bhargava, S., et al. (2020); 2 = Gogus, N., et al. (2014); 43 = Vaishnav, D., Chaudhari, A. (2016); 4 = Bhalke, R., et al. (2017); 5 = Ugur, B., et al. (2007); 6 = Gupta S., Tank P. (2011); 7 = Shailaja, S., Srikantu, J. (2013); 8 = Hancı, V., et al. (2013); 9 = Helfman et al. (1991); 10 = Yu, S. et al. (2013); 11 = Burgdorff, A. (2018); 12 = Landoni, G., et al. (2010); 13 = Hashemian, A., et al. (2018); 14 = Li, Z., et al. (2019); 15 = Bucher, J., Koyfman, A. (2015)

Methods

- **Sympathetic Response the Direct Laryngoscopy**
  - Characterized by an increase in heart rate and/or blood pressure, as well as disturbances to cardiac rhythm.
- **Consequences**
  - Sympathetic response to endotracheal intubation may occur in up to 40% of critically ill patients (Hashemian et al., 2018).
  - Patients suffering from cardiovascular disease and coronary artery disease may experience decreased ventricular filling, increased peripheral vascular resistance, myocardial ischemia, and possible death (Vaishnav & Chaudhari, 2016).
- **Search**
  - Data collection began in September of 2020.
  - Search results include the years 1991-2020.
  - There was no limit on country of origin for our study.
  - The MeSH terms were “adult surgical patients,” “esmolol,” “fentanyl,” and “hemodynamic.”
- **Selection Sources of Evidence**
  - Studies measuring the efficacy of Fentanyl and/or Esmolol in blunting the 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 due to time frames, which included outdated medical practices and dosages.
  - Fifteen articles were chosen for this review
- **Data Charting Process**
  - Author's names, year of publication, journal, study title, study location, article type, methodology used, outcome assessed, population, and specific results for each study were extracted.
  - The information was then placed into a table and organized from each source.
  - This table was available for reference throughout the study review.
- **Data Items**
  - **Data items:** patient age, gender, race, medical history, and ASA status.
  - **Additional data items:** type of surgery, medication received (esmolol or fentanyl), medication dose, time of medication administration, baseline hemodynamics, time of induction, hemodynamic response (illustrated by changes in heart rate or blood pressure), presence of adverse intraoperative outcomes, and presence of adverse postoperative outcomes.
  - **Qualitative data:** increase, decrease, or no change in HR and BP were collected and documented .

Results

The evidence supports statistical significance for the support of the effectiveness of Esmolol in attenuating the hemodynamic response

- All level I studies support effectiveness of Esmolol
- Seven articles supported Esmolol has more significant decrease in heart rate and/or blood pressure than Fentanyl
- Both level IV studies supported Esmolol compared to Fentanyl
- Only two articles provided statistical evidence supporting Fentanyl in attenuation of hemodynamic effects during induction

□, □, —, NE, NR, □ (select symbol and copy as needed)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Outcome #1 Esmolol BP control	↑b	↓c	↓b	↓c	↑c	↓b	↓c	↓b	↓b	↓b	↓b	↓b	NE	↑b	↓c
Outcome #2 Fentanyl BP control	↓c	✓c	↓b	↓c	↑b	↓c	NE	—b	↓b	NE	NE	NE	↑b	NE	NE
Outcome #3 Esmolol HR control	↑c	↓c	↓b	↓c	↓b	↓c	↓b	↓b	↓b	↓b	↓b	↓b	NE	↑b	—b
Outcome #4 Fentanyl HR control	↓b	✓c	↓b	↓c	↓c	↓c	NE	—b	—b	NE	NE	NE	—b	NE	NE
Outcome#5 Fentanyl and Esmolol combined HR control	NE	NE	NE	↓c	NE	NE	↓c	NE	NE	NE	NE	NE	NE	NE	NE
Outcome #6 Fentanyl and Esmolol combined BP control	NE	NE	NE	↓c	NE	NE	↓b	NE	NE	NE	NE	NE	NE	NE	NE

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BP= blood pressure; HR= heart rate
↑ = Increased, ↓ = Decreased, — = No Change, NE = Not Examined, NR = Not Reported, ✓ = applicable or present
a = higher-level evidence; b = statistically significant findings; c = not statistically significant

Implications for Practice

- Indicates utilization of Esmolol is effective in attenuating the sympathetic nervous system response during direct laryngoscopy
  - Standard of care
  - Allowing safer practices
  - Providing better patient outcomes
  - Avoiding intraoperative risk factors from sympathetic nervous system stimulation such as stroke and heart attack

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