

Introduction:

Patients with dyspnea are frequently brought by ambulance to the emergency department in acute respiratory distress. Previous literature documents that prehospital use of Continuous Positive Airway Pressure (CPAP) reduces intubation rates in patients with congestive heart failure (CHF). There is little published literature that prehospital use of CPAP reduces intubation rates in dyspnea other than CHF.

This study recorded intubation rates up to twelve hours post hospitalization for patients who received prehospital CPAP versus conventional oxygen therapy in CHF, asthma, chronic obstructive pulmonary disease (COPD), pneumonia and pulmonary edema.

Methods:

Paramedics underwent a comprehensive education session. All participants were tested on CPAP treatment protocol, inclusion/exclusion criteria of the study, and demonstrated competency on CPAP application in a skills lab session.

This study received expedited Institutional Review Board approval. Data collection began May 9, 2005 and ended May 9, 2006.

Inclusion Criteria / Indications for CPAP application:

1. Any patient in respiratory distress whose medical history, current medications, along with signs and symptoms are consistent with the diagnosis of CHF, asthma, COPD, pneumonia or pulmonary edema.
2. AND who;
 - A. Are awake and able to follow commands
 - B. Are over 17 years old and able to fit the CPAP mask
 - C. Have the ability to maintain an open and protected airway
3. AND who exhibit two or more of the following;
 - A. A respiratory rate greater than 24 breaths per minute
 - B. Pulse Oximetry of less than 94% at any time
 - C. Use of accessory respiratory muscles

Exclusion Criteria:

1. Patient is in respiratory arrest/apneic or in cardiac arrest
2. Patient is suspected of having a pneumothorax or has suffered major trauma
3. Patient has a tracheostomy
4. Patient is actively vomiting or has upper GI bleeding
5. Patient is hypotensive to the degree that their systolic blood pressure is less than 90 mm Hg or has symptom consistent with hypotension
6. The patient is known to have a "do not resuscitate status" (DNR)
7. Patients known to be pregnant or suspected of being pregnant
8. Patient is unresponsive to speech

The study group was formed from patients transported to Aultman Hospital by twenty-two suburban paramedic ambulances equipped with CPAP.

The control group received conventional oxygen therapy and was formed from patients meeting identical inclusion criteria as the study group who were transported to Aultman Hospital by thirty-one suburban paramedic ambulances not equipped with CPAP.

Procedure:

1. Assess Vital Signs
2. Attach heart monitor and pulse oximeter
3. If BP <90 systolic contact Medical Control prior to beginning CPAP
4. Verbally instruct patient.
 - i. Patient requires “verbal sedation” to be used effectively.
 - a. Example: Patient: “I can’t breath!” Care Giver: “This will help you get air in and breath easier as the pressure on the machine is increased.”
 - ii. Start CPAP at ambient pressure (‘0’ cmH₂O).
 - iii. Instruct patient to breath in through their nose slowly and exhale through their mouth as long as possible (count slowly and aloud to four then instruct to inhale slowly).
 - iv. Explain to the patient that you will begin to slowly increase the pressure and to continue exhaling out against the pressure as long as possible before inhaling.
5. Titrate the pressure over 30 to 90 seconds to:
 - a. CHF/Pulmonary Edema 10cmH₂O
 - b. All other Dyspnea 5cmH₂O
6. Treatment should be given continuously throughout transport to ED.
7. Vital Signs q5 minutes.
8. Documentation in the EMS patient care record should include:
 - a. CPAP level
 - b. O2 Sat. q5 minutes
 - c. Vital Sign q5 minutes
 - d. Effects/Adverse reactions

Results:

Study Group	n=148
Control Group	n=161
Total	n=309

Sex	Study Group	Control Group	Total	Age
Female	75 (24.3%)	104 (33.7%)	179 (58%)	72.7 ± 0.86
Male	73 (23.6%)	57 (18.4%)	130 (42%)	69.5 ± 1.12

Patients are classified by primary admission diagnosis:

Diagnosis	Study group (n=148)				Control group (n=161)			
	Intubated		Not intubated		Intubated		Not intubated	
	n=	%	n=	%	n=	%	n=	%
CHF	1	0.7	50	33.8	22	13.7	60	37.3
Asthma	3	2.0	16	10.8	2	1.2	5	3.1
COPD	3	2.0	52	35.1	15	9.3	28	17.3
Pneumonia	0		3	2.0	2	1.2	6	3.7
Pulm Edema	4	2.7	11	7.4	6	3.7	1	0.6
Other	2	1.4	3	2.0	9	5.6	5	3.1
Total	13	8.8	135	91.2	56	34.8	105	65.2

Summary of Results:

1. Intubation rates were decreased from 34.8% in the control group to 8.8% in the study group. The percent of intubation reduction from the control to study group=26.0% with 95% CI (16.7, 35.3), p-value<0.001.
2. CHF consisted of the largest study population (n=133) and the largest reduction in intubation (13%)
3. COPD consisted of the second largest study population (n=98) and the second largest reduction in intubation (7.3%)
4. Asthma consisted of the third largest study population (n=26) and did not demonstrate a reduction in intubation. The authors have an explanation for this.
5. Pulmonary edema consisted of the fourth largest study population (n=22) and demonstrated a 1% reduction in intubation.
6. The "other" classification consisted of the fifth largest study population (n=19) and the third largest reduction in intubation (4.2%). The patients in this category had a primary admitting diagnosis of one of the following:
 - a. Respiratory Failure
 - b. Hypoxemia,
 - c. Hypercapnia
 - d. Respiratory Acidosis

All of the patients had a secondary admitting diagnosis of CHF, COPD, or Pulmonary Edema.

A total of 70 patients received CPAP and were excluded from the study for the following:

- a. 52 patients with DNR or made DNR during the first 12 hours of hospitalization.
- b. 15 patients demonstrated a decreased level of consciousness or were not able to follow commands prior to CPAP application.
- c. 3 patients under 17 years of age

Conclusion:

The group effect for patients who received prehospital CPAP for the treatment of CHF, asthma, COPD, pneumonia and pulmonary edema had a significantly lower incidence of intubation for up to twelve hours post hospitalization.

Discussion:

Strengths:

1. In reviewing published literature 1985 to present, the authors found this study to be the largest randomized study comparing CPAP to conventional oxygen therapy.

Source	Location	Sample Size
Marchetta et al 2007	53 Ambulances and 1 ED in the United States	309
Nava et al 2003	5 ED's in Italy	130
Levitt, 2001	1 ED in the United States	38
Masip et al 2000	1 ICU in Spain	40

2. CPAP was not discontinued due to any complications such as pneumothorax, hypotension, or vomiting/aspiration.
3. Although this abstract analyzed intubation rates and not length of stay, the authors are compelled to report that patients in the study group had an average decrease in length of stay of 2.4 days.
4. The study demonstrated that prehospital use of CPAP was a beneficial therapy in reducing intubation rates in dyspnea other than CHF.

Limitations:

1. Only one CPAP model available for prehospital care was used for this study.
2. Only one hospital was utilized for this study.
3. Twelve hours post hospitalization was used as the conclusion of data collection for intubation. There is no literature available to reference this timeframe as an appropriate endpoint.
4. The study protocol utilized 10cm/H₂O for CHF/pulmonary edema and 5cm/H₂O for other forms of dyspnea. Higher CPAP pressures were not studied.

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