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Evaluation of the epidural analgesic effect of Nalbuphine, Lidocaine and Nalbuphine – Lidocaine combination in bucks

G.A. Ragab, M.Z. Fathy *

Surgery, Anesthesiology and Radiology Dept., Faculty of Veterinary Medicine, Beni-Suef Univ., Beni Suef 62511, Egypt

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ABSTRACT

Nalbuphine is a lipophilic opioid which could be used subcutaneously, intramuscularly, intravenously and epidurally in human, dogs and equine but not used in bucks until yet. The aim of the existing study was to compare the analgesic effect of Nalbuphine, Lidocaine and Nalbuphine – Lidocaine combination injected epidurally in bucks. Fifteen adult apparently healthy bucks were used. The animals were randomly divided into three groups (five animals in each one); group (1) was injected with Nalbuphine HCl at a dose 3 mg/kg, group (2) was injected with Lidocaine HCl 2% at a dose 2.5 mg / kg. Finally, group (3) was injected with Nalbuphine-Lidocaine combination at a dose (1.5 mg /kg and 1.25 mg kg, resp.) to evaluate the analgesic effect of each treatment. Onset and duration of analgesia were recorded after each treatment. Respiratory rate, heart rate, rectal temperature and biochemical parameters were recorded for each treatment. The results revealed that, the onset and duration of analgesia respectively were 12 ± 2 min and 200 ± 4 min in group (1), 6 ± 1 min and 80 ± 3 min in group (2) and 8 ± 2 min and 120 ± 5 min in group (3). In Nalbuphine group, No ataxia was observed while mild ataxia was observed in Nalbuphine-Lidocaine combination group but in Lidocaine treated group, sever ataxia was recorded. Heart rate increased at 90–120 and respiratory rate rectal temperature had no any significantly differentiation from baseline of any treatment. Biochemical parameters returned to basal levels through three hours after all treatments. In conclusion, Nalbuphine – lidocaine combination is useful to perform surgical operations of long duration and had effective analgesia in bucks.

1. Introduction

Local and regional analgesia were more frequently techniques that used in small and large ruminants than general anesthesia which considered as a bad method used in these species due to entrance of ruminal contents into the lungs during rumination (Azari et al., 2014).

Epidural analgesia is the mostly technique used in large ruminants to allow parturition and surgical interference in the tail, anus, rectum, bladder urethra and perineal region (Elmore, 1980; Natalini and Driessen, 2007).

Lidocaine HCl is the most famous local analgesic drug that used for epidural analgesia but has a relatively short duration (Day and Skarda, 1991; Newton et al., 2007; Atiba et al., 2015).

This drug causes ataxia due to motor, sensory fibers and sympathetic receptors blocking (Natalini and Robinson, 2003; Newton et al., 2007).

There are numerous drugs have long analgesic duration for long surgical operations like intra-thecal morphine which provides effective postoperative analgesia, but their use is associated with numerous side effects including pruritus, nausea, vomiting, urinary retention, and respiratory depression. Pruritus is the most common side effect (Moustafa et al., 2016).

Nalbuphine HCl is an opioid pain medication and sometimes called a narcotic. This drug could be administered subcutaneously, intramuscularly or intravenously and epidurally in human, dogs and equine because this drug selective blocking to sensory nerves only and produce very limited side effect such nausea, vomiting, pruritus and respiratory depression. (Arnould and Pinaud, 1992; Fournier et al., 2000).

Nalbuphine HCl was used in human, dogs and donkeys and the analgesic effect not detected in bucks yet. The objective of the existing study is to evaluate the analgesic effect of Nalbuphine, Lidocaine and Nalbuphine-Lidocaine combination when injected into epidural space of the bucks and its effect on clinical and biochemical parameters.

* Corresponding author.
E-mail address: mzfhussein83@gmail.com (M.Z. Fathy).

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2. Material and methods

2.1. Animals

The current study was conducted with fifteen adult, apparently healthy bucks of 20–25 kg body weight and 1.5–2 years old. All animals underwent to physical and hematological examinations to exclude the diseased one according to Radostits et al. (2000). The lumbo-sacral region was prepared for aseptic injection. All procedures were achieved according to Institutional Animal Care.

The prepared animals were randomly divided into three groups (five bucks in each group):- **Group (I)** was injected with Nalbuphine HCL (**Nalufin® 20 mg/1 ml Anoum pharmaceuticals industries Co. Egypt)** at a dose of 3 mg/kg., **group (II)** was injected with Lidocaine HCL 2% **(Debocaine® Al-Debeiky pharmaceutical industries Co. Egypt)** at a dose of 2.5 mg/kg. and **Group (III)** was injected with a combination of Nalbuphine HCL 2% at a dose 1.5 mg/kg. and Lidocaine HCL 2% at a dose 1.25 mg/kg. In all groups, the total volume of injected solution was 5 ml by adding normal saline 0.9%. A 16 gauge needle was inserted in lumbo-sacral space and ensure by loss resistant test and the solution injected slowly in epidural space within 30 s.

Evaluation of analgesia, motor effect and biochemical parameters were reported. The onset and duration were recorded for all animals by detect of losing of response to compression of haemostatic clamps from perineal region toward thoracic region till the response to the pain of haemostatic clamp is return back again. The onset of analgesia was recoded each minute after administration of each drug (Dehkordi et al., 2012).

Motor effect of drugs was evaluated by presence of ataxia by let the animal to walk and this was graded on a 0–3 scale (Grubb et al., 2002). Respiratory rate, heart rate and rectal temperature were recorded at 0 time and every 15 min after each treatment till the end of experiment (Ghazy et al., 2015).

Table 1
Onset and duration Analgesia of epidural administered Nalbuphine, Lidocaine and Nalbuphine-Lidocaine combination in bucks.

Group	Onset of analgesia	Duration of analgesia
Group (I)	12 ± 2 min	200 ± 4 min
Group (II)	6 ± 1 min	80 ± 3 min
Group (III)	8 ± 2 min	120 ± 5 min

2.2. Biochemical parameters

Blood samples were collected from the jugular vein at 0, 15, 30, 60, 120 and 180 intervals. Blood serum glucose level was estimated using test kits supplied by Sigma according to the method described by Trinder (1969), and its level was expressed in mg/dl. Serum aspartate aminotransferase (AST) was estimated using test kits supplied by Spinreact, after the method described by Reitman and Frankel (1957) and its activity was expressed in IU/L. Serum alanine aminotransferase (ALT) activity was estimated using test kits supplied by Spinreact, after the method described by Reitman and Frankel (1957) and its activity was expressed in IU/L. Cortisol concentration in plasma was determined using the Coat-A-Count Assay kit, after the method described by Kannan et al. (2001) its level was expressed in nmol/L. Blood urea nitrogen (BUN) and Creatinine were also examined. All data were presented as mean ± SD. All data were analyzed by ANOVA (analysis of variance) and Duncan's test using SPSS software. The P values were less than 0.05 was considered as statically significant.

3. Results

Epidural administration of Nalbuphine, Lidocaine and Nalbuphine-Lidocaine combination was easy in all bucks and when mix Nalbuphine with Lidocaine in one solution, there is no reaction or turbidity was observed. The onset of analgesia was rapid in lidocaine alone compare with Nalbuphine and Nalbuphine-Lidocaine combination while the duration is longer in nalbuphine alone in compare with lidocaine and Nalbuphine-Lidocaine combination. Onset and duration of analgesia respectively were: 12 ± 2 min and 200 ± 4 min in Nalbuphine group, 6 ± 1 min and 80 ± 3 min in Lidocaine group and 8 ± 2 min and 120 ± 5 min in Nalbuphine-Lidocaine combination group (Table 1).

In Nalbuphine epidural injected group, No ataxia observed, while sever ataxia was observed with Lidocaine epidural injected group but mild ataxia was noted in bucks with epidural injection of Nalbuphine – Lidocaine combination.

Heart rate was increased in animal which injected with nalbuphine at 90-120 min. Respiratory rate and rectal temperatures had no significantly differentiation between the values and were tabulated in Table 2.

Table 2
Respiratory rate, heart rate and rectal temperature of Nalbuphine, Lidocaine and Nalbuphine-Lidocaine combination in bucks (mean ± SD).

Time point	Group	Respiration rate	Heart rate	Temperature C
0 min	Group (I)	25.33 ± 1.53	78.67 ± 5.03	39.00 ± 0.10
	Group (II)	26.33 ± 0.58	82.33 ± 0.58	38.93 ± 0.12
	Group (III)	27.00 ± 1.73	80.67 ± 0.58	39.13 ± 0.23
15 min	Group (I)	25.67 ± 1.53	79.33 ± 6.11	39.00 ± 0.10
	Group (II)	29.00 ± 0.00	86.00 ± 0.00	38.90 ± 0.00
	Group (III)	26.00 ± 1.73	85.67 ± 0.58	38.12 ± 0.23
30 min	Group (I)	23.00 ± 1.73	83.33 ± 3.21	38.83 ± 0.12
	Group (II)	26.00 ± 0.00	85.00 ± 0.00	38.70 ± 0.00
	Group (III)	28.00 ± 1.73	86.67 ± 0.58	38.13 ± 0.23
60 min	Group (I)	24.33 ± 0.58	82.33 ± 4.16	38.93 ± 0.12
	Group (II)	27.00 ± 0.00	84.00 ± 0.00	38.93 ± 0.06
	Group (III)	26.00 ± 1.73	87.67 ± 0.58	39.13 ± 0.23
90 min	Group (I)	23.33 ± 1.53	92.67 ± 5.03*	39.00 ± 0.10
	Group (II)	26.33 ± 0.58	84.33 ± 0.58	38.93 ± 0.12
	Group (III)	29.00 ± 1.73	91.67 ± 0.58	38.11 ± 0.23
120 min	Group (I)	25.00 ± 0.00	95.00 ± 2.65*	39.00 ± 0.00
	Group (II)	28.00 ± 0.00	87.00 ± 0.00	38.97 ± 0.06
	Group (III)	26.00 ± 1.73	90.67 ± 0.58*	39.13 ± 0.23
180 min	Group (I)	24.67 ± 1.15	81.00 ± 0.00	39.00 ± 0.00
	Group (II)	26.00 ± 0.00	85.00 ± 0.00	38.80 ± 0.00
	Group (III)	28.00 ± 1.73	84.67 ± 0.58	38.13 ± 0.23

P < 0.05.

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