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Case Report

Adding dexmedetomidine to ropivacaine for lumbar plexus and sciatic nerve block for amputation of lower limb in high-risk patient-a case report

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Abstract: The ischemia necrosis of limb frequently requires surgery of amputation. Lumbar plexus and sciatic nerve block is an ideal intra-operative anesthetic and post-operative antalgic technique for patients of amputation, especially for high-risk patients who have severe cardio-cerebrovascular diseases. However, the duration of analgesia of peripheral nerve block is hardly sufficient to avoid the postoperative pain and the usage of opioids. In this case, a 79-year-old man, with multiple cerebral infarcts, congestive heart failure, atrial flutter and syncope, was treated with an above knee amputation because of ischemia necrosis of his left lower limb. Dexmedetomidine 1 μg/kg was added to 0.33% ropivacaine for lumbar plexus and sciatic nerve block in this case for intra-operative anesthesia and post-operative analgesia. The sensory function was blocked fully for surgery and the duration of analgesia maintained 26 hours with haemodynamic stability and moderate sedation. The patient did not complain pain and require any supplementary analgesics after surgery. This case showed that adding 1 μg/kg dexmedetomidine to ropivacaine for lumbar plexus and sciatic nerve block may be a feasible and safe technique for high-risk patients for lower limb surgery of amputation.

Keywords: Dexmedetomidine, ropivacaine, lumbar plexus block, sciatic nerve block, high-risk patient

Introduction

Patient with severe cardio-cerebrovascular diseases for non-cardiac surgery is thought to be at high-risk of peri-operative complications and mortality. In consideration of the misgiving of destructive consequences induced by abnormal decrease of perfusion pressure for important organs, it is reasonable to choose anesthetic techniques that hardly disturb haemodynamic stability and pulmonary function.

The ischemia necrosis of limb frequently requires surgery of amputation. Many of patients suffer from severe acute postoperative pain which is harmful to patients' homeostasis and recovery. Moreover, the incidence of chronic neuropathic pain in patients who experience surgery of amputation is approximately 65%-85% [1] and inadequate analgesia is an important risk factor. Lumbar plexus and sciatic nerve block is the optimal intra-operative anesthetic [2] and post-operative antalgic technique [3] for high-risk patients, especially who have severe cardio-cerebrovascular diseases for lower limb surgery. However, the duration of analgesia of ropivacaine for peripheral nerve block is insufficient to avoid the postoperative pain and usage of opioids.

Increasing evidences indicated that dexmedetomidine as an adjuvant to ropivacaine could prolong the duration of sensory block and provide moderate sedation [4, 5]. In this case report, we aimed to report the use of adding dexmedetomidine to ropivacaine for lumbar plexus and sciatic nerve block for amputation of lower limb for high-risk patient with severe cardio-cerebrovascular diseases.

Case reports

A 79-year-old man, who weighs approximately 40 kg, developed severe gangrene of his left lower limb induced by the left common iliac artery occlusion. He had a history of multiple cerebral infarcts, congestive heart failure, arrhythmia atrial (atrial flutter), and syncope. His medications include enalapril, digoxin, aspirin, furosemide, spironolactone, potassium chloride and atorvastatin sodium. Electrocardiogram indicated ectopic rhythm, atrial flutter, T wave changed and complete right bundle branch block. Echocardiogram revealed an ejection fraction of 43% and left ventricular enlargement. Laboratory examination showed B-type natriuretic peptide 811.00 pg/ml, myoglobin 489.00 ng/ml, white blood cell 11.0 $\times 10^{12}$/L, neutrophil rate 84.01%, total protein 59.20 g/L and albumin 23.20 g/L. To minimize haemodynamic disturbance and central nervous system effect, lumbar plexus and sciatic nerve block was chosen for the surgery of above-knee amputation.

In the operation room, oxygen was delivered by face mask, and an 18 G intravenous cannula was inserted in patient's left forearm. Patient was monitored by electrocardiogram and pulse oximeter. A right radial arterial catheter was inserted for continuous arterial pressure monitoring. The basal value were HR 69/bpm, BP 135/64 mmHg and SpO_2 95%. Fentanyl 40 μg was given intravenously for analgesia and then the patient was turned to the right lateral position with the hips and knees flexed to approximately 45 degree. The lumbar plexus was located using an 100 mm insulated short-beveled stimulating needle (PAJUNK®, PAJUNK GmbH Medizintechnologie, Germany), connected to a nerve stimulator (PAJUNK®, PAJUNK GmbH Medizintechnologie, Germany), set at an initial amperage of 1.5 mA. Lumbar plexus blockade was done following Winne's approach [6]. The lumbar plexus injection site was confirmed by contraction of the quadriceps and patella with a current less than 0.5 mA at 1 Hz, and then, after negative aspiration, 30 ml 0.33% ropivacaine containing 0.6 μg/kg dexmedetomidine was injected. Meanwhile, the sciatic nerve was achieved following the method of Labat [7]. Contraction of gastrocnemius muscle in response to a current less than 0.5 mA at 1 Hz confirmed the sciatic nerve injected site had been reached, and then, after negative aspiration, 20 ml 0.33% ropivacaine containing 0.4 μg/kg dexmedetomidine was injected.

The sensory function was blocked fully after fourteen minutes after local anaesthetics was injected. Without administration of other drugs, the 68-minute surgery was carried out under moderate sedation (Ramsay score 3 points) with no complaint of pain and dissatisfactory. During the whole surgery, the haemodynamic parameters were relatively unchanged from baseline values, HR 60-70/bpm, BP 120-140/50-70 mmHg and SpO_2 95-97%. Without application of tourniquet, total blood loss was approximately 120 ml and urine was 150 ml. The patient received 750ml saline during the whole surgery. Postoperatively, the duration of analgesia maintains 26 hours, and he did not require any supplementary analgesics. Ten days after surgery, the patient recovered and was discharged from hospital.

Discussion

We report the successful case of adding dexmedetomidine to ropivacaine for lumbar plexus and sciatic nerve block for amputation of lower limb for high-risk patient with severe cardiocerebrovascular diseases.

Besides peripheral nerve blockage, general anaesthesia and spinal and epidural blocks may be reliable options for this case. However, it is inevitable that general anaesthesia may significantly disturb the hemodynamic stability due to the adverse effect of general anaesthetic agents, such as depression of myocardium and vasodilatation. Spinal and epidural blocks, compared with general anaesthesia, showed a significant reduction of peri- and post-operative morbidity of deep vein thrombosis, pulmonary embolism, confusion, cerebrovascular accident, heart failure, myocardial infarction and renal failure [8]. Nevertheless, Fanelli et al found that, compared with peripheral nerve block, spinal anaesthesia induce vasodilatation below the level of the block and usually induce more hypotension and reduction of cardiac index, that may have negative implications, even be exacerbated in patient with heart failure [9]. In this case, lumbar plexus and sciatic nerve block was chosen because it can completely block the ipsilateral lower limb for surgery of amputation to provide sufficient

postoperative analgesia in high-risk patients, and it produces limited sympathetic blockade and local vasodilatation to minimize haemodynamic disturbance and cardio-cerebrovascular accident [10, 11]. Moreover, lumbar plexus and sciatic nerve block can reduce blood loss during total hip arthroplasty comparing with general anesthesia, which is beneficial for patients with heart failure or multiple cerebral infarcts [12].

Many patients who experience surgery of amputation suffer from severe acute postoperative pain which may develop to chronic pain due to insufficient control of pain. Dijkstra et al found the incidence of chronic neuropathic pain, currently called residual limb pain, was approximately 65%-85% [1] and central and peripheral hyperalgesia resulted from inadequate analgesia were important risk factors. Residual limb pain includes complex regional pain syndrome type II, phantom limb pain and neuropathic pain. Those painful conditions often trouble patients and require complex treatment. Research found peripheral nerve block could control residual limb pain effectively [13]. However, the limited duration of analgesia of single-injection peripheral nerve block is insufficient to avoid the postoperative pain. Continuous catheter technique is a method to increase the duration of analgesia, but it has a close relation with catheter displacement [14] and infection [15]. More and more evidences suggest alpha-2 adrenergic receptor agonists and dexamethasone can increase the duration of local anesthetics for peripheral nerve block [16]. Experimental and clinical researches indicated that adding dexmedetomidine to local anesthetics for peripheral nerve block produced a no less than 60% increase in the duration of sensory block [5, 18]. In this case, the duration of analgesia of lumbar plexus and sciatic nerve block maintains 26 hours and require no supplementary analgesics. The prolonged duration of peripheral nerve block may be mainly produced in a local neuronal mechanism because of the same dose of dexmedetomidine resulted in a 10% increase of duration [5]. Brummett et al. reported that perineural dexmedetomidine added to ropivacaine for sciatic nerve block prolonged the duration of analgesia by blocking the hyperpolarization-activated cation current [18]. Another perineural mechanism may be peripheral vascular contraction. Dexmedetomidine may cause contraction of perineural vessel by coupling with alpha-2B adrenergic receptor, reduce the absorption of local anesthetics and then prolong the duration of analgesia.

Keplinger et al. found dexmedetomidine as an adjuvant to ropivacaine for ulnar nerve block could prolong the duration of sensory block and provide moderate sedation [5]. In this case, 1 μg/kg dexmedetomidine was added to ropivacaine for lumbar plexus and sciatic nerve block. During the whole surgery, the effect of sedation was moderate (Ramsay score 3 points). The effect of sedation may be mainly produced in a central mechanism which has been confirmed by Guo et al [19]. The site of action for sedative effects of dexmedetomidine is locus ceruleus and is mediated by hyperpolarization of noradrenergic neurons thus inhibiting noradrenaline release and inhibiting activity in descending medullospinal noradrenergic pathways. However, Bloor BC et al. found that intravenous dexmedetomidine 1 μg/kg could produce a good sedation, but induced hypotension and bradycardia [20]. In this case, there were not dramatic fluctuations of hemodynamics. The reason may be that dexmedetomidine cause contraction of perineural vessel, reduce the speed of absorption of perineural vessel and then reduce the concentration of dexmedetomidine in locus ceruleus.

Conclusion

In this case, adding dexmedetomidine to ropivacaine for lumbar plexus and sciatic nerve block is feasible and safe for amputation of lower limb for high-risk patient with severe cardio-cerebrovascular diseases.

Disclosure of conflict of interest

None.

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