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## SHORT COMMUNICATION

# Evaluation of the impact of a prescribing guideline on the use of intraoperative dexmedetomidine at a tertiary academic medical center

Abdullah M. Alhammad<sup>a,b,\*</sup>, Nour A. Baghdady<sup>b</sup>, Rachel A. Mullin<sup>b</sup>,  
Bonnie C. Greenwood<sup>c</sup>

<sup>a</sup> Clinical Pharmacy Department, College of Pharmacy, King Saud University, Riyadh 11451, Saudi Arabia

<sup>b</sup> Brigham and Women's Hospital, 75 Francis Street, Boston, MA 02115, United States

<sup>c</sup> Clinical Pharmacy Service, University of Massachusetts, Commonwealth Medicine, Shrewsbury, MA 01545, United States

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**Abstract** *Objective:* To evaluate usage patterns of dexmedetomidine in the operating room after implementation of a prescribing guideline. *Methods:* We conducted a retrospective analysis to evaluate the impact of a prescribing guideline on usage patterns of dexmedetomidine in the operating room at a tertiary, academic medical center during one-month period pre- (July 2010) and post-guideline (July 2011 and July 2012) implementation. *Results:* A total of 267 patients received intraoperative dexmedetomidine during the study period. Dexmedetomidine use in surgical procedures decreased post-guideline implementation [5.7% (pre) vs. 1.9% and 3.3% (post)]. The most common guideline-based indication for intraoperative dexmedetomidine was for anesthesia during bariatric surgery (41% and 38% in 2011 and 2012, respectively). We estimated a cost-avoidance of \$308,856 over the two-year period after guideline implementation. *Conclusion:* Our results suggest that implementation of a prescribing guideline for the use of dexmedetomidine in the operating room is feasible and associated with improved utilization patterns.

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## 1. Introduction

Prescribing guidelines have become a standard component of clinical practice over the past decade. A previous trial demonstrated that implementation of a prescribing guideline in the

operating room (OR) was associated with improvement in the appropriateness of neuromuscular blocker and sedative use, as well as cost savings. However, data demonstrating the impact of prescribing guidelines in the OR remain limited (Higgins et al., 1997).

The use of dexmedetomidine during surgical procedures has increased over time (Carollo et al., 2008). Dexmedetomidine hydrochloride<sup>1</sup> is a centrally selective,  $\alpha_2$ -adrenergic receptor agonist. It provides sedative, hypnotic, anxiolytic, sympatholytic, and analgesic properties without affecting the

\* Corresponding author.

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<sup>1</sup> Precedex®, Hospira Inc., Lake Forest, IL, USA.

respiratory drive (Szumita et al., 2007). Dexmedetomidine was initially approved for sedation of mechanically ventilated patients in the intensive care unit (ICU) for up to 24 h. The indications were updated in 2008 to include sedation of non-intubated patients prior to and/or during surgical and other procedures (Precedex, 2014). While pharmacological properties of dexmedetomidine make it suitable for use in the OR, safety and efficacy data from randomized trials are available for specific surgical indications (Bergese et al., 2010a,b; Bekker et al., 2008; Turgut et al., 2009; Tufanogullari et al., 2008; Feld et al., 2006).

In 2010, an internal analysis of dexmedetomidine utilization at a 793-bed tertiary academic medical center showed that this medication was being used during a variety of surgical procedures. In response to this analysis, a team of pharmacists and anesthesiologists developed and implemented a prescribing guideline to optimize utilization of this costly resource in the OR. The purpose of this study was to evaluate the impact of the prescribing guideline on usage patterns of dexmedetomidine in the OR over three time points.

## 2. Methods

The prescribing guideline was implemented by a multidisciplinary team in the spring of 2011 (Table 1). Upon request for dexmedetomidine during the OR pharmacy business hours, the anesthesiologist used a paper form to document the indication for therapy.

A retrospective chart review of adult patients who had received dexmedetomidine in the OR during July 2011 and July 2012 (post-guideline implementation) was performed. Data previously collected for July 2010 (pre-guideline implementation) were used as the comparator group. A hospital database was used to identify all adult patients who had undergone a surgical procedure and were charged for dexmedetomidine during the study periods. Patients were excluded if the medical record was incomplete or unavailable. This study was approved by our institution's Institutional Review Board.

The paper request form and electronic medical records for all patients were reviewed for relevant information including: demographic information, American Society of Anesthesiologists Physical Status Classification System, dexmedetomidine indication for use, dose, length of therapy, type of surgical procedure, duration of surgery, hospital and ICU length of stay (LOS), and hospital and ICU mortality. The primary endpoint was the number of surgical procedures in which dexmedetomidine was used pre- and post-guideline implementation. Secondary endpoints included dexmedetomidine use by surgical service (pre- and post-guideline implementation), dexmedetomidine use by surgical procedure (post-guideline implementation), and cost utilization.

## 3. Results

A total of 326 patients who received dexmedetomidine in the OR in July 2010, July 2011, and July 2012 were evaluated for participation in the study. Fifty-nine patients were excluded, for a total enrolment of 267 patients (representing 267 surgical procedures). Baseline characteristics were similar amongst the patients in all three groups (Table 2).

**Table 1** Summary of the dexmedetomidine prescribing guideline in the operating room.

Dexmedetomidine is a restricted agent in the operating room and should only be used according to the guidelines outlined below

A. Use in the operating room

1. Awake fibre-optic intubation
2. Awake craniotomy
3. Surgical procedures in patients with body mass index (BMI) greater than 40 kg/m<sup>2</sup>
4. Bariatric surgery in patients with BMI greater than 35 kg/m<sup>2</sup>
5. Surgical procedures when deemed medically appropriate by anesthesiologist

i. Off-guideline usage patterns will be evaluated monthly by anesthesia and pharmacy

B. Duration of therapy

1. Dexmedetomidine is not indicated beyond the length of the surgical procedure
2. Requests for continued use of dexmedetomidine beyond the surgical procedure must be reviewed by the clinical team, including the attending intensivist and pharmacist

### 3.1. Impact of the prescribing guideline on dexmedetomidine utilization

Dexmedetomidine was used in 5.7% (July 2010), 1.9% (July 2011), and 3.3% (July 2012) of surgical procedures during the study periods. Prior to implementation of the guideline, the highest users of intraoperative dexmedetomidine were cardiac surgeries (56%) followed by bariatric surgeries (20%). Post-implementation, cardiac surgery procedures represented only 11% and 5% of total intraoperative dexmedetomidine use in 2011 and 2012, respectively. Overall, the use of intraoperative dexmedetomidine was mostly in accordance with the guideline. The most common guideline-based indication for dexmedetomidine was bariatric surgery in patients with body mass index (BMI) > 35 kg/m<sup>2</sup> (41% and 38% in 2011 and 2012, respectively).

Dexmedetomidine was used off-guideline as deemed 'medically appropriate' by the anesthesiologist in 21% and 27% of cases in 2011 and 2012, respectively. Rationale reported by the anesthesiologist included allergy to other anesthetics and medications, severe bronchospastic lung disease, alcoholism, and opioid abuse.

### 3.2. Impact of the prescribing guideline on cost outcomes

The acquisition cost for dexmedetomidine was higher in the pre-guideline group (\$18,709 [July 2010]) than in both post-guideline groups (\$3577 [July 2011] and \$8103 [July 2012]). Using raw data from July 2010, we anticipated an annual dexmedetomidine expenditure of \$224,508 without implementation of a prescribing guideline. We then estimated the annual cost after implementation of the prescribing guideline by extrapolating from raw data from July 2011 and July 2012. The annual dexmedetomidine cost post-guideline implementation was \$42,924 and \$ 97,236, respectively. This represents a cost-avoidance of \$308,856 over the two-year period post-guideline implementation.

**Table 2** Patient baseline demographics and clinical characteristics.

	Pre-implementation		Post-implementation	
	July 2010 ( <i>n</i> = 144)	July 2011 ( <i>n</i> = 44)	July 2012 ( <i>n</i> = 79)	
Age – years <sup>a</sup>	50 ± 15	48 ± 14	52 ± 14	
Male – <i>n</i> (%)	77 (54)	23 (52)	32 (41)	
Weight (kg) <sup>a</sup>	91 ± 28	122 ± 34	102 ± 31	
<i>ASA physical status classification (%)</i>				
Class I	1.4	0	0	
Class II	27.8	36.4	44.3	
Class III	59.7	61.4	51.9	
Class IV	11.1	2.3	3.8	
Class V	0	0	0	
Class VI	0	0	0	
<i>Surgical procedures in which dexmedetomidine was used (%)<sup>b</sup></i>				
Bolus administered – <i>n</i> (%)	57 (39.6)	10 (22.7)	16 (20.3)	
Bolus dose (mcg/kg) <sup>a</sup>	1 ± 0.3	0.6 ± 0.4	0.6 ± 0.5	
Initial infusion rate (mcg/kg/h) <sup>a</sup>	0.6 ± 0.2	0.5 ± 0.2	0.5 ± 0.2	
Total dose administered (mcg) <sup>c</sup>	169 (98–254)	100 (59–161)	106 (66–159)	
Length of therapy (min) <sup>c</sup>	135 (90–195)	100 (45–161)	130 (80–180)	
Duration of surgery (min) <sup>c</sup>	360 (216–435)	159 (138–240)	195 (160–324)	
<i>Postoperative status</i>				
Inpatient ICU admission – <i>n</i> (%)	87 (60.4)	7 (15.9)	16 (20.5)	
Inpatient non-ICU admission – <i>n</i> (%)	51 (35.4)	32 (72.7)	56 (70.9)	
Day surgery – <i>n</i> (%)	6 (4.2)	5 (11.4)	7 (8.9)	
<i>Length of stay – days<sup>a</sup></i>				
ICU	5.4 ± 6.0	2.1 ± 0.9	1 ± 3	
Hospital	9.5 ± 7.6	4.5 ± 4.8	5.6 ± 5.5	
<i>Mortality – <i>n</i> (%)</i>				
ICU	2 (1.4)	0	0	
Hospital	2 (1.4)	0	0	

Note: ASA = American Society of Anesthesiologists Physical Status Classification System; ICU = intensive care unit.

<sup>a</sup> Values are expressed as mean ± SD.

<sup>b</sup> Total surgical procedures: July 2010 = 2518; July 2011 = 2247; July 2012 = 2359.

<sup>c</sup> Values are expressed as median (interquartile range).

#### 4. Discussion

To our knowledge, this is the first study to examine the impact of a prescribing guideline on usage patterns of dexmedetomidine intraoperatively. We demonstrate that implementation of a multidisciplinary, evidence-based guideline in the OR can improve adherence to appropriate indications while decreasing the costs associated with the use of dexmedetomidine intraoperatively.

Our study has several limitations. First, we did not evaluate surgery-specific clinical outcomes, such as incidence of respiratory depression or recovery room time, which limits the ability to evaluate the overall impact of the decrease in dexmedetomidine utilization. Second, we noted a relatively high use of dexmedetomidine for non-guideline indications. Data obtained from the medication request form can help departments assess whether additional indications should be incorporated into the guideline, or whether a particular prescriber should be contacted to discuss appropriate guideline-based use. Lastly, due to staffing considerations, the OR pharmacy at our institution is not open around the clock, and therefore direct pharmacist intervention with anesthesiology did not occur for every single medication request.

#### 5. Conclusion

Our results provide suggestive evidence regarding the ability of a prescribing guideline to improve medication utilization in the OR. More studies are warranted to further identify appropriate indications for dexmedetomidine in the OR.

#### Authors' contribution

AMH and BG were responsible for the concept, acquisition and interpretation of data, manuscript preparation and final manuscript approval.

NB and RM were responsible for the acquisition and interpretation of data, and manuscript preparation.

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