The effects of different dose levels of peri-neural dexmedetomidine on the pharmacodynamic and side effect profiles of bupivacaine-induced ultrasound-guided femoral nerve block

A Thesis Submitted For Partial Fulfillment Of The MD Degree In Anesthesiology, Surgical Intensive Care Medicine &Pain Management.

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Dedication

This work is dedicated to the soul of my mother, who stood beside me through my entire life, gave me all the support and taught me honesty and sincerity.

To my wife and my daughter for whom I live.

List of abbreviations

DEX	Dexmedetomidine
ECG	Electrocardiogram
FDA	Food and Drug Administration
Hz	Hertz
IASP	International Association for the Study of Pain
ICU	Intensive Care Unit
IV	Intravenous
NRS	Numeric Rating Scale
PACU	Post Anesthesia Care Unit
RASS	Richmond Agitation-Sedation Score
PZT	Lead ZirconateTitanate
SD	Standard Deviation
VAS	Visual Analogue Scale
VRS	Verbal Rating Scale

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Abstract

Rationale and background:

Peri-neural administration of alpha-2 adrenoceptor agonists including dexmedetomidine extends the duration of local anesthetic-induced peripheral nerve blocks in the experimental and the clinical settings. This study was designed to explore and compare the possible effects of different dose levels of peri-neural dexmedetomidine on the clinical and side effect profiles of bupivacaine-induced femoral nerve block in patients undergoing arthroscopic knee surgery under general anesthesia.

Patients and methods:

This randomized, controlled double blinded study included 60 adult patients undergoing arthroscopic knee surgery. Ultrasound-guided femoral nerve block was initiated 30 min before induction of general anesthesia. Femoral nerve block was achieved with the use of 25 ml of bupivacaine 0.5% in all patients. Bupivacaine was combined with 1 ml normal saline (control group, n=15), 25, 50 or 75 μg (1 ml) peri-neural dexmedetomidine groups (n= 15, each). All patients received a standard general anesthetic after ensuring successful femoral nerve block. The onset and duration of sensory and motor blocks, the time to first request to postoperative rescue analgesic, Richmond Agitation-Sedation Score, perioperative hemodynamic data, resting and dynamic visual analogue pain scores, were reported at predetermined time assessment points. Total postoperative rescue intravenous morphine consumption was recorded over 24 hours.

Results:

The onset of sensory block was significantly shorter and its duration was extended with the use of 75 μg peri-neural dexmedetomidine compared to the control, 25 and 50 μg peri-neural dexmedetomidine groups. The durations of sensory block were (43.7±4.3 h, 21.6±3.0 h, 23.3±1.8 h and 30.8±3.6 h respectively). The onset of motor block was significantly shorter

with the use of 75 μg peri-neural dexmedetomidine compared to the control and 25 μg peri-neural dexmedetomidine groups. The duration of motor block was significantly longer in the 75 μg peri-neural dexmedetomidine group compared to the control and other two peri-neural dexmedetomidine groups. Time to first request to postoperative rescue analgesic was significantly longer in the 75 μg peri-neural dexmedetomidine compared to the control, 25 and 50 μg peri-neural dexmedetomidine groups (28.6±10.0 h, 10.8±1.6 h, 11.0±7.1 h and 21.8±3.0 h respectively). The total postoperative morphine consumption was significantly reduced in the 75 μg peri-neural dexmedetomidine group compared to the control and 25 μg group (1.8±2.6 mg, 7.6±5.1 mg and 6.5±3.5 mg respectively). Postoperative sedation was comparable in the four study groups. Statistically significant reductions in systolic blood pressure and heart rate were observed up to 30 minutes after induction of general anesthesia in all groups compared to the baseline values. However, there were no statistically significant differences in the haemodynamic variables among the four study groups.

Conclusion:

The use of peri-neural dexmedetomidine as an adjuvant to bupivacaine reduces the onset and prolongs the duration of ultrasound-guided femoral nerve block and extends the duration of analgesia in patients undergoing arthroscopic ACL surgery in a dose dependent manner. Although the best analgesic profile is achieved with the 75μg dose level, this dose should be cautiously used due to the risk of hypotension.