کارگاه‌های آموزشی مرکز اطلاعات علمی

آموزش نرم‌افزار Word برای پژوهشگران

روش تحقیق کمی

آموزش مهارت‌های کاربردی در تدوین و چاپ مقالات ISI

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Caudal Extradural Analgesia with Lidocaine, Xylazine, and a Combination of Lidocaine and Xylazine in the Iranian River Buffalo (*Bubalus bubalis*)

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Abstract

Objective- To compare the time of onset, duration of action and the extent of analgesia produced by a lidocaine/xylazine combination with that produced by lidocaine and xylazine alone after injection into the caudal extradural space of the Iranian river buffalo.
Design- Observer-blind prospective descriptive trial, Latin square design.
Animals- Eleven adult (aged over 2 years) female non-gravid healthy Iranian river buffaloes (*Bubalus bubalis*), weighing from 450 to 650 kg.
Procedure- Caudal extradural analgesia was achieved in buffaloes on 3 occasions at 14-day intervals by injection of 2% lidocaine (L; 0.22 mg kg^{-1}), 2% xylazine (X; 0.05 mg kg^{-1}), and a combination of 2% lidocaine(0.22 mg kg^{-1}) / 2% xylazine (LX; 0.05 mg kg^{-1}) in a Latin square design. Analgesia was determined by the lack of response to pin-prick and haemostat pressure in the skin of the caudal areas.
Results- Onset of analgesia for X was significantly longer (5.5 ± 0.7 minutes) than that for L or LX. Duration of analgesia was significantly longer for LX (172.3 ± 17.7 minutes) than for either drug used alone (lidocaine, 79.5 ± 5.7 minutes; xylazine, 136.4±11.4 minutes). In X and LX groups, the level of analgesia ascended to thoracic segments; however, in lidocaine-treated buffaloes thighs, flank, and udders remained sensitive. In all buffaloes, xylazine, administered either alone or with lidocaine, induced mild to moderate ataxia.
Conclusions – The LX combination provided a more rapid onset, a longer duration of analgesia, and a more cranial spread of analgesic effect compared with either drug alone.
Clinical relevance: The LX combination may offer a fast and long lasting anesthesia/analgesia to perform obstetrical and surgical procedures without the need for re-injection.
Keywords: lidocaine, xylazine, caudal extradural analgesia, buffalo, *Bubalus bubalis*

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Introduction

Caudal extradural analgesia can be used to perform surgery of the perineum, rectum, and vagina in standing animals. Extradural analgesia is usually produced by local anaesthetics (usually lidocaine 2% solution) injected into the caudal extradural space[1]. Motor, sensory and sympathetic nervous fibres are sensitive to the blocking properties of local anaesthetics in increasing order of sensitivity. Therefore, in addition to analgesia, hypotension and limb weakness may result from the non-selective effect of local anaesthetics on sympathetic nervous and motor fibres. To overcome the unwanted complications of local anaesthetics, extradural administration of an α_2-agonist such as xylazine 2% solution, which has potent sedative and analgesic effects when injected systemically, has been recommended in horses, ruminants, and dogs[2-4].

Buffalo produce draft power, milk, meat, and hides and have a great economical importance in the Asian agriculture. Currently, approximately 150 million Asian buffalo provide 77 million tons of milk and 3 million tons of meat, and in several countries, up to 30% of the draft power for agricultural operations[5]. Information on caudal extradural analgesia in buffaloes is limited.[6, 7] Consequently, this study was performed to compare the effectiveness of analgesia following caudal extradural injection of lidocaine, xylazine, and a lidocaine/xylazine combination in Iranian river buffaloes.

Materials and Methods

Eleven adult (>2 years of age) female non-gravid Iranian river buffaloes with an average body mass of 554 ± 68 kg were used in the trial. The buffaloes were judged to be in good health based on clinical findings and haematological evaluation. Buffaloes were quiet, being accustomed to handling, kept in pens under similar conditions, and provided with hay and water *ad libitum*. The animals were allowed to acclimatize for two weeks. The study protocol was approved by the Higher Committee of Veterinary Clinical Sciences (HCVCS) at College of Veterinary Medicine, Shahrekord University.

Each of eleven buffaloes received 3 extradural treatments at 14-day intervals according to a Latin square design. The treatments were 2% lidocaine[i] (L) without epinephrine (0.22 mg kg^{-1}), 2 % xylazine[ii] (X; 0.05 mg kg^{-1}), and a combination of 2% xylazine (0.05 mg kg^{-1}) plus 2% lidocaine (XL; 0.22 mg kg^{-1}). The doses of L and X were based on the extradural doses used by Grubb and others (2002) in cattle. The volumes of L and X injected were increased with sterile saline solution so that they equalled that of the LX combination.

Before each treatment, buffaloes were confined in a crush and the skin over the sacro-coccygeal area was surgically prepared. Injections were made into the extradural space through the sacro-coccygeal space or between the first and second coccygeal vertebrae, using an 18 SWG 3.7 cms long hypodermic needle. Extradural deposition was confirmed by the "hanging-drop" technique and by the lack of resistance to injection.

Time to onset, duration and the anatomical distribution of analgesia were recorded. Time from injection to loss of sensation was considered as time to onset of analgesia. The presence of analgesia was taken as lack responses to "pin pricking" and applying haemostat pressure or pinching (haemostats closed to the first ratchet). These tests were first applied to the perineal area and in the absence of a response, to more cranial dermatomes until a response was observed. Positive responses to needle prick or haemostat pressure were defined as movement, kicking, or contraction of the cutaneous muscles. In this way the presence and the anatomic extent of analgesia was determined. Testing was repeated every 5 minutes until

sensation returned. The time from the loss of, to the return of sensation was considered to be the duration of analgesia. The buffaloes were evaluated throughout the study for the presence of sedation and ataxia based on criteria described by Grubb and others, 2002. Sedation was graded as none (no sedative effect), mild (slight lowering of head carriage and, or protrusion of the lower lip), moderate (signs of mild sedation plus presence of prolapsed 3rd eyelid and ptyalism) or severe (signs of moderate sedation plus need to lean on stanchions for support). Ataxia was graded as none (no signs of stumbling), mild (slight stumbling, easily able to continue walking), moderate (marked stumbling, walking but very ataxic), or severe (falling). The same investigator assessed analgesia, sedation and ataxia in all cases, and was unaware of the treatment given.

Statistical Alalysis

All data were evaluated using a repeated-measures ANOVA with significance at $p<0.05$ (SigmaStat for Windows, version 2.03, Jandel Corporation, San Rafel, CA).

Results

Caudal extradural analgesia and ataxia were produced in all buffaloes following administration of lidocaine, xylazine, and lidocaine/xylazine, but no animal became recumbent. In each animal, loss of sensation to pin prick and pinching were attained in 3.3 ± 0.5, 5.5 ± 0.7, and 3.2 ± 0.4 minutes for L, X, and LX, respectively. The onset of analgesia provided by each treatment is summarized in figure 1. The duration of maximal analgesic effect in X and LX-treated buffaloes were 136.4 ± 11.4 and 172.3 ± 17.7 minutes, respectively, compared to 79.5 ± 5.7 minutes in the animals of the L group. Data (mean ± SD) are presented in figure 2. Extradural administration of X and the LX combination prevented responses to "pin pricking" and pinching of the tail, perineal area, thigh, flank, and udders, and the anatomical level of analgesia ascended to at least the thoracic segments (T13 and L1). However, the thighs, flank, and udders remained sensitive in L-treated buffaloes. In all cases, xylazine administered either alone or with lidocaine, induced mild to moderate sedation and ataxia, whereas lidocaine alone produced mild ataxia. None of the buffaloes experienced severe sedation or ataxia.

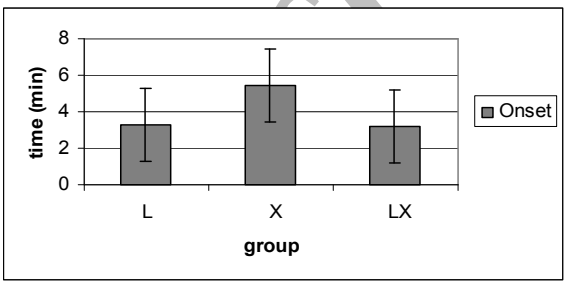

Fig. 1: Mean time to onset (minutes) of analgesia following caudal extradural injection of lidocaine (L), xylazine (X), or a lidocaine/xylazine (LX) combination in buffaloes. Error bars = SD; onset in X groupo is significantly different from other two groups.

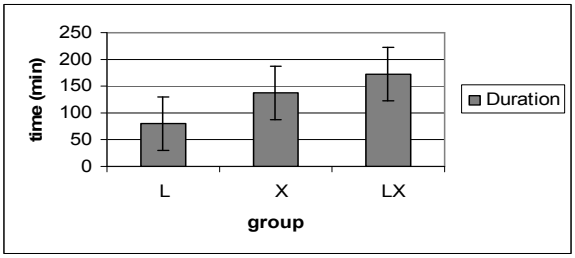

Fig. 2: Mean duration of analgesia following caudal extradural injection of lidocaine (L), xylazine (X), or a lidocaine/xylazine (LX) combination in buffaloes.
Error bars = SD; duration in LX group is significantly different from the other two groups.

Discussion

Caudal extradural injection of analgesic agents can be made in buffaloes at the sacrococcygeal junction or at the junction of the first and second coccygeal vertebrae as in horses[2]; llamas[8]; sheep[9]; cattle[3] and goats[10].

The results of the present study show that extradurally administered LX in buffaloes had a shorter onset and a longer duration of analgesia than either component alone. Co-administration of α_2-agonists and local anesthetics provide prolonged analgesia in human beings[11, 12], horses[13], llamas[8] and dogs[14, 15]. The additive effects of local anesthetic agents and α_2-agonists probably arise from several mechanisms.[16] The possibility that α_2-receptor agonists cause vasoconstriction and retard drug absorption seems unlikely because analgesia is abolished by vasodilating drugs.[4] However, the α_2-agonists can inhibit the vasodilator properties of local anesthetics and delay subsequent vascular uptake.[3, 4] Alternatively, additive effects might occur because α_2-agonist-induced analgesia may intensify and prolong the lidocaine-induced sensory blockade through a pre- or post-synaptic α_2-mediated mechanism and, or an α_2-agonist effect on arterioles.[4]

Xylazine has procaine-like local anesthetic activity, which may be responsible for analgesia after extradural injection and for the motor blockade seen at high dosages.[8] Following extradural injection, α_2-agonists bind to nonopioid receptors in the substantia gelatinosa of the dorsal horn grey matter and produce analgesia [3], but as the spinal cord terminates at the level of 2nd sacral vertebrae in buffalo[17], it cannot be taken into account to explain analgesia here as the agent must migrate cranially to allow receptor-site binding in the spinal cord.

Dose-related ataxia can be expected following extradural administration of lidocaine because it blocks both sensory and motor fibres.[3] In the current study, ataxia was seen after extradural L and after the LX combination. Ataxia also occurred with extradural X alone which was unexpected; as α_2-agonism within the spinal cord should result primarily in sensory blockade. The local (α_2-agonist) anesthetic effect of X could have caused the ataxia observed. However, as the buffaloes appeared to be moderately sedated, it is likely that the ataxia resulted from xylazine-mediated central sedative effects, in which case administration of an α_2-antagonist like atipamezole would have resolved the problem.

Horses do not generally become sedated after extradural xylazine[13, 18] although cattle[17, 20, 21] and llamas[8] may exhibit mild to moderate sedation. This discrepancy probably arises from species-related variation in sensitivity to α_2-agonists, with ruminants being the most, llamas intermediate and horses the least sensitive. The limited volumes of extradural xylazine that were subsequently absorbed systemically appeared to be sufficient to cause sedation in the buffaloes in the current study.

It is concluded that a combination of lidocaine and xylazine administered extradurally to buffaloes produces an effective, safe, with more rapid onset of longer perineal analgesia when compared with either agent alone. The combination caused mild to moderate sedation and ataxia and cutaneous analgesia extending from the coccyx to approximately T13. Veterinarians might choose extradural LX combinations for producing long-lasting conditions for obstetrical surgery. The LX combination might allow obstetrical procedures to begin shortly after administration and to be continued without the need for repeated injections.

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چکیده

بیحسی اکسترادورال خلفی با لیدوکایین، زایلازین و مخلوط لیدوکایین/زایلازین در گاومیش رودخانه ای ایران *(بوبالوس بوبالیس)*

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هدف: مقایسه شروع، دوام و گستره بی دردی ناشی از تزریق اکسترادورال خلفی مخلوط لیدوکایین/زایلازین با لیدوکایین و زایلازین به تنهایی در گاومیش رودخانه ای ایران.

طرح: مطالعه آینده نگر توصیفی ، شیوه مربع لاتین.

حیوانات: یازده گاومیش ماده رودخانه ای ایرانی، بالغ (بالای ۲ ساله)، سالم، غیر آبستن و با وزن ۴۵۰ تا ۶۵۰ کیلوگرم.

روش کار: در ۳ نوبت به فاصله چهارده روز، بیحسی اکسترادورال خلفی در گاومیش ها با تزریق لیدوکایین ۲٪ (گروه L، ۰/۲۲ میلی‌گرم بازای هر کیلوگرم وزن بدن)؛ زایلازین ۲٪ (گروه X، ۰/۰۵ میلی گرم بازای هر کیلوگرم وزن بدن) و مخلوط لیدوکایین ۲٪ (۰/۲۲ میلی گرم بازای هر کیلوگرم وزن بدن)/ زایلازین ۲٪ (گروه LX، ۰/۰۵ میلی گرم بازای هر کیلوگرم وزن بدن) به شیوه مربع لاتین صورت گرفت. بی دردی به واسطه عدم بروز واکنش در آزمون های نیش سوزن و فشار هموستات در پوست نواحی خلفی، مورد ارزیابی قرار گرفت. نتایج حاصله به کمک آزمون آنووا یک طرفه مورد مقایسه قرار داده شد.

نتایج: شروع بی دردی در گروه X بطرز معنی داری طولانی تر از دو گروه دیگر بود (۰/۷ ± ۵/۵ دقیقه). دوام بی دردی در گروه LX (۱۷/۷ ± ۱۷۲/۳ دقیقه) بطور معنی داری طولانی تر از گروه L (۵/۷ ± ۷۹/۵ دقیقه) و گروه X (۱۱/۴ ± ۱۳۶/۴ دقیقه) بود. در گروه های X و LX ، سطح بی دردی تا قطعات سینه ای پیشروی داشت، درحالیکه در گاومیش های گروه لیدوکایین، بی دردی در ران ها، پهلو و پستان ها بروز نکرد. در کل گاومی‌ش ها، تزریق زایلازین چه به تنهایی چه بصورت مخلوط با لیدوکایین آتاکسی خفیف تا متوسطی را ایجاد کرد.

نتیجه گیری: بی دردی ناشی از تزریق اکسترادورال مخلوط لیدوکایین/زایلازین در مقایسه با هرکدام از داروها به تنهایی، شروع سریع تر اثر، دوام و گستره بی‌شتری را نشان داد. مخلوط لیدوکایین/زایلازین به دلیل ایجاد بی دردی سریع و با دوام می تواند به خوبی بدون نیاز به تکرار تزریق در بیحسی اکسترادورال خلفی در گاومیش رودخانه ای ایران استفاده شود.

کلید واژگان: لیدوکایین، زایلازین، بیحسی اکسترادورال خلفی، گاو میش، *بوبالوس بوبالیس*.

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