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First report on spinal hyperbaric opioids in horses

Primeiro relato do uso de opióide hiperbárico por via espinhal em cavalos

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- NOTE -

ABSTRACT

This study is the first to report the use of spinal hyperbaric opioids in horses injected through a lumbar-sacral subarachnoid catheter. The injection of hyperbaric subarachnoid morphine and methadone produced short term intense analgesia over the dermatomes of the perineal, sacral, lumbar, and thoracic areas without cardiorespiratory depression, ataxia or central nervous system excitement. The technique involves the use of 10% dextrose as a hyperbaric solvent producing an average hyperbaric solution with a specific gravity of 1030. The use of spinal hyperbaric opioids in horses can be recommended for short term moderate to severe pain management in this species.

Key words: *analgesia, equine, morphine, methadone, buprenorphine, hyperbaric.*

RESUMO

Este estudo relata pela primeira vez o uso de opioide hiperbárico por via espinhal em cavalos, administrado através de um cateter subaraquenóide lombo-sacro. Foi demonstrado que a administração de morfina ou metadona hiperbáricos em solução de dextrose 10% produz analgesia intensa e de curta duração sobre os dermatomas perineais, sacrais, lombares e torácicos, sem depressão cardiorrespiratória, ataxia ou excitação do sistema nervoso central. A técnica descrita, neste estudo, produziu soluções com gravidade específica de 1030. O uso de solução hiperbárica de opióides pode ser recomendado para obtenção de analgesia intensa de curta duração no cavalo.

Palavras-chave: *analgesia, eqüinos, morfina, metadona, buprenorfina, hiperbárico.*

Providing effective analgesia in horses remains challenging (CLARK et al., 1999). Nonsteroidal anti-inflammatory can be associated with potentially deleterious gastrointestinal tract and renal effects (MATHEWS, 1992). Administration of opioid analgesics have been associated with ileus and behavioral changes in horses (KOHN et al., 1988; ADAMS et al., 1984)

Spinal analgesia can be obtained with opioid agonists, alpha-2 adrenergic agonists, and ketamine (IGNACIO et al., 1998; BROWN, 1994; KLIDE, 1992). The use of subarachnoid opioids has proven to be effective in producing profound and long lasting analgesia in human beings (BROMAGE et al., 1980; COUSINS et al., 1984; RAWAL et al., 1986; INAGAKI et al., 1992). Sympathetic stimulation and central nervous system excitation (CNS) are observed with intravenous opioids in horses (KAMERLING et al., 1992).

The potency of different opioids and tramadol is related to their lipid solubility as described in several papers (TRAFTON, 1999; FLECKNELL & WATERMAN-PEARSON, 2000, NATALINI & ROBINSON, 2000). Methadone is eight times as potent as morphine. When administered intramuscularly methadone, has a slightly shorter duration of action, more sedation, and evokes less euphoria than morphine (BENNET & STEFFEY, 2002).

The objective of this study was to evaluate and compare the analgesic effect of hyperbaric subarachnoid morphine, buprenorphine, and methadone on pain threshold to electrical stimulation

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and on behavior, cardiovascular and respiratory response variables in horses.

Six healthy adult horses were studied. The study was conducted at Louisiana State University, School of Veterinary Medicine, under the institutional care and use committee authorization number 02-051. Previously to the actual study a pilot study was conducted using 0.01mg.kg^{-1} isobaric morphine that was administered spinally in two horses to observe if CNS excitement would be achieved. All horses received randomly all three treatments, administered subarachnoidly at periods no less than 7 days between each treatment. Those involved in collection of data and making behavioral observations were blinded as to the identity of the agent being tested. Measurements of response variable took place immediately prior to subarachnoid injection, then at 5, 10, 20, 30, 40, 50, 60, 90, 120, 150, 180 minutes and hourly for 24 hours after administration. For subarachnoid injections an 18-gauge sterile catheter was placed in the lumbar-sacral space. Hyperbaric Morphine 0.01mg.kg^{-1}, buprenorphine 0.001mg.kg^{-1}, and methadone 0.01mg.kg^{-1} in equal volume (5ml) were obtained diluting the opioid with 10% dextrose. The specific gravity of the solutions was adjusted to 1030.

Heart rate and blood pressure (systolic, diastolic, and mean) were recorded as well as respiratory rate. Arterial blood gases were also determined. Sedation was assessed by measuring the distance from the muzzle to the floor in cm. Spontaneous locomotor activity was evaluated for ataxia. Analgesia was assessed with an electrical noxious stimulation over dermatomes of perineal, lumbar-sacral and thoracic areas. The voltage was increased at 10 volts increments up to 80 volts. Positive pain responses were considered purposeful avoidance movements. One way repeated measured analysis of variance (ANOVA) and Friedman repeated measured analysis of variance test were used. Difference were considered significant at $P<0.05$.

The results showed no significant differences for cardiovascular and respiratory variables. Heart rate, blood pressure, respiratory rate, and blood gases stayed within normal limits, demonstrating that the technique is safe. No ataxia, sedation or central nervous system excitement were observed in the hyperbaric study while the two horses that received isobaric morphine showed marked CNS excitement, increased respiratory rate and had increased stepping in the stocks similar to what have been described in the literature (KAMERLING et al., 1992). This can be probably explained due to a more segmental effect of the hyperbaric solution. Other study with epidural isobaric morphine showed profound sedation (NATALINI & ROBINSON, 2000). Avoidance threshold for noxious electrical stimulation increased from baseline for buprenorphine, morphine, and methadone. Analgesia was intense (> than 40 volts) after 5 to 10 minutes at perineal, sacral, lumbar, and thoracic dermatomes and lasted approximately for 120 minutes for morphine and methadone but not for buprenorphine, demonstrating that both morphine and methadone produce faster onset of action but shorter duration than when used in an isobaric solution epidurally (NATALINI & ROBINSON, 2000). Buprenorphine also produced analgesia from 5 up to 60 minutes that was considered moderate. The reason why buprenorphine was not as effective as morphine and methadone can be explained by buprenorphine's high affinity but poor specificity for mu-opioid receptors (STOELTING, 1992).

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