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SCIENTIFIC ARTICLE

Faster onset time of supraclavicular brachial plexus block using local anesthetic diluted with dextrose☆

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KEYWORDS
Ultrasound;
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Abstract
Background and objectives: A high sodium concentration is known to antagonize local anesthetics when infiltrated around neural tissue. Thus, we hypothesized that the onset time for sensory and motor blockade, in supraclavicular brachial plexus block using ropivacaine diluted with dextrose would be shorter than with saline.
Methods: Patients scheduled for upper limb surgery were randomized to receive ultrasound guided supraclavicular brachial plexus block with 0.5% ropivacaine. Evaluation of sensory and motor blockade was performed every 5 min for 60 min. Patients were followed-up on postoperative day 1, and between days 7 and 10 for the presence of any complications. Twenty-five patients in each group were analyzed.
Results: Mean time for onset of analgesia for the dextrose group was 37.6 ± 12.9 min while the mean time for the saline group was 45.2 ± 13.9 min with a *p*-value of 0.05. The effect size was 0.567, which was moderate to large. No major complications were observed.
Conclusion: We conclude that there was a decrease in onset time of analgesia when dextrose was used as a diluent instead of saline for ultrasound guided supraclavicular block.

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PALAVRAS-CHAVE
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Bloqueio;
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Dextrose

Tempo mais rápido de início do bloqueio do plexo braquial supraclavicular usando anestésico local diluído com dextrose

Resumo
Justificativa e objetivos: A alta concentração de sódio é conhecida por antagonizar anestésicos locais quando infiltrado em torno de tecido neural. Portanto, a nossa hipótese foi a de que o tempo de início para os bloqueios sensorial e motor, em bloqueio do plexo braquial supraclavicular usando ropivacaína diluída com dextrose, seria menor do que com solução salina.
Métodos: Os pacientes agendados para cirurgia em membro superior foram randomizados para receber bloqueio do plexo braquial supraclavicular com ropivacaína a 0,5%g guiado por ultrassom. A avaliação dos bloqueios sensorial e motor foi realizada a cada 5 minutos durante 60 minutos. Os pacientes foram acompanhados no pós-operatório no primeiro dia e, entre os dias 7-10 para presença de qualquer complicação. Foram analisados 25 pacientes em cada grupo.
Resultados: A média do tempo para o início da analgesia no grupo dextrose foi de $37,6 \pm 12,9$ minutos, enquanto que no grupo solução salina a média foi de $45,2 \pm 13,9$ minutos, com um valor-*p* de 0,05. O tamanho do efeito foi 0,567, o que foi de moderado a grande. Complicações maiores não foram observadas.
Conclusão: Concluimos que houve uma redução do tempo de início da analgesia quando dextrose em vez de solução salina foi usada como diluente para bloqueio supraclavicular guiado por ultrassom.

Introduction

Regional anesthesia with local anesthetics blocks specific nerves to enable pain free surgery, or for intra- and postoperative pain relief. Dilution of local anesthetics with normal saline is a common practice to enable administration of larger volumes of local anesthetics particularly in cases whereby multiple nerve blocks are needed. This will also minimize the risk of systemic toxicity.

Local anesthetics block the function of sodium channels located in neural tissue, inhibiting depolarization and thus the transmission of nerve impulses.[1] A high sodium concentration is known to antagonize the analgesic effect of local anesthetics.[2] On the other hand, dextrose when injected around nervous tissue does not cause any pain on injection and does not cause any long term neurological deficit in animals or humans.[3–5] Dilution with dextrose would reduce the concentration of sodium ions and hence reduce its antagonistic effect. In the literature, only one study using dextrose as diluent to produce 0.5% ropivacaine for axillary brachial plexus block showed a reduction in the onset time for sensory blockade when compared with dilution with saline.[6] Our hypothesis was that dilution of the local anesthetics with dextrose would shorten the onset time compared to saline for a supraclavicular brachial plexus block.

In the present randomized and blinded clinical study, 0.75% ropivacaine was diluted with dextrose or saline to produce 0.5% ropivacaine, for ultrasound guided supraclavicular brachial plexus block. The primary aim was to compare the onset time for complete analgesia and motor blockade in both groups. Analysis with regards to the duration of the neural blockade was also carried out.

Methods

This clinical study was registered at clinicaltrials.gov (ID no. NCT01815944). After obtaining approval from the Medical Ethics Committee, University Malaya Medical Centre (Ethics committee/IRB reference no. 883.11 dated 19 October 2011), patients aged between 18 and 85 years who were ASA I to III, scheduled for elective or emergency surgery of the hand, forearm and elbow were evaluated for eligibility to be enrolled in the study. Patients were excluded if they had a history of diabetes mellitus, any neurological deficit, contraindications to supraclavicular brachial plexus blockade, were unable to give consent, or refused to participate.

Upon obtaining written informed consent, patients were randomly assigned to either the dextrose (D5%) or normal saline (NS) group. Randomization was performed using a computer-generated random table and patients were blinded as to their group allocation. Group allocations were concealed in a sealed opaque envelope and were opened by an independent anesthesiologist just before the performance of the block. The same anesthesiologist prepared 20 mL 0.5% ropivacaine by diluting 13.3 mL of 0.75% ropivacaine with 6.7 mL of either dextrose or normal saline, depending on the patient's group allocation.

An anesthesiologist familiar with the technique, who was blinded to group allocation, performed all ultrasound-guided supraclavicular blocks. Prior to the block, all patients were placed supine on a trolley and were equipped with routine monitoring, i.e. ECG, SpO_2, NIBP, and a patent intravenous line. Patients were given IV midazolam 0.03–0.04 mg/kg before the brachial plexus blockade