Hereland Clinic Hillcrest Hospital

Abstract.

Purpose: To determine if end tidal carbon dioxide (etCO²) values in a post-anesthesia care unit increased nurses' perceptions of confidence in patients' readiness for discharge to next level care. **Methods:** This was a prospective, cross-sectional, comparative, one-group (pre-post) design. Nurses completed an assessment of confidence in readiness for discharge on a 1 to 10 scale, where 1, not confident at all and 10, completely confident at 2 time points; when they believed a patient was ready for discharge (pre) and after monitoring etCO₂ for 3 minutes (post). The case report form included patients' pain level at discharge (on a 0-10 standard scale), body mass index (BMI), history of obstructive sleep apnea, and narcotic use in post-anesthesia care. It also included 3 nurse characteristics: years as a RN, years in the current unit and prior work setting. Analysis included descriptive statistics and paired t-tests. Linear regressions were used to compare mean difference in nurses' perceptions of pre-post readiness for discharge, after creating 3 categories of etCO₂ (low, <30 mmHg; normal, 30-44 mmHg and high, > 44 mmHg) values. **Findings:** Of 133 patients, mean (SD) age was 57.9 (16.0) years, 50.4% were male, 12.1% had history obstructive sleep apnea, and 54.1% had trunk surgeries. Patients' mean pain score at discharge readiness was 2.3 (2.4) and etCO₂ was 36.1 (5.7) mmHg. Mean years as a RN was 9.2 (9.1), years in post-anesthesia care was 3.0 (2.9). Nurse mean confidence in readiness for patients' discharge was 9.6 (0.61) pre-etCO₂ assessment and 9.7 (0.59) post- etCO₂ assessment. Using 3 categories of etCO₂, nurses confidence in readiness for discharge differed from pre-to-post etCO₂ assessment (p<0.001); nurses were more likely to lower their confidence score when etCO₂ was low (p=0.003) or high (p=0.005), compared to normal values. Female gender was the only patient factor that increased the likelihood of nurses' lowering their confidence in discharge readiness, p=0.044. No nurse factor was associated with confidence in patient readiness for discharge. After controlling for patient gender, etCO₂ remained an important factor in nurses' confidence in readiness for discharge (p < 0.001). **Recommendations for practice:** In a post-anesthesia care unit, etCO₂ assessment is not an objectively assessed component of discharge planning. Based on results of this single-center study, etCO₂ may increase nurses' confidence that patients are ready for discharge. Future research should be conducted to determine if $etCO_2$ assessment may alter discharge time and reduce untold complications after surgery.

Background & Significance

- Post-surgical patients are at risk for respiratory complications
- End tidal CO₂ monitoring may be an early indicator of postoperative respiratory depression
- End tidal CO₂ values are not routinely obtained in the post anesthesia care unit (PACU) unless ordered by providers
- An end tidal CO₂ value is not routinely obtained as a part of the PACU discharge score.

Purpose

To determine if end tidal carbon dioxide ($etCO_2$) values in a post-anesthesia care unit increased nurses' perceptions of confidence in patients' readiness for discharge to next of level care.

Research Questions.

- 1. Does etCO₂ (capnography) monitoring for a short period (3 minutes) change nurses' confidence in readiness for discharge from PACU?
- 2. Are patient and nurse factors associated with a significant change in nurses' confidence in readiness for discharge from pre- to post-capnography monitoring?

Effect of End Tidal CO, on Nurses' Confidence in Patient **Readiness for Post-Anesthesia Discharge**

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Methods.

Design

Prospective, cross-sectional, comparative, one-group (pre-post) design

Setting & Sample

- Setting: Hillcrest Hospital, a 500 bed medical center in Northeast Ohio
- Subjects: adult patients in PACU who were ready for discharge based on nurses' assessment using a valid and reliable discharge score tool
- Patients had surgical procedures and general anesthesia
- Exclusion criteria: undergoing facial surgery and those with continuous capnography monitori orders in PACU
- Participants: a convenience sample of PACU nurses who were willing to assess patients' etCC pre discharge and complete a case report form.

Intervention

- $etCO_2$ monitoring:
- Pre discharge, nurses connected patients to an etCO₂ module that was part of the hemodynamic monitoring system
- etCO₂ was monitored for 3 minutes

Outcomes and measurement

- Nurses' confidence in readiness for discharge from PACU: an investigator-developed case report form was used. Nurses responded using a numerical scale from 0, not confident at all to 10, completely confident.
- Patient factors: using an investigator-developed case report form that provided the following: body mass index, history of obstructive sleep apnea, narcotic pain medicine administered in F
- Nurse factors: years as a RN, years as a PACU RN, and prior work environment before PACU

Data Collection

- Nurses received the case report form and carried out the following steps for each patient enroll
- Competed a self-assessment of confidence in patient's readiness for discharge (pre-intervention)
- 2. Measured and recorded etCO₂ level after 3 minutes of monitoring
- 3. Competed a self-assessment of confidence in patient's readiness for discharge (post-intervention)
- 4. Record patient and nurse characteristics

Data Analysis Plan

- Categorical variables were described as frequencies and column percentages
- Continuous variables were reported as means (standard deviations)
- Linear regression methods were used to assess the relationships between the differences between post and pre-confidence scored and categorical and continuous measures.
- For categorical variables the mean difference in nurses' perceptions of pre-post readiness for discharge for each level within a category were computed and pairwise mean comparisons with Tukey-Kramer adjustments for multiple comparisons were run to test for statistically significant mean differences.
- In each case the number of means for comparisons were determined by the number of levels within a given category. Differences in category means with p < .05 were considered statistically significant.
- For continuous measures, differences in nurse perceptions were regressed against the continuous measure and the slope of the resultant regression line was tested against the probability that the slope was significantly different from 0.
- In all cases a test *p*-value < .05 was considered significant.

	 In total, 133 patients were assessed pre- and post- etCO₂ monitoring by PACU nurses. Patients: mean age was 57.9 (16.0) years. By gender, patients were evenly matched; 84.2% of patients were Caucasian. See Table 1 			
t	Table 1			
ing D ₂	Patient Factors n(%) except where notedTotal (NAge, years; mean (SD)57.9 (Gender, Female66 (4Body Mass Index*; mean (SD)31.1Race, Black21 (1Marital Status, Married (versus all other options)82 (6Insurance type, Private + Other vs other options92 (6Surgical classification, trunk (versus limb or no incision)72 (5Length of stay; mean (SD)1.01etCO2 level; mean (SD)36.1History- Obstructive sleep apnea*; yes16 (1Pre-discharge pain score* mean (SD)2.3 (Readmission within 30 days, no124 (9Discharge status, Home/home health/outpatient125 (9Narcotic dose, in PACU (morphine equivalent); mean mg (SD)5.9 (
PACU J	Nurse FactorsYears as an RN; mean (SD)9.2 (Years as PACU RN; mean (SD)3.0 (Previous work setting, medical or surgical, mean (SD)91 (6)			
olled:	 *Data not available for all subjects. Missing values: Body Mass Index = 1, Obstructive Sleep Pain Score = 26, Statistics presented as N (column %) or Mean (SD) Nurses' Confidence in Readiness for Discharge Post etCO2 vs Pre etC 			

- Nurses' confidence scores in readiness for discharge from PACU (
- Of 13 patient factors, nurses' confidence in readiness for discharge score only differed based on 2 factors:
- Female gender: estimate (standard error), -0.05 (0.05), p=0.044
- Readmission in 30 days, yes: 0.33 (0.14), p=0.028

Limitations:

- Single center, single unit study with convenience sampling of nurses
- Nurses who participated could have been different than non-participants
- A single etCO₂ observation of 3 minutes was used; it is unknown if a longer period of monitoring would have changed readiness for discharge
- Results may not apply to other PACU settings

Conclusion

- In a PACU setting, low and high etCO, values decreased nurses' perceptions of confidence in readiness for discharge patients who were re-hospitalized within 30-days.
- research that allows for monitoring beyond a 3 minute period is needed to learn if nuances in etCO2 values over time could have changed nurses' confidence scores.





vere Total (N=133) 57.9 (16.0) 66 (49.6) 31.1 (7.5) 21 (15.8) 82 (61.7)	 End tidal CO₂ (capnography) monitoring and change in nurses' confidence in readiness for PACU discharge Nurses' confidence scores in readiness for discharge from PACU were similar pre and post etCO₂ monitoring: mean (SD) 9.6 (0.6) vs. 9.7 (0.59), p=0.63. When etCO2 values were categorized as low, normal or high, nurses' confidence scores in readiness for discharge changed from pre to post etCO₂ monitoring, p<0.001, see Table 2. Table 2. Change in Nurses' Confidence Based on etCO₂ Value 			
92 (69.2)	Level of etCO ₂ Nurs	ses' Confidence Estima	te* Standard Error	
72 (54.1)	Low (< 30 mm HG)	-0.31	0.11	
1.01 (1.9)	Normal (30-44 mm Hg)	0.09	0.04	
16 (12.1)	High (> 44 mm Hg)	-0.67	0.23	
2.3 (2.4) 124 (93.2) 125 (94.0) 5.9 (6.2)	*, Estimate reflects the change in nurses' confidence score from post to pre etCO ₂ monitoring; negative value reflects a decrease in nurses' confidence post etCO ₂ monitoring			
9.2 (9.1) 3.0 (2.9) 91 (68.4)				
ctive Sleep Apnea = 1	- ,			
S Pre etCO2 mon differed as follow	nitoring after Adjusting for P /S:	atient and Nurse Fa	actors	

Of 3 nurse factors, none were associated with a change in scores of nurses' confidence in readiness for discharge from PACU (post versus pre etCO2)

Additionally, confidence in readiness for PACU discharge decreased post etCO, monitoring in female patients and increased post etCO, monitoring among

Although we cannot explain findings related to changes in nurses' confidence in readiness to discharge based on gender and re-hospitalization, future etCO₂