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Pharmacy & Therapeutics Update: Drug Information for Health Care Professionals

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Evaluation of Propofol Usage and Selected Adverse Events in Adult Patients Medication Use Evaluation Results

Background: Propofol has a rapid onset and short duration of action once discontinued; therefore, it is often used to provide sedation for patients in whom frequent neurologic evaluations may be necessary. Although propofol is a highly effective sedative agent, it has been associated with many adverse effects.[1,2]

Adverse effects commonly associated with propofol include hypotension, which is usually dose-related and occurs more frequently following bolus administration, bradycardia, and pain upon injection. In addition, rare cases of metabolic acidosis, rhabdomyolysis, hyperkalemia, and/or cardiac failure have been reported.[1,2]

Propofol is manufactured as a phospholipid emulsion that has the potential to cause hypertriglyceridemia and subsequent pancreatitis when high doses are used or when it is used for prolonged periods of time. Patients at risk of hyperlipidemia should be monitored for increases in serum triglycerides as well as elevations in pancreatic enzymes.

Propofol requires a dedicated infusion catheter when administered as a continuous infusion because of the potential for drug incompatibilities and line infections. The manufacturer suggests that the propofol infusion bottle and tubing should not hang for longer than 12 hours.[1,2]

Purpose: The purpose of this medication use evaluation (MUE) was to assess propofol usage and selected adverse events in adult patients.

Methods: Patients were identified for review based on records from the automated medication dispensing system (AcuDose-Rx®) or the pharmacy order entry system (MSMeds™) from August 2004 to April 2005.

Patients were eligible for inclusion if they were at least 18 years of age and received propofol during their hospitalization. In addition to patient demographics, the following data were obtained: admitting diagnosis, attending and prescribing physicians, service, location, indication, dose, administration method, pharmacist order review status, and adverse events.

The adverse events included pain on injection, bradycardia (ie, heart rate less than 60 beats per minute), hypotension (ie, systolic blood pressure less than 90 mmHg or a mean arterial pressure less than 60 mmHg), hypertriglyceridemia (ie, triglycerides greater than 200 mg/dL), elevations in amylase and lipase concentrations (ie, concentrations greater than 130 and 50 IU/L, respectively), and metabolic acidosis (ie, pH less than or equal to 7.25, arterial HCO_3 less than 19 mEq/L, anion gap greater than 12). Concomitant analgesic medications and documentation of propofol infusion bottle or tubing changes were also recorded.

Results: There were 124 patients and 137 records included in the data analysis. Of these patients, 63 (46%) were male, 73 (53%) were female, sex was unknown for 1 (1%) patient. The average age of the patients was 57 years (range 15 to 90 years). The average patient weight was 82 kg (range 44 to 171 kg).

A written order for propofol was documented in the chart 85% (n = 116) of the time and an order was present in MSMeds™ 88% (n = 121) of the time. Orders for propofol were not documented in the chart 15% (n = 21) of the time and orders were not found in MSMeds™ 12% (n = 16) of the time. The absence of these records may indicate emergent administration of propofol, transfer of the patient from the operating room to another unit, or lack of documentation. The formulary restriction for propofol use was followed in 96% (n = 131) of the orders documented.

Propofol was ordered for the following indications: continuous sedation (n = 92, 67%); continuous sedation during surgery or a procedure (n = 14, 10%); surgery (n = 16, 12%); and procedure (n = 7, 5%). The indication for propofol use was not documented for 5 (6%) encounters. One hundred nineteen (87%) patients received propofol via continuous infusion, compared with 13 (9%) patients receiving intravenous push.

The average initial continuous infusion rate was 38 mcg/kg/min (range 9 to 150 mcg/kg/min), which is higher than the initial rate (5 mcg/kg/min) recommended by the manufacturer for initial ICU sedation and the clinical practice guidelines by the Society of Critical Care Medicine.[1,2] The infusions continued for an average of 2.8 days (range 1 to 17 days). The minimum average daily rate for continuous infusion was 33 mcg/kg/min (range 0.85 to 150 mcg/kg/min), while the maximum average daily rate was 49 mcg/kg/min (range 4.9 to 168 mcg/kg/min). These average daily rates are consistent with those reported in the product labeling (5 to 50 mcg/kg/min). Three patients had an average maximum daily dose that exceeded the dose recommended in the *MUSC Continuous Infusion Guidelines for Adult Patients* (ie, 5 to 100 mcg/kg/min).

The average intravenous push dose administered was 1.53 mg/kg (range 0.0027 to 2.4 mg/kg) and patients received 1.8 doses on average. The average dose is consistent with the doses recommended for induction of general anesthesia (ie, 0.5 to 2 mg/kg). The average total dose given via intravenous push was 1.7 mg/kg (range 0.0027 to 3.6 mg/kg).

Adverse events that were evaluated are listed in Table 1. For the 13 patients who received propofol via intravenous push, pain on injection was monitored for and subsequently documented in 1 patient. Blood pressure was monitored in 12 (92.3%) patients, and 3 (23%) patients experienced hypotension. Systolic and diastolic blood pressures decreased from baseline by an average of 24% and 30%, respectively (range, 14 to 35%, 17 to 43%, respectively). Heart rate was monitored in 12 (92.3%) patients, and bradycardia occurred in 1 (8%) patient.

Metabolic acidosis was assessed in 108 patients (79%), but only occurred in 9 patients (6.5%). In patients who received propofol via continuous infusion for at least 72 hours (n = 35), triglycerides were monitored in 12 (34%) patients, and elevated triglycerides occurred in 6 patients. Amylase and lipase concentrations were monitored in 10 (29%) patients who received propofol for at least 72 hours, and elevations occurred in 2 patients. Propofol bottle and/or tubing changes were recorded in only 40 records (29%).

Conclusion: Propofol is being used for appropriate indications in adult patients. The initial doses used for continuous infusion and the documented adverse events

Table 1. Monitoring for and Occurrence of Selected Adverse Events

	Monitoring Documented n (%)	Occurrence Documented n (%)
Bradycardia*	12 (92)	1 (8)
Hypotension*	12 (92)	3 (23)
Pain on injection*	1 (8)	0 (0)
Amylase and lipase elevations†	10 (29)	2 (20)
Hypertriglyceridema†	12 (34)	6 (50)
Metabolic acidosis	108 (79)	9 (8)

* Monitored only in patients receiving propofol via intravenous push (n = 13)
† Monitored only in patients receiving propofol via continuousinfusion for at least 72 hours (n = 35)

are higher than those reported in the literature. Practitioners should be educated regarding appropriate dosing, duration of therapy, monitoring parameters, and adverse events.

Process Improvements: Inservices will be provided to the professional staff regarding propofol use and appropriate monitoring parameters. A standardized propofol initiation order form will be developed with weight-based dosing, titration guidelines, pertinent monitoring parameters. An entry will be placed on the medication administration record to enhance documentation of propofol infusion bottle and tubing changes.

MUE Team: This MUE was conducted by Brent Anderegg, Courtney Bickford, Wendy Bullington, Brandy Causey, Anne McDonnnell, Nicole Weimert, Cathy Worrall, Nannette Berensen, and Holly MacFall, and Kelli Davis.

References and supporting documentation for this MUE are available upon request.

MED•U•WAY Conference to Focus on Moderate Sedation

The next MED•U•WAY conference will focus on moderate sedation and the best practices to ensure patient safety. The program will be held on Thursday, February 16, 2006, at 12:00 PM, in 2 West Ampitheater.

The featured speakers will be Gary Haynes MD, PhD, Department of Anesthesia and Perioperative Medicine, Marc Lapointe, PharmD, BCPS, BCNSP, Associate Professor, Department of Pharmacy and Clinical Sciences, and Phyllis Malpas, RN, MA, GCRN, Manager Endoscopy.

The objectives are as follows:

- Define moderate sedation and the best practice initiatives that promote patient safety.
- Identify and manage patients who extend beyond the moderate level of sedation.
- Describe the what, how, and why of reporting sedation related adverse events.

Attendees will receive 1 credit hour of continuing education and lunch is provided. MED•U•WAY is sponsored by the Pharmacy and Therapeutics Committee.

Use of Prohibited Abbreviations

By:
Amy Bain, PharmD Candidate

Medication errors significantly affect iatrogenic morbidity and mortality and increase healthcare costs.[1,2] In a case control study by Classen and colleagues, medication errors were shown to increase length of hospital stay by up to 5 days compared with matched controls.[2] Costs related to medication errors, in a large health system, could be driven into the millions based on the estimated $6,000 increased cost per error per hospital stay.[1] Many commonly encountered errors are a result of unsafe prescribing practices, and about 11% of these are a result of the use of dangerous abbreviations.[1]

Current institutional policies targeted to meet the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) accreditation standards prohibit the use of dangerous abbreviations in handwritten documentation.[2] The purpose of this regulation is to reduce preventable prescribing errors in order to improve patient safety. The policy applies to all types of handwritten documentation including orders, medication-related documentation in the medical record, and preprinted

order forms. The exceptions to this policy include laboratory results or reports and vendor computed generated documents (ie, medication administration record [MAR]).

The MUSC-MC policy C-21 entitled *Use of Abbreviations* is summarized below.

- No abbreviations found on the list of *Prohibited Abbreviations* may be used when documenting in the patient's inpatient or outpatient medical record (Table 2).
- Practitioners should be immediately contacted via pager upon discovery of use of a prohibited abbreviation in the orders section of the medical record, and the order should be rewritten.
- If a prohibited abbreviation is used in any other section of the medical record, the author should be contacted as soon as possible and the information should be rewritten.
- Prohibited abbreviation use will be monitored via record review, and trends that are identified will be reported to a department director or chair, as necessary.
- Names of medications should never be abbreviated (eg, AZT, HCTZ, Neo).
- Abbreviations are not allowed in an informed consent document or when documenting final diagnoses.
- Any request to change this list may be submitted to the Medical Records Committee.
- The list of *Prohibited Abbreviations* will be reviewed annually or at the discretion of the Medical Director and/or the Medical Records Committee.

Reduction of medication errors is ultimately dependent on the commitment of individual healthcare professionals to observe the MUSC-MC policies regarding safe medication practices. Avoiding the use of dangerous abbreviations enables all practitioners and hospital staff to contribute to the improvement of patient safety.

Policies regarding the use of abbreviations and other policies related to patient safety may be found at musc.edu/medcenter/policy/Med/clintoc.html.

References are available upon request.

Table 2. Prohibited Abbreviations Based on MUSC-MC Policy C-21

Prohibited Abbreviation	Intended Meaning	Misinterpretation
Absence of a preceding zero (.5 mg)	0.5 mg	The decimal point may not be seen or copied, resulting in a 10-fold overdose.
Presence of a trailing zero (5.0 mg)	5 mg	The decimal point may not be seen or copied, resulting in a 10-fold overdose.
µg, mcg, or ug	microgram	This may be mistaken for “mg” when handwritten and may result in an overdose.
qd, q.d., or QD	every day	The period after the “q” has been mistaken for “I,” and the medication is administered “QID” (4 times daily) rather than daily.
qod, q.o.d, or QOD	every other day	This may be mistaken as “q.d.” or “q.i.d” if the “o” is poorly written.
MS, MSO_4	morphine sulfate	This may be mistaken for magnesium sulfate.
$MgSO_4$	magnesium sulfate	This may be mistaken for morphine sulfate.
U or u	unit or umbilicus	This may be mistaken as a 0 or 4, resulting in overdose (4U seen as “40” or 4u seen as “44”).
IU	international unit	This may be misread as IV (intravenous).