Developing a Respiratory Depression Scorecard for Capnography Monitoring

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Abstract
Pulse oximetry is the most common way to measure a patient's respiratory status in the hospital setting; however, capnography monitoring is a more accurate and sensitive technique which can more comprehensively measure respiratory function. Due to the limited number of capnography monitoring equipment at the University of Minnesota Medical Center-Fairview (UMMC-Fairview), we analyzed which patients should preferentially be chosen for capnography monitoring over pulse oximetry based on risk of respiratory depression. We conducted a retrospective chart review of all serious opioid-induced over-sedation events that occurred at UMMC-Fairview between January 1, 2008 and June 30, 2012. Thirteen risk factors were identified which predispose patients to respiratory depression. The average patient demonstrated 3.75 risk factors. The most commonly occurring risk factor was the concomitant use of multiple opioids or an opioid and a CNS-active sedative, followed by an ASA score ≥ 3. Based on this data, we developed a scorecard for choosing patients at the most risk of developing respiratory depression; these patients are the best candidates for capnography. Although further studies are necessary to corroborate this research, at this time giving extra consideration to patients demonstrating the previously stated risk factors is prudent when assessing those patients most in need of capnography.

Introduction

Pulse oximetry is the current standard of practice for monitoring a patient's respiratory status in the hospital setting. A pulse oximeter sensor is placed on a thin part of a patient's body, usually on a fingertip or earlobe. It uses a light-emitting diode and photo detector to measure changes in the wavelength of the light due to absorption by oxygenated hemoglobin. Therefore, it obtains a measurement of the percentage of a patient's hemoglobin that is saturated by oxygen molecules[1, 2, 3]. A healthy person should have an arterial oxygen saturation level of 97-99%, and anything less than 90% is considered hypoxic[3]. Pulse oximetry has been described as "arguably the most significant technological advance ever made in the monitoring of the wellbeing and safety of patients during anesthesia, recovery, and critical care" as prior to its advent the primary way of measuring hypoxemia was assessing the skin for cyanosis[3, 4].

However, despite the huge medical monitoring advancement oximetry has proven to be, it is not perfect, and there have been instances when oximeters have failed to alert a nurse that a patient was in respiratory distress[4]. A major disadvantage of pulse oximetry is that it only measures oxygenation of the arterial blood and therefore can only detect hypoxemia[1-5]. It does not have the capability to measure ventilation status or the adequacy of carbon dioxide elimination; therefore it is not an all-encompassing tool to measure respiratory function[4]. Additionally, pulse oximetry is unable to detect important early indicators of respiratory depression such as changes in respiratory rate, pauses in breathing, or decreases in exhaled carbon dioxide levels[1]. Also, pulse oximeters may give deceptive results under certain situations, such as when a patient is receiving supplemental oxygen, has weak pulses, has poor perfusion, or has a dyshemoglobinemia[1-3, 5].

The term capnography refers to the monitoring of the partial pressure of carbon dioxide during exhalation, and it has been shown to be a more reliable way of detecting respiratory depression[1, 5]. Capnography is more sensitive than pulse oximetry in detecting respiratory abnormalities, and it can more rapidly detect acute changes in respiratory status[5]. Unlike a pulse oximeter, capnography monitoring involves wearing a nasal cannula. The cannula contains an infra-red light and a sensor, which detects the amount of carbon dioxide being exhaled based on changes in the amount of infra-red light returning to the sensor.

Capnography monitoring can measure many more components of respiration than pulse oximetry. Respiratory rate, exhaled carbon dioxide levels, and apneic events or pauses in breathing can all be detected by capnography. Additionally, the patient can also receive supplemental oxygen through the nasal cannula[1]. Capnography monitoring is proactive, as respiratory status is measured in real-time by continuously measuring expiratory carbon dioxide. In contrast, pulse oximetery monitoring is more reactive, as it only detects hypoxemia, providing an indirect measurement of respiratory function[5].

The major downfall of capnography is its invasiveness and potentially reduced patient compliance, as some patients refuse to wear the nasal cannula. Additionally, there is a potential for capnography failure in patients who have severely congested nasal passages or significant deviation of the nasal structures. To bypass this problem, some capnography devices contain an attached mouth piece; these devices are able to measure the exhaled carbon dioxide via the nose and mouth. Therefore, capnography would still be a feasible option for these patients as long as the patient can breathe through the mouth. [Note: the capnography device (Oridion Capnostream) used at UMMC-Fairview does contain a mouth piece.]

There are several reports in the literature that illustrate the superiority of capnography over pulse oximetry. In a study by Hutchison and Rodriguez conducted in post-orthopedic surgery patients at risk for developing obstructive sleep apnea and receiving opioids, capnography detected 146 episodes of respiratory depression while pulse oximetry detected only six[1.] Cacho et al. monitored 50 patients receiving opioids, benzodiazepines, and/or propofol during colonoscopy using pulse oximetry and capnography simultaneously and found that pulse oximetry only detected 38% of the oxygen desaturation episodes detected by capnography[5]. While there is consensus within the medical community regarding the superiority of capnography compared to pulse oximetry, the use of capnography is still limited. Although its use has recently grown from being used to monitor intubated patients under general anesthesia to other hospital settings and during emergent situations[5, 6], capnography is still far from being routinely used hospital-wide.

The main reason the use of capnography is not more widespread is due to the fact that there has not been a strong consensus on which patients should receive capnography monitoring. The Joint Commission suggested capnography in patients receiving opioid analgesics, but has not further specified which patients or taken a strong stand on this[7]. The Anesthesia Patient Safety Foundation stated that capnography should be used in patients who require supplemental oxygen[8]. As it stands, much of the decision-making regarding which patients will get capnography monitoring and which patients will get pulse oximetry is left up to the individual hospitals and health systems, rather than being directed by national group or association consensus.

Currently, there is a limited number of capnography monitoring equipment available at the University of Minnesota Medical Center-Fairview (UMMC-Fairview), and no solid criteria has been established at that institution regarding which patients should be monitored with capnography and which patients can be safely monitored by oximetry. Therefore, the aim of this research was to develop a scorecard for identifying those patients at UMMC-Fairview who are at the highest risk for experiencing respiratory depression during their hospitalization. These patients are the ideal candidates for capnography monitoring and should preferentially be chosen over other patients to receive capnography monitoring instead of pulse oximetry monitoring. It has been estimated that opioid-induced respiratory depression in the hospital setting occurs as frequently as one in every 200 patients[7]. Therefore, a retrospective chart review of opioid-induced adverse events was conducted to identify the most significant risk factors for developing opioid-induced respiratory depression.

Methodology

This study was approved by the University of Minnesota Institutional Review Board (IRB); IRB code number 1206M16442. A retrospective chart review was conducted for all serious opioid-related over-sedations that occurred within UMMC-Fairview hospitals (including both East and West banks, but excluding Amplatz Children's Hospital) from January 1, 2008 to June 30, 2012. Serious adverse events were defined as those classified as Category F, G or H according to the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) criteria. Per these criteria, a category F event is defined as an error that may have contributed to or resulted in temporary harm to the patient and required initial or prolonged hospitalization. A category G event is defined as an error that may have contributed to or resulted to in permanent patient harm. A category H event is defined as an error that occurred that required intervention necessary to sustain life[9] (see Table 1)

Records of adverse events that occurred during this time period were accessed through Fairview's adverse event reporting system, I-CARE. I-CARE is a confidential adverse event reporting system. When a patient at a Fairview hospital receives naloxone (an opioid antagonist given during suspected or confirmed opioid overdose) an automatic trigger alerts the pharmacist. The pharmacist is then required to conduct a patient safety review and report the over-sedation event in I-CARE.

Once the adverse event records meeting the inclusion criteria were accessed through I-CARE, the patient involved in the adverse event was identified through the I-CARE report. Throughout the duration of the study, each patient was solely identified by the twelve digit I-CARE event tracking number which was assigned to each adverse event upon reporting it

to the I-CARE system. Prior to any data collection, each patient's chart was reviewed to ensure that the patient did not object to the use of their medical records for research purposes, as designated on the 'Consent for Services' form filled out by each patient on admission to the hospital. Once consent to use the patient's medical record was verified and documented, the patient's electronic medical record (EMR) and paper chart were reviewed to collect additional data surrounding the adverse event. Data collected included the following:

1. Opioid(s) the patient was taking that led to the adverse event
2. American Society of Anesthesiologists Physical Status Classification System (commonly referred to as the ASA score) which is a system of assessing patients' fitness or physical status prior to surgery. The categories are[10]:
    a. ASA 1: a normal healthy patient,
    b. ASA 2: a patient with mild systemic disease,
    c. ASA 3: a patient with severe systemic disease,
    d. ASA 4: a patient with severe systemic disease that is a constant threat to life,
    e. ASA 5: a moribund patient who is not expected to survive the operation,
    f. ASA 6: a declared brain-dead patient whose organs are being removed for donor purposes

    [Note: The ASA score was only included if the patient had surgery during the admission during which the adverse event occurred.]
3. Renal or hepatic insufficiency, documented in history & physical or other notes from the admission during which the adverse event occurred; conditions included are hydronephrosis, history of renal transplant or heminephrectomy with baseline elevated serum creatnine (SCr) (defined as SCr > 1.25 mg/dL), chronic kidney disease (CKD) from any cause, diabetic nephropathy with baseline elevated SCr, hepatitis, cirrhosis, end-stage liver disease (ESLD) from any cause, and history of liver transplant
4. Patient age at the time of the adverse event
5. Use of a patient-controlled analgesia pump (PCA pump)
6. Other central nervous system/sedating medications the patient was taking concurrently with the opioid; medication classes included in this study are benzodiazepines, barbiturates, hypnotics such as 'Z-drugs' (zolpidem, eszopliclone, and zaleplon), and first-generation H_1 antagonists
7. Diagnosed lung disease; conditions included are asthma, chronic obstructive pulmonary disease (COPD), cystic fibrosis (CF), chronic shortness of breath, chronic dyspnea on exertion, emphysema, history of lung transplant, pulmonary fibrosis, and lung cancer
8. Body mass index (BMI), calculated with the weight and height of the patient during the admission during which the adverse event occurred
9. Diagnosed sleep apnea
10. Diagnosed muscular-skeletal disorder; conditions included are multiple sclerosis (MS), Bell's Palsy, chest muscle atrophy, and paralysis
11. Unstable post-anesthesia care unit (PACU) transfer, which was defined as any patient requiring supplemental oxygen upon transfer out of the PACU
12. High opioid dose; defined as:
    a. Fentanyl patch dose > 50mcg/hr
    b. Methadone use
    c. IV hydromorphone dose ≥ 1mg or equivalent
    d. Long-acting opioid formulations with a total daily dose > 30mg oral morphine or equivalent
    e. Long-acting opioid formulations with as needed (PRN) instructions or dosage ranges

    Note: all equivalent doses calculated based on standard accepted opioid conversions[11]
13. PCA pumps with a basal rate being used in a opioid-naïve patient (opioid naïve being defined as daily total oral morphine dose < 30mg or equivalent[11])
14. Dose stacking, defined as rapid subsequent administration of multiple doses of medications

The above criteria were chosen as data collection points based on risk factors for respiratory depression as reported in the literature[7, 8, 12-16]. In addition, data such as renal and hepatic function, dose stacking, and ASA score were collected based on input from the multi-disciplinary work group involved in the implementation of the widespread use of capnography throughout the hospital. Cut-offs for ASA score and age to be considered a risk factor were determined to be ASA score ≥ 3 and age ≥ 65 years. Obesity was defined as a BMI ≥ 35.

Results

During the study period, 49 serious opioid-related adverse events occurred, of which 40 were included in the study. There were 30 category F events, zero category G events, and 19 category H events. Of these 49 events, nine patients/events were excluded due to patients not

consenting to the use of their medical records for research purposes (n=3) and inability to locate the patient's paper charts or an incomplete EMR due to a system outage during the time that the adverse event occurred (n=6).

Table 2 displays the breakdown of each risk factor with the associated number and percentage of patients with each risk factor. Even though the total study population was 40 patients, not all patients were able to be assessed for all risk factors. Due to incomplete medical records, BMI information and all medication administration records could not be collected for all patients. Additionally, ASA score was not calculated for patients who did not undergo a surgery during their hospitalization, and PCA use in the opioid naïve could only be determined for patients on PCAs. Therefore, the total number of patients assessed for each condition is also noted in the table.

In almost 90% of all patients who experienced an opioid-induced over-sedation, the patient was on multiple sedating medications, including multiple opioids. Three out of four patients studied had an ASA score greater than 3. Approximately one-third of patients exhibited the risk factors of high opioid dose, PCA use, diagnosed lung disease, renal or hepatic dysfunction, dose stacking, age ≥ 65, PCA with a basal rate used in an opioid naïve patient, and BMI ≥ 35. Diagnosed sleep apnea, muscular disorder, and unstable PACU transfer were rarely-seen risk factors, occurring in 12.5% or less of the study population.

Of the 13 risk factors listed above, all but one patient in the study displayed multiple risk factors. Most patients had a sum total of four risk factors for respiratory depression (n=11), followed by three risk factors (n=9), two risk factors (n=8), five risk factors (n=5), six risk factors (n=5), one risk factor (n=1), and seven risk factors (n=1). No patients in this study had zero risk factors or greater than seven risk factors. The distribution of the number of risk factors was noted to fall in a bell-shaped curve with the average patient having a total of 3.75 risk factors. Both the median and mode were 4 risk factors.

The majority of patients who experienced an opioid-induced adverse event were taking one opioid concurrently (n=21), followed by two concurrent opioids (n=15), and three concurrent opioids (n=4). The most commonly implicated opioid was fentanyl IV boluses, followed by hydromorphone PCAs and hydromorphone IV boluses. The majority of the CNS-active/sedating medications used concurrently with opioids in this patient population were benzodiazepines followed by first generation H_1 antagonists (Table 3). There are no hospital-wide standing orders that dictate the predominant use of fentanyl, which would have helped to explain why fentanyl is the most frequently implicated opioid. However, at UMMC-Fairview fentanyl is frequently used in the operating room and ICU, and is part of the order set for procedures such as endoscopy.

Half of our patient population (n=20) had three or four risk factors for developing respiratory depression, and the average, mean, and median fell within the range of three to four risk factors. Therefore, it was decided to further quantify the most common risk factors present in the most 'average risk' (3-4 risk factors) patient. This provides a method for distinguishing the most frequently implicated, and hence critical risk factors for respiratory depression present in these patients; in other words, a way to 'tease out' the most important risk factors. Since the aim of this research was to develop a scorecard for assessing those patients most at risk for experiencing an opioid-induced over-sedation, this also helps to limit, focus, and specify the risk factors of most concern to consider while developing the scorecard.

The results of this analysis are shown in Table 4, which describes the associated number and percentage of patients with each risk factor. Eighty-five percent of all three and four risk factor patients were taking more than one CNS-active sedative medication, including multiple opioids. Forty-six percent of patients had an ASA score ≥ 3, and 45% of patients experienced opioid dose stacking. Forty percent were opioid naïve but had a PCA with basal rate. Approximately one-third of 'average risk' patients exhibited the risk factors of high opioid dose, diagnosed lung disease, and renal or hepatic insufficiency. BMI ≥ 35, PCA use, age ≥ 65, muscular disorder, and unstable PACU transfer occurred in one quarter or less of the 'average risk' patient population. No patients in the average risk group had diagnosed sleep apnea.

The frequency of risk factors in the 'average risk' patient group was similar to that of the entire study population. The number one and number two risk factors in both groups—multiple CNS-active sedatives, including multiple opioids and ASA score ≥ 3, respectively—were the same between the two groups. The most significant difference between the two groups was the frequency of dose stacking, which was 30% in the entire study population compared to 45% in the 'average risk' patients.

Based on the frequency of multiple risk factors per patient and the quantification of the most critical risk factors in all and in 'average risk' patients, the scorecard was developed (Figure 1). Since ASA ≥ 3 and use of multiple opioids or CNS-active sedatives were the two most commonly implicated risk

factors in the entire study population and the 'average risk' subset, it was decided these risk factors should be weighted more heavily compared to the other risk factors. Therefore, in developing the scorecard, these two risk factors are scored as two points (the equivalent of 2 risk factors), while the other risk factors are scored as one point. After calculating the sum total of the risk factors—called the 'risk factor equivalent'—if that number is five or greater, the patient should be preferentially considered for capnography. Unstable PACU transfer and dose stacking were excluded for the purpose of developing the scorecard as they are risk factors that are not based on patient characteristics or medication regimens, but rather are indicative of errors or oversights in care that can contribute to opioid-induced respiratory depression.

Discussion

We examined the most significant risk factors in predicting an opioid-induced respiratory depression event in a retrospective chart review of patients at UMMC-Fairview. We demonstrated that an ASA score ≥ 3 and concomitant use of multiple opioids or an opioid and another CNS-active sedative are the two most significant risk factors in predisposing a patient to this type of adverse event. Therefore, these risk factors should be given additional consideration when determining a patient's respiratory depression risk.

The author did not know at the start of the study that the data would suggest a 'risk factor equivalent' score of 5. The decision to use 5 as the cut-off at which capnography should be considered was based on several factors. Primarily, the data collected during the study suggested 5 as an appropriate cut-off. As the average patient in our study had 3.75 risk factors, patients with five or more 'risk factor equivalents' were assumed to be a higher risk patient and would be considered good candidates for capnography. Practicality was also considered, as the goal of this research was to pare down the number and decide the importance of each risk factor. It was crucial to design the scorecard in a way that the most at-risk patients can be identified yet limited to a manageable number that can realistically be monitored by the hospital's capnography resources. Therefore, our scorecard was constructed with 5 'risk factors equivalents' as the cut off. When our study population was assessed with this scorecard, 20 patients (50%) would have met criteria for capnography monitoring.

Our results were somewhat consistent with already established guidelines for identifying patients at risk for respiratory depression. The American Society of Anesthesiologists Task Force (ASATF) recommends that particular attention should be directed toward those with obstructive sleep apnea, coexisting disease or conditions (e.g., obesity, diabetes), preoperative medications (including opioids), high opioid doses, concomitant use of opioids with sedatives or hypnotics, and extremes of age when identifying at-risk patients[13]. The Anesthesia Patient Safety Foundation (APSF) lists obstructive sleep apnea, obesity, and chronic opioid therapy as risk factors of concern[8]. The Joint Commission states sleep apnea, morbid obesity, snoring, old age, no recent opioid use, post-surgery, increased opioid dose requirement, longer length of time receiving general anesthesia during surgery, concomitant use of other sedating medications, preexisting pulmonary or cardiac disease, smoker, and thoracic surgical incisions as characteristics of patients who are at higher risk of respiratory depression[7]. Both Joint Commission and ASATF guidelines mention the significance of concomitant use of opioids with sedatives/hypnotics, a risk factor which was also strongly corroborated by the results of this study, as it was our most significantly predictive risk factor. Although no group specifically identified a high ASA score as a risk factor, having an ASA ≥ 3 indicates the presence of severe systemic disease; a patient with a coexisting disease such as obesity or sleep apnea (risk factors mentioned in all three sets of guidelines) would likely be assigned an ASA score ≥ 3 anyway.

It is also worth mentioning that some of the risk factors examined in this study are modifiable and can be omitted with sound judgment from the health care provider. Dose stacking, the practice of rapid and subsequent administration of sedating mediations, was implicated in 30% of over-sedation events in this study. Nurses need to be cautious about using too many sedating medications in a patient in a short time span to avoid over-medicating, and should also be utilizing non-pharmacological methods to relax and comfort patients, such as repositioning or distraction. Unstable PACU transfers were only a contributing factor in 5% of over-sedation events in this study, but continued, careful assessment is necessary prior to patient transfer to assure good outcomes. Finally, one-time bolus dosing, especially fentanyl boluses, is common is procedural areas. Limiting the amount of bolus dosing and being cognizant of the cumulative amount given in multiple boluses is another important safety measure. While capnography is a sensitive tool, too many bolus doses can quickly cause respiratory depression even before capnography is able to detect the decreasing expiratory carbon dioxide levels.

There are also many opportunities for pharmacists to prevent respiratory depression and over-sedation events before they occur. High opioid doses were a contributing factor in 40% of over-sedation events in this study. Although at times high opioid doses are necessary for opioid-tolerant patients

experiencing intractable pain, careful pharmacist assessment is prudent in preventing an accidental overdose. PCA usage is another area for pharmacists to be extra vigilant. The use of a PCA with a basal rate in an opioid naïve patient was involved in 27% of over-sedation events in this study. Although PCA order sets specifically advise against this practice, it still sometimes occurs. This is an area of opportunity for pharmacists to intervene on the patient's behalf, verifying the patient's use of opioids prior to admit, as well as educating physicians on the importance of reserving basal rates for opioid tolerant patients, until the need for a basal rate is otherwise demonstrated.

There are several limitations to this research. Most significant is the small sample size. Our study was not adequately powered; rather, the aim was to identify trends which could be useful to distinguish between patients. Additional studies examining a larger patient population would help to further guide the determination of the most important risk factors in the prediction of respiratory depression. Additionally, since the scorecard generated by the results of this study has not been tested or validated, it should be seen as guide and not a diagnostic tool for identify the most at-risk patients.

In conclusion, the results of this retrospective chart review seem to demonstrate that the most important risk factors in predicting those patients most at risk for respiratory depression are ASA score ≥ 3 and the concomitant use of multiple opioids or an opioid and another CNS-active sedative. Further studies are warranted to support these results. At this time, however, giving extra consideration to patients with these two important risk factors is likely prudent to decide the best candidates for capnography.

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Table 1: The National Coordinating Council for Medication Error Reporting and Prevention Index for Categorizing Medication Errors

Category	Description
A	Circumstances or events that have the capacity to cause error.
B	An error occurred but the error did not reach the patient.
C	An error occurred that reached the patient but did not cause patient harm.
D	An error occurred that reached the patient and required monitoring to confirm that it resulted in no harm to the patient and/or required intervention to preclude harm.
E	An error occurred that may have contributed to or resulted in temporary harm to the patient and required intervention.
F	An error occurred that may have contributed to or resulted in temporary harm to the patient and required initial or prolonged hospitalization.
G	An error occurred that may have contributed to or resulted in permanent patient harm.
H	An error occurred that required intervention necessary to sustain life.
I	An error occurred that may have contributed to or resulted in the patient's death.

Table 2: Frequency and percentage of each risk factor in our entire study population

Risk Factor	Number of Patients	Total Number Patients Assessed	Percentage
Multiple CNS/Sedating Meds	33	38	86%
ASA≥3	21	28	75%
High Opioid Dose	16	40	40%
PCA Use	15	40	37.5%
Diagnosed Lung Disease	14	40	35%
Renal or Hepatic Insufficiency	14	40	35%
Dose Stacking	12	40	30%
Age≥65	11	40	27.5%
PCA with Basal Rate in Opioid Naive	3	11	27%
BMI≥35	10	37	27%
Diagnosed Sleep Apnea	5	40	12.5%
Muscular Disorder	4	40	10%
Unstable PACU Transfer	2	40	5%

Table 3: The most commonly implicated medications in respiratory depression events in the study population

Medication	Number
	Opioids
Fentanyl IV bolus	15
Hydromorphone PCA	13
Hydromorphone IV bolus	11
Oxycodone IR	6
Morphine IV bolus	4
Percocet	4
Methadone	4
Fentanyl patch	2
Oxycontin	2
Morphine PCA	2
Norco 5/325	1
	CNS-active sedatives
Benzodiazepines	
Midazolam	12
Lorazepam	5
Clonazepam	1
Alprazolam	1
First-generation H_1 Antagonists	
Diphenhydramine	5
Hydroxyzine	1
Others	
Zolpidem	2

Table 4: Frequency and percentage of each risk factor in 'average risk' (3-4 risk factor) patients

Risk Factor	Number of Patients	Total Number Patients Assessed	Percentage
Multiple CNS/Sedating Meds	17	20	85%
ASA≥3	6	13	46%
Dose Stacking	9	20	45%
PCA with Basal Rate in Opioid Naive	2	5	40%
High Opioid Dose	7	20	35%
Diagnosed Lung Disease	7	20	35%
Renal or Hepatic Insufficiency	7	20	35%
BMI≥35	5	19	26%
PCA Use	5	20	25%
Age≥65	5	20	25%
Muscular Disorder	2	20	10%
Unstable PACU Transfer	1	20	5%
Diagnosed Sleep Apnea	0	20	0%

Figure 1: Proposed scorecard

Scorecard for Assessing Respiratory Depression Risk:

1. Give the patient one point for each of the following risk factors:
-PCA use
-PCA use with a basal rate in a opioid-naïve patient
-high opioid dose (>30mg oral morphine per day or equivalent)
-diagnosed muscular disorder
-diagnosed lung disease
-diagnosed sleep apnea
-renal or hepatic insufficiency
-BMI ≥ 35
-age ≥ 65 years

2. Give the patient two points for each of the following risk factors:
-ASA ≥ 3
-concomitant use of multiple opioids or an opioid with another CNS-active sedative (such as a benzo, barbiturate, first generation H_1 antagonist, or Z-drug)

3. Calculate the sum—the 'risk factor equivalent'. If it is five or greater, patient should be preferentially considered for capnography monitoring.