Incidence of Deep Sedation and Respiratory Compromise During Procedural Sedation

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Introduction

Moderate to deep sedation during procedures is increasingly performed outside operating rooms by non-anesthesia providers. Complications include drug related respiratory depression, desaturation and hypoventilation. Monitoring could allow detection of events before complications develop. The goal of this study is to prospectively monitor patients to determine the incidence and coincidence of hypoventilation and excess sedation during procedural sedation.

Methods

IRB approved investigator initiated trial. After written informed consent, GI or interventional radiology patients received standard monitoring during procedural sedation, which includes pulse oximetry (SpO2) and noninvasive blood pressure. Patients were also monitored for respiration rate with rainbow acoustic monitoring (RRa; Rad-87 Pulse CO-Oximeter, sw 7805, with acoustic respiration sensor, rev C; Masimo Corp, Irvine CA) and depth of sedation monitoring (PSI; SEDLine brain function monitor, sw 162; Masimo Corp). The occurrence of the following events was recorded while clinicians were blinded to RRa and PSI: SpO2 ≤92%; respiration rate of ≤8 breaths per minute (respiratory depression); respiration rate of 0-4 breaths per minute for ≥15 sec (respiratory pause); and PSI values ≤50, indicating sedation at the level of general anesthesia. The incidence of each type of event and concurrence of events were calculated.

Results

50 patients completed participation; 2 were excluded from analysis due to data collection software or monitor malfunction. Patient demographics are shown (Table 1). Of the 464 events recorded in 48 patients there were 91 respiratory pause events, 27 respiratory depression events, 303 desaturation events and 38 excessive sedation events (Table 2). Desaturation, respiratory depression or respiratory pause occurred in ≥50% of patients. The type and frequency of alarm and concurrent events is shown (Table 2). Fifteen patients (31%) had PSI values ≤ 50, indicating general anesthesia and 4% of patients had PSI values ≤ 25 indicating very deep anesthesia (Figure 1)

Discussion

Respiratory depression, apnea and deep sedation were common in our cohort of patients receiving procedural sedation. These events may not be detected by standard care monitoring of SpO2 and blood pressure. We found concurrent excess sedation or respiratory depression with SpO2 ≤92% in some patients. Our results indicate that advanced respiration rate and brain function monitoring should be considered for patients undergoing procedural sedation. Further research is planned to evaluate the outcome impact of such monitoring.

References: Curr Opin Anaesthesiol. 2010;23:523 J Clin Anesth. 2011;23:189 Br J Anaesth 2012;108:872

Table 1: Demographic and procedure characteristics of patients included for analysis. Results are expressed as mean ±SD and counts.

Table 1	
Number analyzed	48
Age years	57.8 ± 13.0
Gender: %Female; %Male	64; 36
Weight kg	80.0 ± 18.1
Height cm	166.8 ± 9.9
Number of Procedures	48
# Gastroenterology (GI)	29
#Interventional Radiology	19
Table 1: Demographic and procedure characteristics of patients included for analysis. Results are expressed as mean ± SD and counts.	

Table 2: incidence and count of alarm events in 48 adults undergoing GI and interventional radiology procedures under sedation.

Incidence of Alarm Events						
Number (%) of Patients with Alarm Events	**1 device** 40 (83.3%)		**2 devices** 21 (43.8%)		**3 devices** 6 (12.5%)	
Number (%) of Patients with Monitor Alarm on	**RRa** 24 (50%)		**SpO2** 26 (54%)		**SedLine** 15 (31%)	
Individual Alarm Events						
Type	**A: respiratory**		**B: Desaturation**		**Excess sedation**	
	Pause: RR 0 - 4 n = 91	**Depression:** RR 5 to 8 n = 27	**SpO2≤92** n = 308		**PSI≤50** n = 38	
Concurrent Events						
Type	**A + B** n = 4	**A + C** n = 1	**B + C** n = 1		**A + B + C** n = 0	
Events occurring within 5 minutes of each other						
PSI ≤ 50		**RRa ≤ 8**		**RRa ≤ 8**		
Before SpO2≤92	**After SpO2≤92**	**Before SpO2≤92**	**After SpO2≤92**	**Before PSI ≤50**	**After PSI ≤50**	
11	8	20	26	3	2	

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Figure 1: Frequency distribution of processed EEG (PSI) ranges: 61 – 80 moderate to deep sedation; 51 – 60 deep sedation to general anesthesia; 26 – 50 general anesthesia; 1 – 25 deep general anesthesia.