

The Effect of EtCO₂ Monitoring on the Frequency of Emergency Calls for Patients Receiving Patient Controlled Analgesia

Katherine Myers, PharmD Candidate, Patrick McCool, M.S., RRT, and Patrick E. Parker, M.S., RPh.
Department of Pharmacy, Lawrence Memorial Hospital, Lawrence, Kansas



Background

Monitoring end-tidal carbon dioxide and respiratory rates (EtCO₂) in patients receiving patient controlled analgesia (PCA) can prompt early intervention in patients who experience substantial respiratory depression, possibly resulting in fewer emergency response calls.

An emergency was defined as the need for a team of healthcare workers to immediately respond and assess patients in distress.

In September 2009, Lawrence Memorial Hospital implemented EtCO₂ monitors, in conjunction with Alaris Smart Pumps, for patients on PCA. This project was to determine if the implementation of these monitors reduced our emergency response calls.

Objective

To determine if there is a statistically significant difference in the frequency of emergency calls after implementation of EtCO₂ monitoring in patients receiving PCA.

Null Hypothesis

There is NO difference in the number of emergency calls for patients receiving PCA with or without the use of EtCO₂ monitoring.

Limitations

Emergency call data was not available for two of the 21 months before the EtCO₂ monitors were in place, so the PCA data was excluded for these months.

For statistical purposes, all patients were assumed to be on EtCO₂ monitoring after implementation. The number of patients not on EtCO₂ monitors is unknown.

EtCO₂ monitors were implemented September 19, 2009, but PCA data was only available for the month of September as a whole. This month was included in the pre-monitor data because the monitors were not in place for the majority of the month.

Methodology

All emergency calls (Code Blue and MET Calls) were reviewed for the 21 months prior to and the 17 months after EtCO₂ monitoring became available to determine if the emergency calls were likely to be related to PCA use. The data was summarized to compare the number of emergencies per PCA doses administered prior to and after implementation of EtCO₂ monitors.

Criteria for inclusion involved patients with an emergency call who were on PCA at the time of the call. Exclusion criteria eliminated patients not on PCA during the time of the emergency call.

The number of PCA doses was determined through billing documentation for the time period noted above. The frequency of emergency calls associated with PCA use was assessed to compare the two time periods.

The data was analyzed using Fisher's Exact testing for statistical significance, a priori set at p = 0.05.

Conclusion

There was an overall trend toward fewer emergency calls after implementation of EtCO₂ monitoring, but the difference is not statistically significant. (p value = 0.1411). More data is needed to assess this trend.

All of the emergency calls occurred within 24 hours of starting the PCA.

After implementation of EtCO₂ monitors, three patients NOT on EtCO₂ monitoring had emergency calls. If these patients are excluded, there is a statistically significant difference in emergency calls before and after implementation of EtCO₂ monitors (p value = 0.0078).

Results

Emergency Calls Associated with Patients Receiving PCA

Date Range	Emergency Calls	Total PCAs	p Value
Before EtCO ₂ Monitoring*	8	3082	--
After EtCO ₂ Monitoring - All Data**	3	3013	0.1411
After EtCO ₂ Monitoring - Monitors Used***	0	3013	0.0078

- Data is missing for two months during the time period before the monitors were implemented; only 19 months of data is shown.
- ** Three patients had emergency calls after implementation of EtCO₂ monitoring. However, none of these patients were using EtCO₂ monitors at the time of the call because they were in Radiology.
- *** Statistical assessment assuming all patients were on EtCO₂ monitoring.

Drugs Associated with Emergency Calls in Patients Receiving PCA*

Drug	Emergency Calls	Total PCAs	Calls/1000 Doses
Hydromorphone	5	1633	3.06
Fentanyl	3	1668	1.80
Morphine	3	2773	1.08

*21 meperidine PCAs were used during the same time period but none were associated with emergency calls.

Time in Hours for Emergency Calls After Initiation of PCA

Average	Range
8 hours 26 minutes	2 – 20 hours

Note: Data for the eleven emergency calls

Discussion

Our data supports the theory that EtCO₂ monitors can help prevent emergency calls in patients on PCA. Since the implementation of the monitors at LMH, no emergency calls have occurred in patients on PCA who were also on an EtCO₂ monitor.

In order for the EtCO₂ monitors to be effective, they must be used. The three emergency calls that occurred after implementation of the monitors were for patients who did not have the monitor on because they were in radiology.

Future directions:

- Improved assessment of EtCO₂ monitor use, including possible elimination of use after 24 or more hours on PCA.
- Complete emergency call data for retrospective and ongoing PCA use for presentation at LMH improvement forums.
- Assess EtCO₂ monitors for patients receiving high doses of narcotic analgesics by other routes as a means to further prevent emergency calls.

Disclosure

Authors of this presentation have the following to disclose concerning possible financial or personal relationships with commercial entities that may have a direct or indirect interest in the subject matter of this presentation:

Katherine Myers - Nothing to disclose, Patrick McCool - Nothing to disclose, Patrick E. Parker - Nothing to disclose