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SPECIAL ARTICLE

Perineural dexmedetomidine effects on sciatic nerve in rat

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KEYWORDS
Paw withdrawal latency testing;
Analgesia meter;
Sciatic nerve;
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Dexmedetomidine

Abstract The present study was designed to test the hypothesis that high dose dexmedetomidine would increase the duration of antinociception to a thermal stimulus in a rat model of sciatic nerve blockade without causing nerve damage. The rats were anesthetized with isoflurane. After electromyography (EMG) recordings, right sciatic nerves were explored and perineural injections were delivered: Group D ($n = 7$), 40 μg μg kg^{-1} dexmedetomidine administration, Group II ($n = 6$), (0.2 mL) saline administration, Group III ($n = 2$), only surgically exploration of the right sciatic nevre. Time to paw withdrawal latency (PAW) to a thermal stimulus for both paws and an assessment of motor function were measured every 30 min after the nerve block until a return to baseline. The compound muscle action potential (CMAP) of right and left sciatic nerves were recorded 10 times per each nerve once more after perineural injections at 14 day. After EMG recordings, right and the part of left sciatic nerve were excised at a length of at minimum 15 mm for histopathological examination. Comparison of right/left CMAP amplitude ratios before and 14 days after the procedure showed a statistically significant difference ($p = 0.000$). There were no differences in perineural inflammation between the Group D, Group S, and Group E at 14 days.

PALAVRAS-CHAVE
Testes de latência de retirada da pata;
Medidor de analgesia;
Nervo ciático;

Efeitos de dexmedetomidina perineural no nervo ciático em ratos

Resumo O presente estudo foi desenvolvido para testar a hipótese de que dexmedetomidina em dose alta aumentaria a duração da antinocicepção a um estímulo térmico em modelo de rato de bloqueio do nervo ciático sem causar danos ao nervo. Os ratos foram anestesiados com

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Eletromiografia;
Dexmedetomidina

isoflurano. Após os registros da eletromiografia (EMG), os nervos ciáticos direitos foram explorados e injeções perineurais foram administradas: Grupo D ($n = 7$) recebeu 40 $\mu g/kg^{-1}$ de dexmedetomidina, Grupo II ($n = 6$) recebeu 0,2 mL de solução salina, Grupo III ($n = 2$) recebeu apenas exploração cirúrgica do nervo ciático direito. O tempo de latência de retirada pata (LRP) a um estímulo térmico para ambas as patas e uma avaliação da função motora foram avaliados a cada 30 minutos após o bloqueio do nervo até o retorno à fase basal. O potencial de ação muscular composto (PAMC) dos nervos ciático direito e esquerdo foi registrado 10 vezes para cada nervo, mais uma vez, após as injeções perineurais no 14° dia. Após os registros da EMG, o nervo ciático direito e parte do esquerdo foram excisados com um comprimento de no mínimo 15 mm para exame histopatológico. A comparação das proporções da amplitude do PAMC direito/esquerdo antes e 14 dias após o procedimento mostrou uma diferença estatisticamente significativa ($p = 0,000$). Não houve diferenças em inflamação perineural entre os grupos D, S e E aos 14 dias.

Introduction

Peripheral nerve blocks are frequently used in surgical procedures targeted at post-operative pain and surgical anesthesia. Long-acting local anesthetics may also provide analgesia per se for 9–14 h.[1–4] If the block is performed in the morning and afternoon, patients generally report post-operative pain at night hours. The need for opioid cause's opioid-related potential side effects and suppression of healing sleep.[5] Using opioids results in potential airway obstruction, which causes saturation to decrease.[6–8] Ideally, single-time peripheral nerve block should provide analgesia during the first post-operative night.

Interventions targeted increasing the duration of block in order to heal post-operative pain with many additional local anesthetics are under investigation. The efficacy of clonidine has been proven in many regional anesthetic techniques.[9] However, long-acting local anesthetics have produced results that are not very impressive.[10,11] In some studies, no beneficial effects of adding clonidine to long-acting anesthetics have been found.[11]

Dexmedetomidine is a selective alpha-adrenoceptor agonist. A previously performed study showed that dexmedetomidine extends the sensorial and motor block time when combined with bupivacaine in rat models with sciatic nerve block.[12]

Studies indicated that local anesthetics result in myonecrosis; however, it is believed that the damage may not be clinically important since the muscles are regenerated in a normal way.[13–16] Local anesthetic doses are generally reliable in healthy human beings; however, there may really be neurotoxicity present in patients with subclinical neuropathy diabetes or multiple sclerosis.[17–19] An increase in inflammatory mediators was identified following the administration of perineural clonidine.[20–25] A study reported a significant decrease in perineural inflammation at 24 h with the addition of dexmedetomidine to bupivacaine as compared with the administration of bupivacaine alone. The same study found that the perineural inflammation values at 24 h were higher as compared with the bupivacaine-only saline control group. The perineural inflammation values of the group that received both bupivacaine and dexmedetomidine and the group that received only dexmedetomidine were similar to those of the saline group.[26]

As discussed in previous studies, it is believed that decreased perineural inflammation with the use of dexmedetomidine is due to decreased proinflammatory products of healing immune cells and increased anti-inflammatory cytokines at the wound site.[20–25] It is very important to determine the functional statuses of nerves. One of the functional evaluation methods for neural healing or transmission disorder is to perform electrophysiological measurements. Electromyography is a common procedure in clinical and fundamental studies in the context of *in vivo* and *in vitro* functional nerve studies. It has a widespread use in the electro-diagnostic evaluation of peripheral nerve damage of the sciatic nerve in animal models. A study performed showed that the use of a silicone tube filled with hyaluronic acid following end-to-end repair of an incised nerve could have a positive effect on latency and CMAP, and consequently on axonal regeneration.[27] CMAP is a valuable parameter that generally shows the time aspect of nerve regeneration and reinnervation.[28] A study demonstrated that stimulation single fiber electromyography (SSFEMG) was a more sensitive electrophysiological method in the detection of neuromuscular transmission block that occurs in rats with weak muscles and acute organophosphate poisoning.[29] These electromyographic studies showed that both nerve healing and nerve damage could be shown using electromyographic methods. In our study, we determined the effects of dexmedetomidine injection on neural transmission by using electromyographic methods.

We conducted this study in order to assess the effects of dexmedetomidine on sciatic nerves of rats through analgesimetry, histopathology and electromyography.

Method

This study was conducted at the Animal Experiments Laboratory of Bağcılar Teaching and Research Hospital upon ethics committee approval obtained during the 19th project meeting issue 2012/60, number HADYEK/2012-13 held on

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