Research Article

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Locoregional Anesthesia Plus Sedation with Dexmetomidine for Surgery in Critical Patients

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ABSTRACT

Background: Dexmedetomidine (DXM) is an a-2 adrenergic receptor agonist, which is highly selective due to its pharmacological characteristics, since it provides a sedative, anxiolytic effect, which allows optimal airway conversation.

Methodology: A systematic review was carried out through various databases from 2018 to 2021; The search and selection of articles was carried out in indexed journals in English and Spanish. Key words were used: anaesthesia, locoregional, sedation, dexmedetomidine, surgery, critical patient.

Results: Locoregional analgesia plus sedation with dexmedetomidine due to its physiological effects is recurrently used in the perioperative treatment for pain in relation to surgical procedures, it is also used for the treatment of acute pain in critically ill patients in stressful situations.

Conclusion: Dexmedetomidine is an anaesthetic that fulfils several functions in favor of its administration in critical patients, which makes it a good alternative to provide sedation due to its low incidence of bradycardia, hemodynamic changes without causing respiratory depression, making it a useful and safe medicine.

KEYWORDS: Anesthesia; locoregional, sedation, dexmedetomidine, surgery, critical patient

INTRODUCTION

It is worth mentioning that pain management in critically ill patients is one of the most important and demanding obligations that the entire health team has, it is very important that the entire interdisciplinary team have comprehensive training to recognize the physiology of the pain mechanisms, types, and manifestations of

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pain, into order apply the different patterns of analgesic adsorption, distribution and pharmacological characteristics [1].

Dexmedetomidine [DXM] is an a-2 adrenergic receptor agonist, which is highly selective due to its pharmacological characteristics, since it provides a sedative, anxiolytic effect, which allows optimal airway conversation. This drug was approved in 1999, for sedation in adult patients with mechanical ventilation in the ICU, and its use was subsequently approved for sedation in non-intubated patients during surgical procedures [2]. This drug is currently used in the ICU and operating room, demonstrating that it has neuroprotective effects in different brain injuries, despite this, protective effects have been proven in ischemic stroke and hypoxia injuries [3].

It is very common when using locoregional anaesthesia to implement sedation given the different degrees of anxiety that can occur in the patient during the transanesthetic. The objective of this is to produce a good level of comfort, induce sleep, reducing stress levels during the surgical procedure [4]. The objective of the present investigation is to carry out a systematic review about local regional anaesthesia plus sedation with dexmedetomidine for surgery in critical patients, describing aspects such as current knowledge of DXM, its pharmacological bases, advantages of its use and how it interacts in pain management in critical patients, as well as the latest trends in other clinical settings.

MATERIALS AND METHODS

A systematic review was carried out since January 2018 in the virtual databases, NCBI, Lilacs, PubMed, Biomed Central, Science direct, among others, using the Mesh descriptors: "anaesthesia, locoregional, sedation, dexmedetomidine, surgery, critical patient."; and their equivalents in the English language: "anaesthesia, locoregional, sedation, dexmedetomidine, surgery, critical patient. ". A search criterion was established for the language, thus choosing articles in Spanish and English. The search time interval was from 2018 to 2022. Those articles that contained information on locoregional anaesthesia plus sedation with dexmedetomidine for surgery in the critically ill patient. A total of 145 articles were obtained from all the consulted databases, which were filtered taking into account the inclusion and exclusion criteria, and 20 articles were obtained with all the previously stated requirements.

RESULTS

Mechanism of Action of the Dexmedetomidine

This drug acts directly on the α2 adrenergic receptors, which causes sedation through the receptors located in the locus ceruleus area, pain analgesia at the level of the dorsal horn, it also inhibits the release of norepinephrine from presynaptic neurons, until At the moment its molecular mechanism has not yet been fully described, among the different proposed mechanisms it is believed, the selectivity derived from the activation of receptors of the inhibitory G proteins (α -2A, α -2B, α -2C) and the integration of the cGMP pathway, this allows the inhibition of adenyl cyclase, producing a reduction in the levels of adenosine monophosphate, which generates a hyperpolarization of noradrenergic neurons [5]. Which is to say that the suppression of nerve conduction by inhibiting the entry of calcium for the integration of neurotransmission vesicles.

Pharmacodynamics

Within sedation, dexmedetomidine achieves an effect called cooperative sedation, allowing a dynamic interaction with the patient through stimulation [6]. Within the proposed mechanism of action, we managed to maintain this effect due to the activation of pre- and post-synaptic α2 receptors. Within the consulted bibliography, we found that several authors argue that to find stimulating sedation, plasmatic concentrations between 0.2 and 0 are required. 0.3 ng/ml and to achieve significant sedation plasma concentrations higher than 1.9 ng/ml are required. Within the guidelines, dosages have been established between 0.2 or 0.6 µg/kg h after a bolus of 1 µg/kg. In Table 1, we will find the established dosages plus their routes of administration:

Table 1: Dosage of thedexmedetomidine.

Dosage Regimen			
		Dosage	
Scenarios	**Via**	**Bolus (mcg/kg)**	**Perfusion ()mcg/kg/h**
Adults			
Sedation	Intravenous	1	0.2-0.6
Sedation in critical patient	Intravenous	-	0.2-0.7
Analgesia	Intravenous	1	0.5
Cardiovascular surgery	Intravenous	1	0.2-0.4
Neurosurgery	Intravenous	0.5-1	0.1-0.7
Obstetric analgesia	Periodical	0.25-0.75	
Peridual anesthesia	Periodical	0.5-1	
Pediatric			
Anxiolysis (preoperative)	Intranasal	1-2	-
Endotracheal intubation	Intravenous	0.5-1	-
Neurosurgery	Intravenous	0.5	0.21-0.2
Analgesia (adjuvant)	Intravenous	0.2-0.5	-
	Subcutaneous	1-2	-

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Locoregional anesthesia

Table 2: Indications for regional anesthesia in critically ill patients.

Surgical and post-surgical analgesia
Trauma
Non-surgical analgesia, sympatholysis
Painless procedures in ICU

Locoregional analgesia, due to its physiological effects, is recurrently used in the perioperative treatment for pain related to surgical procedures, it is also used for the treatment of acute pain in critically ill patients, if we focus on the physiological effects of nerve blockade. has in stressful situations [7,8]. Regional anaesthesia in this group of patients extends to a great diversity of situations, both surgical and medical, the critical patient must be evaluated individually and uniquely, prioritizing their vital affectation, since the risk of systematic toxicity, coagulopathies, infections, among other related problems, can develop Table 2 shows the causes for the use of regional anaesthesia in critically ill patients [9].

Sedation in critical patient

Sedation aims to produce comfort, amnesia, the reduction of the different types of anxiety that usually occur during the surgical act. sedation by dexmedetomidine dina in patients with a critical condition, is an adjuvant in regional anaesthesia and analgesia, presents a series of favourable characteristics, as well as; decrease in the time connected to the mechanical ventilator, less possibility of coma or delirium, it has a score of -1 on the Richmond scale and a lower mortality rate compared to other drugs [10,11].

Table 3: Continuous peripheral nerve blocks in the critically ill patient.

Block	Indications	Contraindications	Problem	Dosage Suggestion
Interscalene	Shoulder/arm pain	Untreated contralateral pneumothorax	Horner's syndrome may obscure neurologic evaluation.	Bolus regimen
				10 mL of 0.25% bupivacaine or 0.2% ropivacaine every 8-12 h as needed
		Dependence on diaphragmatic breathing	Ipsilateral frenzied nerve block	
		Contralateral vocal cord paralysis	Close proximity to tracheostomy sites and jugular vein line	Continuous infusion
		Local infection at the puncture site		0.125% bupivacaine or 0.1-0.2% ropivacaine at 5 mL/h
Cervical paravertebral	Shoulder/elbow/wrist pain	severe coagulopathy	Horner's syndrome may obscure neurologic evaluation.	Bolus regimen
		Dependence on diaphragmatic breathing		10 mL of 0.25% bupivacaine or 0.2% ropivacaine every 8-12 h as needed
		Contralateral vocal cord paralysis	Ipsilateral phrenic nerve block	Continuous infusion
		Local infection at the puncture site	Patient positioning	0.125% bupivacaine or 0.1-0.2% ropivacaine at 5 mL/h
Infraclavicular	Arm/hand pain	Severe coagulopathy	Risk of pneumothorax	Bolus regimen
		Untreated contralateral pneumothorax	Steep angle for catheter placement	10-20 mL bupivacaine 0.25% or ropivacaine 0.2% every 8-12 h as needed
		Local infection at the puncture site	Interference with the subclavian lines	Continuous infusion
Axillary	Arm/hand pain	Local infection at the puncture site	Arm positioning	Bolus regimen
			Catheter maintenance	10-20 mL bupivacaine 0.25% or ropivacaine 0.2% every 8-12 h as needed
				Continuous infusion
				0.125% bupivacaine or 0.1-0.2% ropivacaine at 5-10 mL/h
Thoracic paravertebral Lumbar	Restricted unilateral chest or abdominal pain a few dermatomes	Severe coagulopathy	Patient positioning	Bolus regimen
		No treatment contralateral pneumothorax	Stimulation success sometimes it's hard to visualize	10–20 mL of 0.25% bupivacaine or 0.2% ropivacaine every 8–12 h and on demand
		Local infection in puncture site		Continuous infusion
				Bupivacaine 0.125% or 0.1–0.2% ropivacaine at 5-10 ml/h

Femoral or sciatic	Unilateral leg pain	Severe coagulopathy	Patient positioning	Bolus regimen
		Local infection at the puncture site	Femoral interference nerve catheters with femoral lines	10 mL of 0.25% bupivacaine or 0.2% ropivacaine every 8–12 h and on demand
				Continuous infusion
				Bupivacaine 0.125% or 0.1–0.2% ropivacaine at 5 mL/h

One of the most typical characteristics of the dexmedetomidine It is its analgesic effect, which is carried out by the hyperpolarization of interneurons and the reduction of the release of substance P and glutamate in alpha 2 receptors, which presented in patients subjected to high levels of pain is considered an analgesia Adequate [12,13]. However, like any medication, we must be careful with the side effects of the drug. Dexmedetomidine, which develop at the hemodynamic level, can cause bradycardia, and should be considered as a predictable response to this drug. In these cases, patient evaluation is recommended [14]. The most frequent side effects are hypotension, related to sympathetic blockade, bradycardia, changes at the hemodynamic level occur due to intermittent bolus dosing and when administered peri dually [15]. It is very important to take into account certain conditions when considering locoregional analgesia as an option in a critically ill patient, it is necessary to have a highly trained team for the positioning of tubes and catheters Table 3 includes the indications, contraindications, and frequent problems of continuous peripheral catheters. [16,17].

DISCUSSION

Within the literature we can find different opinions about the use of regional anaesthesia with sedation with dexmedetomidine in the critically ill patient, both positive and negative, as we found in the research carried. Out by the researcher Daniel Zavala Morales, which is called "use of dexmedetomidine for analgesia in patients operated on for laparoscopic cholecystectomy"[18].

Where he states that the use of the dexmedetomidine improves recovery in the postoperative period of surgery, they conducted a clinical trial in operated patients, dexmedetomidine was applied in the first group and ketorolac was applied to the other group, among the parameters evaluated were ASA, hemodynamic variables, pain with the EVA scale, It was concluded that the hemodynamic variables were lower with dexmedetomidine, the pain was mild after 30 minutes with dexmedetomidine, demonstrating that this medication is superior as analgesia and in terms of safety in patients. On the other hand, in the investigation carried out by Ruales Arce et al. [19] which is called conventional anaesthesia versus anaesthesia with dexmedetomidine.

During their investigation different types of anaesthesia with or without opioids were evaluated based on their exclusion criteria, the samples compared the use of dexmedetomidine versus remifentanil, morphine, oxycodone, where the benefits obtained in favour of the patient are as follows: remifentanil, dexmedetomidine, morphine and oxycodone, concluding that dexmedetomidine is a good choice in anaesthetics without opioids avoiding its use providing results very prosperous.

The dexmedetomidine It is a good option as anaesthesia for patients who are taken to mosh surgery under loco-regional anaesthesia due to its low incidence of bradycardia with hemodynamic repercussions, as maintained by anaesthesiologist Nataly Chávez et al. [20] who conducted an observational study of 30 patients who underwent mosh micrographic surgery with reconstruction, where more than 53% were female patients, the average age of the patients was 68 years, these patients were classified as ASA I 21.4%, ASA II 53, 5%, ASA III 25%. The average time for surgery was 183+61 minutes and for anaesthesia with dexmedetomidine was 196+65.2 minutes. Only one patient presented bradycardia and was administered doses of atropine and ephedrine.

CONCLUSION

Optimal analgesia in critically ill patients is closely related to a pharmacological regimen whose intention is to produce amnesia, comfort, and rest. When implementing locoregional anaesthesia as an option in critically ill patients, the use of sedation is very frequent, due to the different degrees of anxiety that the patient may present during the transanesthetic. Dexmedetomidine is an anaesthetic that fulfils several functions in favour of its administration in critical patients, which makes it a good alternative to provide sedation due to its low incidence of bradycardia, hemodynamic changes without causing respiratory depression, making it a useful and safe medicine.

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