CAUDAL EXTRADURAL ANALGESIA WITH LIDOCAINE, XYLAZINE, AND A COMBINATION OF LIDOCAINE AND XYLAZINE IN THE IRANIAN RIVER BUFFALO

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Abstract

This study was conducted to compare the time of onset, duration of action, and the extent of analgesia produced by a lidocaine/xylazine combination with those produced by lidocaine and xylazine alone after injection into the caudal extradural space of the Iranian river buffalo. The study was designed as a prospective, descriptive, observer-blind trial, in a Latin square pattern. Eleven adult (aged over 2 years) non-gravid and healthy females of Iranian river buffaloes (Bubalus bubalis), weighing from 450 to 650 kg, were used. Caudal extradural analgesia was achieved 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 (LX; 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 pinprick and haemostat pressure in the skin of the caudal areas. X was significantly longer (5.5 ± 0.7 min) than that by L or LX. Duration of analgesia was significantly longer by LX (172.3 ± 17.7 min) than that by either drug used alone (lidocaine, 79.5 ± 5.7 min; xylazine, 136.4±11.4 min). 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 the buffaloes, xylazine, administered either alone or with lidocaine, induced mild to moderate ataxia. It was concluded that the LX combination provided a more rapid onset and a longer duration of analgesia, and a more cranial spread of analgesic effect compared with either drug alone. As a result, the LX combination may offer a fast and long lasting anaesthesia/analgesia to perform obstetrical and surgical procedures without the need for re-injection.

Key words: water buffaloes, analgesia, lidocaine, xylazine.

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 (10). 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 α₂-agonist, such as xylazine 2% solution, which shows potent sedative and analgesic effects when injected systemically, has been recommended in horses, ruminants, and dogs (2, 9, 12).

Buffaloes provide draft power, milk, meat, and hide, and have a great economical importance in the Asian agriculture. Currently, approximately 150 million Asian buffaloes 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 (15). Information on caudal extradural analgesia in buffaloes is limited (20, 21). 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.

Material and Methods

Eleven adult (>2 years of age), non-gravid females of Iranian river buffaloes (Bubalus bubalis), with an average body mass of 554 ± 68 kg, were used in the trial. On the basis of clinical and haematological examinations, the buffaloes were judged to be in good health. 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 acclimatise for two weeks.

Each of eleven buffaloes received 3 extradural treatments at 14 d intervals, according to a Latin square design. They were treated with 2% lidocaine (L) without epinephrine (Nasr Pharmaceutical Co., Iran: 0.22 mg kg\(^{-1}\)), 2% xylazine (Rompun®, Bayer, Germany: 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\textsuperscript{et al.} (9) in cattle. The volumes of L and X injected were filled up with sterile saline solution so that they equalled that of the LX combination.

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

Time to the onset, duration, and anatomical distribution of the analgesia were recorded. Time from the injection to loss of the sensation was considered as time of the onset of the analgesia. The presence of the analgesia was taken as lack of 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 the analgesia was determined. The testing was repeated every 5 min until sensation returned. The time from the loss to the return of the sensation was considered to be the duration of the analgesia. The buffaloes were evaluated throughout the study for the presence of sedation and ataxia based on criteria described by Grubb\textsuperscript{et al.} (9). The 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 3\textsuperscript{rd} eyelid and ptyalism), or severe (signs of moderate sedation plus need to lean on stanchions for support). The 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, unaware of the given treatment, assessed analgesia, sedation, and ataxia in all cases.

All the data was evaluated using a repeated-measures ANOVA with significance at P<0.05 (SigmaStat for Windows, version 2.03, Jandel Corporation, San Rafael, CA).

**Results**

Caudal extradural analgesia and ataxia were obtained in all the buffaloes following administration of lidocaine, xylazine, and lidocaine/xylazine, but no animal became recumbent. In each animal, loss of sensation to pin pricking and pinching were attained in 3.3 ± 0.5, 5.5 ± 0.7, and 3.2 ± 0.4 min for L, X, and LX, respectively. The onset of the analgesia provided by each treatment is summarised in Fig. 1. The duration of maximal analgesic effect in X and LX-treated buffaloes were 136.4 ± 11.4 min and 172.3 ± 17.7 min, respectively, compared to 79.5 ± 5.7 min in the animals of the L group. The data are presented in Fig. 2. Extradural administration of X and LX combination prevented responses to “pin pricking” and pinching of the tail, perineal area, thigh, flank, and udder, and the anatomical level of the analgesia ascended to at least the thoracic segments (T13 and L1). However, the thighs, flanks, and udders remained sensitive in L-treated buffaloes. In all the 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](image-url)
Fig. 2. Mean duration of the analgesia following caudal extradural injection of lidocaine (L), xylazine (X), or a lidocaine/xylazine (LX) combination in buffaloes. Error bars = SD; * duration significantly different from that of the other two groups.

**Discussion**

Caudal extradural injection of analgesic agents can be made in buffaloes at the sacro-coccygeal junction or at the junction of the first and second coccygeal vertebrae, as in horses (12), llamas (8), sheep (14), cattle (9), and goats (1).

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 α2-agonists and local anaesthetics provide prolonged analgesia in humans (16, 18), horses (7), llamas (8), and dogs (3, 13). The additional effects of local anaesthetic agents and α2-agonists probably arise from several mechanisms (6). The possibility that α2-receptor agonists cause vasoconstriction and retarded drug absorption seems unlikely because analgesia is abolished by vasodilating drugs (2). However, the α2-agonists can inhibit the vasodilator properties of local anaesthetics and delay subsequent vascular uptake (2, 9). Alternatively, additional effects might occur because α2-agonist-induced analgesia may intensify and prolong the lidocaine-induced sensory blockade through a pre- or post-synaptic α2-mediated mechanism and/or a α2-agonist effect on arterioles (2).

Xylazine has procaine-like local anaesthetic activity, which may be responsible for the analgesia after extradural injection and for the motor blockade seen at high dosage (8). Following extradural injection, α2-agonists bind to non-opioid receptors in the substantia gelatinsa of the dorsal horn grey matter and produce analgesia (9). However, as the spinal cord terminates in buffalo at the level of the 2nd sacral vertebra (19), it cannot be taken into account to explain the 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 (9). In the current study, the ataxia was seen after extradural administration of L and LX combination. The ataxia also occurred after extradural X alone, which was not expected, as α2-agonism within the spinal cord should result primarily in sensory blockade. The local (α2-agonist) anaesthetic 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 this case administration of a α2-antagonist, like atipamezole would have resolved the problem.

Horses do not generally become sedated after extradurally injected xylazine (7, 11), although cattle (5, 17, 19) and llamas (8) may exhibit mild to moderate sedation. This discrepancy probably arises from species-related variation in the sensitivity to α2-agonists, with bovines being the most, llamas intermediate, and horses the least sensitive animals. The limited volumes of extradurally injected xylazine that was 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, ataxia, and cutaneous analgesia extending from the coccyx to approximately T13. Veterinarians might choose extradural LX combinations to obtain 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.

**References**
