

Paramedic – Evidence Based Medicine (P-EBP) Program

Paramedic CAT (Critically Appraised Topic) Worksheet

Title:

The Use of Ketamine Only Breathing Intubation vs Rapid Sequence Intubation in First Pass Intubation Success Without Hemodynamic Compromise

Report By:

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2nd Party Appraiser:

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Clinical Scenario:

EHS is dispatched to a short of breath 68 year-old male. Upon their arrival they find a tachypneic patient at a rate of 44 breaths/min with elevated work of breathing and accessory muscle use. Patient has a history of COPD, and has been unwell with fever/chills and a productive cough with green sputum for the last 3 days. On auscultation he has coarse crackles apices to bases, with significantly decreased air entry to the bases. He has been intubated in the past for previous episodes of respiratory distress. He is a full code. His other vitals include: 82% SPO2 RA, HR 114 BPM, temp. 38.6C, and GCS 14 (4-4-6). EHS attempts to relieve the patient's respiratory distress with CPAP, Salbutamol, Ipratropium Bromide, and a magnesium infusion to little effect. Pt. has no relief to his respiratory effort or tachypnea, O2 sats improved to 90% with CPAP at 10 cmH20, and he is starting to decrease in GCS to 13 (3-4-6). EHS decides to intubate the patient in order to more effectively oxygenate and ventilate, and to safely extricate. They need to decide on an induction strategy. They are in a system which allows for both ketamine-only breathing intubation (KOBI) and rapid sequence intubation (RSI). They need to decide on the best strategy for their patient in order to have the best chance of first pass success.

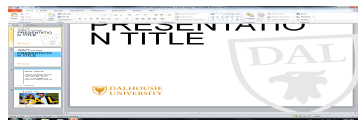
PICO Question:

Population - Paramedics with intubation within their scope of practice (ACPs and CCPs)

Intervention - Ketamine-only breathing intubation (KOBI)

Comparison - Rapid sequence intubation (RSI)

Outcome - First pass success of intubation without hemodynamic compromise



P-EBP Program
CAT Worksheet 2015

EHS
Emergency Health Services

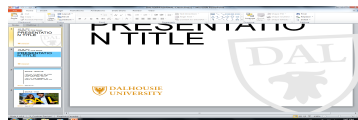
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Search Strategy:

- 1) "ketamine facilitated intubation" OR "KOBI" OR "ketamine-only breathing intubation" OR "ketamine-only intubation"
- 2) "Emergency Medical Services"[MeSH Terms] OR "Emergency Medical Technicians"[MeSH Terms] OR "paramedic*"[Title/Abstract] OR "emergency medical technician*"[Title/Abstract] OR "prehospital"[Title/Abstract] OR "pre-hospital"[Title/Abstract] OR "out of hospital"[Title/Abstract] OR "first responder*"[Title/Abstract] OR "emergency responder*"[Title/Abstract] OR "ambulance"[Title/Abstract]
- 3) #1 AND #2
- 4) "ketamine facilitated intubation" OR "KOBI" OR "ketamine-only breathing intubation" OR "ketamine-only intubation" from 2015 - 2023
- 5) "ketamine facilitated intubation" OR "KOBI" OR "ketamine-only breathing intubation" OR "ketamine-only intubation" from 2018 - 2023

Search Outcome:

- 1) 252
- 2) 202,204
- 3) 25
- 4) 134
- 5) 92



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Relevant Papers:

AUTHOR, DATE	POPULATION: SAMPLE CHARACTERISTICS	DESIGN (LOE)	OUTCOMES	RESULTS	STRENGTHS/ WEAKNESSES
Driver B. 2020 Success And Complications Of The Ketamine-Only Intubation Method In The Emergency Department	N = 12,511 patients Inclusion Criteria: fourteen years of age requiring intubation. Of registry entries between January 1, 2016 and December 31, 2018, we included patients \$14 years of age intubated orally or nasally using RSI (defined as administration of a sedative agent and NMBA), ketamine alone as a sedating agent without a NMBA, or topical anesthesia facilitation (defined as an intubation facilitated with topical anesthesia alone or in conjunction with sedative analgesia).	Observational retrospective study with derived control group of patients to evaluate the success of ketamine-only intubation, intubation with the use of topical anesthesia and the use of rapid sequence intubation techniques. Level of Evidence: Level 3 - non-randomized study.	First pass ketamine-only 61%, with topical analgesia 85%, with RSI 90% success rates. Not including adverse event during intubation, the confidence interval of 95% CI between ketamine and topical anesthesia is demonstrated. Evidence to prove that ketamine-only intubation is as successful as RSI intubation with a topical analgesic, sedative and neuromuscular blocking agent in the emergency department.	102 intubated with ketamine alone, 80 facilitated with topical analgesia. The comparison of ketamine only, and topical anesthesia, resulted in a first pass success rate of -24% (95% confidence interval =37% to -12%), and a difference in number of cases with > or =1 adverse effects was 13% (95% confidence interval 0-25%), both favouring the topical anesthesia group.	Flawed in that this data and outcome was extrapolated from quantitative evidence of intubation within the emergency department only, and not in a pre-hospital setting. Not quite pertinent to the PICO question, but similar in its inference. This study demonstrated the use of a large sample size in a demographic generalized to pre-hospital interventions. However, being that the question asked is a succinct reflection of pass/fail quantitative results, holds true to the PICO question. The data collection was compromised by being gathered through registries. Bias expressed in that there are no independent observers used for data collection. Bias in the results gathered by being dependent on operator reporting, which leaves room for skewed reported information: no information on who performed the skill or their level of experience.



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<p>Pollack, M. 2020</p> <p>The Use of Ketamine for Air Medical Rapid Sequence Intubation Was Not Associated With a Decrease in Hypotension or Cardiopulmonary Arrest</p>	<p>N = 7,466</p> <p>Inclusion criteria: is patients who were intubated during helicopter transport throughout the US between April 2015 - June 2017. Of the study number, 69.9% were male, 2.4% were under the age of 8, 83.3% were ages 8-70, and 14.3% were over the age of 70.</p>	<p>Retrospective Observational study with no randomization. It utilized a large air medical airway database. It compared post intubation clinical complications between the medications of Etomidate, Ketamine, Midazolam, and Fentanyl.</p> <p>Level Of Evidence: Level 3 - Cohort Study.</p>	<p>Multivariable logistic regression was used to calculate the odds ratio of both hypotension and arrest for each for each sedative/dissociative agent. Overall, Ketamine was associated with with higher incidence of both hypotension and arrest compared with other agents, with an odds ratio of approximately 3.0 for both hypotension and cardiac arrest.</p>	<p>The P value of this experiment was 0.05. Overall there was a practitioner preference for ketamine as the rate of ketamine for rapid sequence intubation increased compared to the other induction agent. However, Ketamine had a higher incidence of both hypotension and cardiac arrest, with hypotension percentage of 1.8 (CI 1.1 - 2.4), compared to 0.5 (CI 0.2 - 0.7) for etomidate, 0.6 (CI 0.2 - 1.0) for fentanyl, and 0.4 (0.0 - 0.9) for midazolam. This pattern is reflected in the incidence rate of cardiac arrest, with a percentage of 1.3 (CI 0.7 - 1.8), compared to etomidate 0.3 (CI 0.1 - 0.4), fentanyl 0.4 (CI 0.0 - 0.7), and midazolam 0.3 (CI 0.0 - 0.7).</p> <p>Pertaining to the PICO question, ketamine had the lowest 1st pass success rate without desaturation at 87 percent, compared to the other medications which had at a minimum of 90 percent first pass without desaturation.</p>	<p>Pertaining to the PICO question, although ketamine had to highest percentage of hypotension and cardiac arrest, with the lowest percentage of first pass success without hemodynamic compromise, the data is still inconclusive is this evidence was due to the pre-existing hemodynamic instability of the patients or due to ketamine itself. Since the study was not randomized, the variable of ketamine for intubation was not independent of other variables, and may reflect a bias in practitioner selection in more hemodynamically unstable patients. This was noted in the study as an increase of practitioner preference for ketamine, without the rationale as to why each practitioner chose what medication for RSI. The lack of randomization means compromises the study's internal validity. Internal validity is also compromised through the lack of p value for each statistical percentage and confidence interval, as data is displayed in percentage and not statistical significance. Another validity concern is the lack of specificity to which RSI utilized a single medication for induction, whereas other RSI had multi-medication use for induction. This means that there is unaccounted for pharmacodynamics of the combined medications, which directly influences clinical outcomes of the medication. A review from a pharmacist or section on specific pharmacodynamics should have been included the study to clarify clinical outcomes.</p> <p>However, this study has strength in the large amount of participants and in the direct comparison and itemization of ketamine for RSI in regards to patient outcomes and first pass success. It is also specific to the pre-hospital setting. The data brought forward demonstrates the outcomes of ketamine RSI not being as favourable as other induction agents, and alludes to further research to be done to demonstrate an independent, randomized use of ketamine for a more accurate evaluation of it's hemodynamic safety in comparison to other medications used for RSI.</p>
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<p>Sibley A. 2010</p> <p>A prospective review of the use of ketamine to facilitate endotracheal intubation in the helicopter emergency medical services (HEMS) setting</p>	<p>n = 71</p> <p>Inclusion Criteria: Patients who received ketamine for prehospital intubation by HEMS</p> <p>mean age 49.7 (SD = 23.3)</p> <p>73.2% male</p> <p>59.2% medical 40.8% trauma</p>	<p>This study is a prospective cohort study that looked at all patients from a single HEMS program who's intubation was facilitated by ketamine.</p> <p>Level of Evidence: Level 3 - prospective study with no control/comparison</p>	<p>The outcomes for this study include mean arterial pressure (MAP), heart rate (HR), and complications including failed intubation, hypotension, hypertension, bradycardia, tachycardia, and death.</p>	<p>Changes to MAP: (2.3 mmHg; 95% CI: -8.0 to 3.3) [no statistical difference].</p> <p>Changes to HR: (0.45 bpm, 95% CI: -4.9 to 4.0) [no statistical difference].</p> <p>Failed intubations: 5 (7%) Hypotension: 5 (7%) Hypertension: 4 (6%) Bradycardia: 1 (1%) Tachycardia: 2 (3%) Deaths: 5 (7%)</p>	<p>A major flaw of this study is that it doesn't differentiate outcomes between different adjuncts used with ketamine during intubation. For example, 75% of patients received a paralytic agent in conjunction with ketamine, but this is not differentiated in the results. Additionally, the sample size is very small and there is no comparison or control group. Fortunately this study is generalizable to EMS as the data is taken from STARS; a helicopter EMS service.</p> <p>Overall, given that this study does not differentiate between KOB and RSI, it is not applicable to our PICO question. However the study concludes that ketamine is an effective agent for (H)EMS intubation, with complications similar to use in the ED. This may support the generalization of data from studies done in the ED on ketamine to EMS environment.</p>
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Comments:

- Very hard to find research on ketamine only intubation as there is a research gap in the first pass success rate and hemodynamics of ketamine only intubation in relation to intubation.
- Most literature is level three evidence, and there are very little randomized control trials. Therefore there is the potential for biases which affect the internal validity and external validity of the current research.
- There is a lack of opportunity to conduct research on ketamine only intubation since ketamine is clinically used in conjunction with other medications for RSI and intubation and very few pre-hospital services do ketamine only outside of British Columbia. There is lack of documentation on ketamine only intubation which rates interpractitioner variability and patient factors such as graded view of airway by the practitioner and vital signs of patient prior to intubation.
- Since ketamine has been associated with higher incidence of post intubation complications, hemodynamic instability and decreased first pass success, the ethics of doing ketamine only intubation may conflict provider's duty to provide patient centered care in relation to clinical interventions

Consider why would we NOT change current practice:

- KOB involves fewer medications and therefore fewer variables than RSI.
- Using only one medication has the potential to decrease cognitive load on the practitioner.

Clinical Bottom Line:

- RSI was found to have a superior first pass success rate compared to KOB, however clinical evidence on KOB is limited, and patient acuity in most cases was not specified.
- Ketamine is considered to be as safe for use in the prehospital setting as it is in the controlled environment of the ED



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References

Driver, B. E., Prekker, M. E., Reardon, R. F., Sandefur, B. J., April, M. D., Walls, R. M., & Brown, C. A. (2020). Success and complications of the ketamine-only intubation method in the emergency department. *The Journal of Emergency Medicine*, 60(3), 265–272. <https://doi.org/10.1016/j.jemermed.2020.10.042>

Pollack, M, Fenati, G. M, Pennington T. W., Olvera. D. J., Wolfe, A., Owens M., & Davis, D. (2020). The use of ketamine for air medical rapid sequence intubation was not associated with a decrease in hypotension or cardiopulmonary arrest. *Air Medical Journal*. <https://doi.org/10.1016/j.amj.2019.11.003>

Sibley, A., Mackenzie, M., Bawden, J., Anstett, D., Villa-Roel, C., & Rowe, B. H. (2010). A prospective review of the use of ketamine to facilitate endotracheal intubation in the helicopter emergency medical services (HEMS) setting. *Emergency Medicine Journal*, 28(6), 521–525. <https://doi.org/10.1136/emj.2009.088237>

