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CLINICAL EVALUATION OF EPIDURAL ADMINISTRATION OF MORPHINE, FENTANYL, METHADONE, LIDOCAINE AND LIDOCAINE WITH EPINEPHRINE IN CATTLE

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ABSTRACT

The purpose of this study was to determine the analgesic efficacy and clinical effects of morphine, fentanyl, methadone, lidocaine, lidocaine with epinephrine and saline (control) when injected epidurally into the caudal epidural space in cattle. Epidural analgesia was achieved in five cattle on five successive occasions at weekly intervals. Analgesia was defined as a lack of response to hemostat pressure and pinprick in the skin of the perineal area and ventral aspect of the tail. The results demonstrated that while epidural lidocaine and lidocaine with epinephrine decreased the response to hemostat and pinprick compared to control, there was no reduction in response after the administration of morphine, methadone or fentanyl. Heart rate, pulse and respiratory rates were not significantly altered by any of the drugs. Neither did the drugs produce any change in the electrocardiogram (ECG) of the animals.

Key words: Epidural, morphine, fentanyl, methadone, lidocaine, cattle.

INTRODUCTION

In recent years, the epidural administration of opioids and alpha adrenergic agonists have effectively relieved postoperative and cancer pain in human and animal patients (Valverrde *et al*., 1990; Ohlsson *et al*., 1992; Hendrickson *et al*., 1996; Kuplulu and Vural, 1996; Lin *et al*., 1998). Opioids and α_2 adrenergic agonists selectively block sensory fibers, thereby providing analgesia with decreased likelihood of hind limb dysfunction (North 1986; Pablo 1993; Lin *et al*., 1998; Prado *et al*., 1999).

The purpose of the present study was to evaluate the epidural effects of opioids in cattle and to compare them with the effects of analgesia produced by lidocaine or lidocaine with epinephrine.

MATERIALS AND METHODS

Five healthy female cattle (Holstein-Friesian) aged 2-3 years were used. The animals were stabled and fed a diet of hay with water available *ad libitum*. They were restrained using stock and cross ties during the epidural injection. The sacrococcygeal area of each cow was shaved and scrubbed with povidone-iodine. All injections were given aseptically in the sacrococcygeal space through an 18 gauge 3.7 cm hypodermic needle. Confirmation of proper injection was based on the evidence of negative pressure and negligible resistance to injection. Proper placement of the catheter was verified by radiography.

Each cattle received five treatments at weekly interval. The treatments were: lidocaine hydrochloride without epinephrine (0.22 mg/kg of body weight), lidocaine hydrochloride with epinephrine (0.22 mg/kg of body weight), morphine (0.1 mg/kg body weight), fentanyl (0.005 mg/kg body weight), methadone (0.1 mg/kg body weight) and saline (0.9% sodium chloride solution at 0.2 ml/kg body weight). The volume of each treatment was 20 ml, made by using sterile saline as the diluent. Electrocardiogram (ECG) was taken using a base apex lead before drug administration and at 5, 10, 15, 20, 25, 30, 45, 60, 90 and 120 minutes afterwards. Heart rate and ECG activity were monitored constantly on an oscilloscope but recorded only at the described intervals. Respiratory rate was also recorded at the same intervals. The skin of the ventrum of the tail and perineal area was pricked using a 20 gauge needle to measure hemostate pressure at above intervals. Presence or absence of an avoidance response was recorded.

The effects of treatments on heart rate and respiratory rate at each time period were analyzed using one-way analysis of variance through general linear model. Where significance was found, Duncan's multiple range test was used for multiple mean comparisons.

RESULTS AND DISCUSSION

Epidural administration of lidocaine and lidocaine with epinephrine prevented an avoidance response to pinprick and hemostat pressure of the tail and the perineal area. The cattle receiving this drug showed a normal avoidance response when stimulation was from outside the desensitized area. Ventral aspect of the tail or the perineal region were not desensitized with morphine, fentanyl, methadone and saline administered in the caudal epidural space. This was not sufficient to prevent an avoidance response to pinprick the perineal area.

There were no significant differences in mean heart rate, pulse or respiratory rate between the five treatments at any time point. Cardiac rhythm did not show any difference between treatment groups. Sedation was not present in cattle treated by opioid drugs administered epidurally.

Sedation was characterized by decreased mental awareness, prolapsed third eyelid, lowered head and drooping of the lower lip. Mild ataxia without complication developed in cattle given lidocaine and lidocaine with epinephrine.

Epidural administration of analgesics and anesthetics is useful for intraoperative management of high-risk patients, perioperative analgesia, caudal anesthesia and analgesia. Opioid agonists commonly used perioperatively include morphine, fentanyl and methadone. Cardiovascular effects of these opiods included vagally induce bradycardia, direct depression of the sinoatrial node and slowed atrioventricular conduction. Ventilation is directly depressed through inhibition of central respiratory centers. Opioids are administered as continuous intravenous infusion in humen pain management and are also being used clinically in veterinary practice. Fentanyl and methadone are synthetic opioids. They have a quicker onset of action than morphine but the action is of shorter duration (Hansen, 1994).

In this study, the injection of morphine, methadone and fentanyl into the epidural space showed no evidence of analgesia as compared to the injection of saline into the epidural space. The amount of opioids used in this study was the same as has currently been used in small animals and horses (Valverrde *et al*., 1990; Pablo, 1993; Sysel *et al*., 1996). Specific location, density and subtype of spinal opioid receptors (North, 1986) have not been elucidated in cattle, nor has the selectively of morphine for these receptors been investigated. Therefore, it is difficult to speculate on the action and interaction of these epidural injections. Opioids in cattle did not affect the specific parameters examined in this study. This may be related to an insufficient number of sympathetic fibers which are blocked to influence the overall cardiovascular system of cattle.

In conclusion, results of the present study indicate that epidural injection of morphine (0.1 mg/kg), methadone (0.1 mg/kg) and fentanyl (0.005 mg/kg) does not provide regional analgesia in cattle.

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