

## Sedation with Xylazine-Diazepam and Epidural Administration of Lidocaine and Xylazine for Castration and Ovariohysterectomy in Cats

Amin Bigham-Sadegh <sup>1\*</sup>  
Mohammad Shadkhast <sup>2</sup>  
Zahra Shafiei <sup>3</sup>  
Bizhan Ziaei <sup>4</sup>

<sup>1</sup>*Department of Clinical Sciences, Faculty of Veterinary Medicine,  
Shahreh-kord University, Shahreh-kord, Iran*

<sup>2</sup>*Department of basic science, Faculty of Veterinary Medicine,  
Shahreh-kord University, Shahreh-kord, Iran*

<sup>3</sup>*Department of Clinical Sciences, Faculty of Veterinary Medicine,  
Shiraz University, Shiraz, Iran*

<sup>4</sup>*DVM student of Faculty of Veterinary Medicine,  
Shahreh-kord University, Shahreh-kord, Iran*

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### Abstract

The aim of this study was to determine whether anesthesia consisting of sedation induced by intramuscular administration of xylazine-diazepam and lumbosacral analgesia induced by epidural administration of lidocaine and xylazine is satisfactory for castration and ovariohysterectomy in cats. Six adult (3 male and 3 female,  $2.5 \pm 0.5$  years of age) cats (mean body weight  $\pm$  SD,  $2.2 \pm 0.44$  kg) were used in this study. Cats were sedated with xylazine ( $1-2 \text{ mg kg}^{-1}$  IM) and diazepam ( $0.2 \text{ mg kg}^{-1}$ , IM) and 5 minutes later a 2% solution of lidocaine ( $0.5\text{ml}/4.5\text{kg}$ ) and xylazine ( $1 \text{ mg kg}^{-1}$ ) were administered into the lumbosacral epidural space. Open castration technique or ventral midline routine ovariohysterectomy were performed. Time to onset, duration and cranial spread of analgesia were recorded. Heart rate, respiratory rate and rectal temperature were recorded at time 0 (prior to epidural drugs administration) as a base line values and at 10, 20, 30, 45 and 60 minutes after the epidural administration. Onset time of analgesia was  $4.0 \pm 0.63$  min (Mean  $\pm$  SEM) and duration of analgesia was  $89.5 \pm 3.0$  min (Mean  $\pm$  SEM). However, surgical procedures were completed within 25-37 min. There were significant decrease in heart rate and rectal temperature values and significant increase in respiratory rate ( $P < 0.001$ ). Intramuscular administration of xylazine-diazepam for sedation and epidural administration of lidocaine and xylazine for analgesia provided satisfactory analgesia for castration and ovariohysterectomy in cats. Utilizing epidural anesthetic technique with this combination is most useful for spaying surgery, especially when the surgical procedure can be completed in  $< 40$  minutes.

**Key words:** Epidural, Lidocaine, Xylazine, Castration, Ovariohysterectomy, Cat

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### \*Corresponding author:

Amin Bigham-Sadegh, DVM, DVSc

Department of Surgery and Radiology, Faculty of Veterinary Medicine, Shahreh-kord University, Shahreh-kord, Iran.

E-mail address: [dr.bigham@gmail.com](mailto:dr.bigham@gmail.com)

## Introduction

Although regional anesthesia is infrequently used in feline practice - presumably because of the practical problem of handling the conscious cat-epidural anesthetic techniques have been shown to be effective in experimental cats<sup>1</sup> and can be of value in such procedures as orthopedic surgery of the hind limb and caesarian operation, particularly in seriously ill cats or those that are either lightly anaesthetized or heavily sedated.<sup>2</sup> Lignocaine (LIG) is traditionally used for epidural block in dogs and cats.<sup>3</sup> Branson *et al.* (1993) have reported the epidural use of an alpha 2 agonist, medetomidine, for analgesia in isoflurane-anesthetized dogs.<sup>4</sup> Whereas the epidural use of xylazine, another alpha 2 agonist, has also been reported in large animals, its clinical use in the dog and cat is yet to be reported.<sup>2</sup> The aim of this study was to determine whether anesthesia consisting of sedation induced by intramuscular administration of xylazine-diazepam and lumbosacral analgesia induced by epidural administration of lidocaine-xylazine is sufficient for castration and ovariohysterectomy in cats.

## Materials and Methods

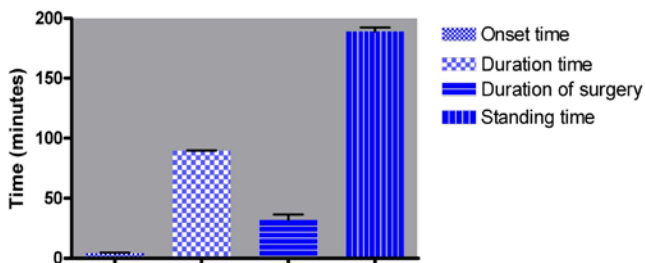
Six adult (3 male and 3 female,  $2.5 \pm 0.5$  years of age) cats (mean body weight  $\pm$  SD,  $2.2 \pm 0.44$  kg) were used in this study. The cats were presented for elective ovariohysterectomy or castration to the department of veterinary surgery and radiology. The study was approved by the Research Committee of the Shahreh-kord University. Each cat was deeply sedated with xylazine ( $1-2 \text{ mg kg}^{-1}$  IM, 2% injectable sterilized solution, Bayer Co, Germany) and diazepam ( $0.2 \text{ mg kg}^{-1}$ , IM, Bayer Co, Germany).<sup>5</sup> This heavy sedation was employed to allow handling of the cats for epidural puncture to be carried out efficiently and humanely. The sedated cat was positioned in sternal recumbency, the

lumbosacral site identified<sup>6</sup> and prepared aseptically. Following subcutaneous infiltration with 3.0 ml diluted 2% lidocaine of 0.5% (2% injectable sterilized solution, preservative-free Lidocaine Hydrochloride, Bayer Co., Germany), a 20-gauge 5 cm-long Tuohy needle (Braun Melsungen AG) was inserted into the epidural space at the interspace between the last lumbar and first sacral vertebrae. The epidural space was identified by loss of resistance to injection after piercing the ligamentum flavum.<sup>6</sup> A mixture of 2% solution of lidocaine ( $0.5 \text{ ml } 4.5 \text{ kg}^{-1}$ ) and 2% xylazine ( $1 \text{ mg kg}^{-1}$ ) were administered into the lumbosacral epidural space. Analgesia was assessed by response to the pinch of hemostat forceps applied to the skin of the proximal hind limbs, perineum and abdominal wall. Response was noticed each minute until no reaction occurred and then at 5 minutes intervals until a response reoccurred. Onset of analgesia was determined as the time interval (in minutes) between the epidural drug injection and loss of pain response. Duration of analgesia was calculated as the time interval (in minutes) between the loss and return of pain response. Duration of recumbency was calculated as the time interval (in minutes) between xylazine-diazepam-induced recumbency and the cats' ability to stand. Duration of surgery was calculated as the time interval between skin incision and skin suturing. Heart rate, respiratory rate and rectal temperature were calculated immediately following the epidural injection of the anesthetic solution (time 0) and at 10, 20, 30, 45 and 60 min intervals after the epidural injection. Heart rate was determined with the aid of a precordial stethoscope. Respiratory rate was determined by visual observation of chest excursions. Rectal temperature was measured using a clinical thermometer. Following epidural injection and onset of analgesia, the animal was placed on an operating table and positioned in dorsal recumbency. Open scrotal approach

castration technique (3 cats) or ventral midline approach ovariohysterectomy (3 cats) were performed. Epidural anesthetic indices and duration of surgery were recorded in all cats, and the physiological variables using ANOVA for repeated measures, followed by least significant difference test. Statistical significance was set at  $P < 0.05$  (computer program SPSS, analytical soft ware, version 15.00).

## Results

The total amount of anesthetic (lidocaine-xylazine mixture) used was between 0.30 and 0.45 ml. Onset time of analgesia was  $4.0 \pm 0.63$  min (Mean  $\pm$  SEM) and duration of analgesia was  $89.5 \pm 3.0$  min (Mean  $\pm$  SEM). Time to standing (duration of recumbency time) was  $188.8 \pm 3.31$  min (Mean  $\pm$  SEM). In overall, five minute after the end of epidural injection, there was no response to sterile needle pricks in any of the animals, and surgery was begun usually within 5 min (with patient and surgery team preparations). No pain was observed in any of the animals during castration or ovariohysterectomy, and there was a good level of muscle relaxation. Surgical procedures were completed within 25 min and 37 min for castration and ovariohysterectomy, respectively. However, efficient anesthesia in the animals was seen for 85-93 min. Therefore, none of the animals required an additional dose of lidocaine-xylazine (Fig.1)



**Fig 1.** Anesthetic indices (mean  $\pm$  SEM) epidurally administered lidocaine-xylazine in 6 cats

The animals did not experience any neurological or clinical complications at the end of anesthesia or during the recovery period. Changes seen in rectal temperature, heart and respiratory rates during anesthesia are shown in Table 1. There was significant decreasing of heart rate before induction of regional anesthesia and 45, and 60 min after anesthesia ( $P < 0.001$ ). Likewise, significant decreasing of rectal temperature was observed before induction of regional anesthesia and at 30, 45, and 60 min after anesthesia. Also, significant increasing of respiratory rate was observed before induction of regional anesthesia and at 45, and 60 min after anesthesia ( $P < 0.001$ ) (Table 1).

## Discussion

In this study, a combination of xylazine, an alpha-2 adrenergic agonist, and lidocaine, a local anesthetic agent, was additive for the duration of analgesia when administered epidurally to cats. Onset of analgesia with lidocaine-xylazine ( $4.0 \pm 0.63$  min) obtained in this study is shorter than the  $5.2 \pm 6.9$  min obtained in previous similar study using xylazine alone.<sup>7</sup> Duration of analgesia with lidocaine-xylazine ( $89.5 \pm 3.0$  min) obtained in our study is approximately same as the  $96.3 \pm 7.9$  min obtained with lidocaine epinephrine in previous study<sup>1</sup> and much longer than the  $51.8 \pm 6.9$  min obtained with xylazine by Adetunji *et al.* (2002).<sup>7</sup> In our study we used lidocaine-xylazine however Duce *et al.* (1969) used lidocaine-epinephrine that epinephrine lead to prolonged duration of analgesia and long duration in this study was related to epinephrine usage.<sup>1</sup> Prolonged duration of epidural analgesia following administration of alpha-2 adrenergic agonist/local anesthetic combination has been reported in human beings,<sup>8-10</sup> horses,<sup>11</sup> llamas,<sup>12</sup> cattle<sup>13</sup> and dogs.<sup>14,15</sup>

Xylazine is a non-narcotic, centrally acting analgesic and sedative with muscle

**Table 1.** Various parameters recorded before (0min) epidural anesthesia and at 10, 20, 30, 45 and 60 min after epidural anesthesia

Parameter	Time (min)					
	0	10	20	30	45	60
Heart Rate	132.5 ± 5.3	128.5 ± 5.3	127.6 ± 4.9	127.3 ± 5.3	125.0 ± 3.2 <sup>a</sup>	123.5 ± 2.34 <sup>a</sup>
Respiratory Rate	19.0 ± 1.7	20.0 ± 2.3	19.5 ± 2.07	20.0 ± 1.7	22.0 ± 1.67 <sup>b</sup>	24.8 ± 1.3 <sup>b</sup>
Rectal Temperature	38.5 ± 0.46	38.0 ± 0.67	37.8 ± 0.5	37.4 ± 0.53 <sup>c</sup>	36.9 ± 0.87 <sup>c</sup>	36.8 ± 0.45 <sup>c</sup>

<sup>a, b and c</sup> means significance differences between base line values (0 min) of physiological variables with other time intervals ( $P < 0.001$ )

relaxant properties. It is widely used in dogs and cats for restraint during various diagnostic and surgical procedures. The effects of xylazine are achieved primarily by stimulation of central presynaptic alpha-2 adrenergic receptors.<sup>16,17</sup> Stimulation of these receptors inhibits the release of norepinephrine from the nerve terminals, possibly by inhibiting the  $Ca^{++}$  influx that develops during an action potential.<sup>16</sup> Although the mechanism of prolonged duration is unknown, at least a theory exists. Alpha-2 adrenergic agonists may produced vasoconstriction or inhibit local anesthetic agent-induced vasodilation and subsequently decrease vascular uptake of the anesthetic agents.<sup>15,18</sup> Respiratory rate was increased significantly after epidural injection of lidocaine-xylazine that this finding has been observed previously by Adetunji *et al.*(2002).<sup>7</sup> Hall and Clark in 2001<sup>19</sup> believed that xylazine as a member of adrenoceptor agonist may produce tachypnoea. Heart rate was decreased significantly during the study in comparison with base line values. Xylazine is reported to cause bradycardia.<sup>17,20</sup> In our study bradycardia had been induced due to systemic and epidural injection of xylazine. On the basis of literature, xylazine may produce hypothermia.<sup>21</sup> In our study significant decrease in rectal temperature was observed after anesthesia.

## Conclusions

The results of this study confirm that intramuscular administration of xylazine-diazepam for sedation and epidural administration of lidocaine and xylazine for analgesia provided acceptable analgesia for castration and ovariohysterectomy in cats. The epidural anesthetic protocol is most useful when respiratory compromise (e.g. following inhalation anesthesia, inhaled anesthetic agents are depressant for respiratory system by depressant effects on central nervous system) or costs are concerns and the surgical procedure can be completed in < 40 minutes.

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