

A Randomized Trial of Low-Dose Ketamine and Lignocaine Infiltration for Laparo-caecectomy in Layer Chickens

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Abstract: This study compared the anaesthetic effects of intramuscular injection of Ketamine (K) (15 mg/kg) with intramuscular injection of Ketamine (K) (15 mg/kg) and Lignocaine (L) (4 mg/kg) infiltration for laparo-caecectomy in 12 layer chickens (1.1±0.06 Kg) randomized into two groups (K, 5 chickens and K-L, 7 chickens). The duration of recumbency of the K-L group (100.3±16.4 min) was significantly longer ($p<0.05$) than that of K group (33.8±6.0 min). Time to stand for the K-L group (20.8±4.0 min) was also significantly longer ($p<0.05$) than those of K group (10±1.4 min). The mean heart rates, respiratory rates and cloacal temperatures were lower in the K-L group than the K group. All the birds recovered smoothly and no mortality was recorded following the procedure. In the absence of inhalatory anaesthesia, low dose ketamine and lignocaine infiltration may be a preferred anaesthetic protocol for non-protracted abdominal procedures such as laparo-caecectomy in birds.

Keywords: Chickens, ketamine, laparo-caecectomy, lignocaine, low-dose

INTRODUCTION

Although inhalation anesthesia using isoflurane is preferred for birds, its practice is not wide spread in developing countries due to high cost and non availability of portable anesthetic unit for birds, including difficulty of use in field conditions as well as other technical intricacies (Curro, 1998). Injectable anesthesia, on the other hand, is known for being rapid, cheap and needs less equipment (Gandomani Javdani *et al.*, 2009). However; injectable agents are rarely used as sole agents for avian anaesthesia. Several injectable drugs including barbiturates, chloral hydrate, phenothiazine derivatives, alpha 2-agonists and propofol have been tried in birds with varying responses (Allen and Oosterhuis, 1986; Mandelker, 1988; Mama *et al.*, 1996; Sandmeier, 2000). Ketamine is one of the most commonly used anaesthetic agents around the world and anaesthetic agent of choice in many developing nations (Grace *et al.*, 2001). Ketamine has been used alone, or in combination with other agents like xylazine and diazepam for less protracted procedures in birds (Samour *et al.*, 1984; Christensen *et al.*, 1987; Degernes *et al.*, 1988). When used alone, ketamine produces chemical restraint with poor muscle relaxation and only moderate analgesia which is unsuitable for major surgical procedures (Ludders, 1992). The rationale for combination therefore, has been the amelioration of individual drug side effects, alongside with the need for chemical restraint, muscle relaxation and adequate analgesia for surgery. The use of lignocaine has been favoured for bigger birds where

toxicity due to gross overdose could be avoided (Franchetti and Klide, 1978; Hall *et al.*, 2001). Although local anaesthesia provides sufficient local or regional analgesia they are not able to produce chemical restraint necessary for surgery (Ludders, 1992; Hall *et al.*, 2001). The combination of low dose ketamine and lignocaine local infiltration was therefore considered for laparo-caecectomy as there is a dearth of information in literature regarding this anesthetic protocol in birds. Besides, the duration of action of local anaesthetics is not known in most avian species (Longey, 2008). The aim of this study therefore was to investigate the quality of anaesthesia produced by a combination of 15 mg/kg ketamine (Hall *et al.*, 2001) and surgical site infiltration with 4 mg/kg lignocaine (Ludders, 1992) in laying chickens undergoing laparo-caecectomy for nutritional trials. Some selected anaesthetic indices including Heart Rate (HR), Respiratory Rate (RR) and Cloacal Temperature (CT) responses were also determined.

MATERIALS AND METHODS

Animals: The experimental animals consisted of 12 clinically healthy layer chickens (Boran hybrid), aged between 19-20 weeks with a mean body weight of 1.1±0.06 Kg. The chickens, which were to be involved in a nutritional trial, were presented to the Surgery clinic of the Veterinary Teaching Hospital, University of Ibadan, for caecectomy. The chickens were housed in the teaching and research farm of the University of Ibadan, Ibadan, Nigeria in well ventilated cages and

provided with a compounded layer's ration and water ad-libitum. The study protocol was approved by the Faculty ethical committee for the use of animals for research.

Procedure: The chickens were randomized into two groups K-L group (7 chickens) and K group (5 chickens). Feed was withdrawn 12 h prior to drug administration but the birds had access to water till 1 h before induction of anaesthesia. Each chicken was given an intramuscular injection of ketamine (15 mg/kg). The depth of anaesthesia was determined by response of the birds to skin and wattle pinch. Following aseptic preparation of the surgical site, chickens in the K-L group then had a midline infiltration of their ventral abdomen with lignocaine (4 mg/Kg) and laparo-caecectomy was performed.

Drugs: The anaesthetic drugs used in this study included:

- Lignocaine hydrochloride with adrenaline (Glocain, Vital Health Care PC Ltd, India) which was supplied as 20 mg per mL multidose bottle.
- Ketamine hydrochloride (Ketamine; Rotex Medica, Germany) which was supplied as 50 mg per mL solution for injection in 10 mL multidose vial.

Measurement: The following measurements were taken; CT (°C) using a digital thermometer, HR (beats/min) with a pre-cordial stethoscope, RR (breaths/min) by observing the thoraco-abdominal excursions.

Calculations: Onset of action, duration of recumbency and time to stand were calculated. The calculated variables were defined as follows:

- **Onset of action:** Time interval (min) between ketamine administration and loss of righting reflex.
- **Duration of recumbency:** Time interval (min) between loss of righting reflex and assumption of sternal recumbency.
- **Time to stand:** Time interval (min) between assumption of sternal and standing postures.

Data analysis: All data were expressed as mean±Standard Error of Mean (SEM). Mean values of anaesthetic indices were compared using student t test for unpaired data. Analysis of Variance (ANOVA) with repeated measures was used to detect the significant differences of mean values of HR, RR and CT from baseline. Dunnet's test was used to detect the time at which treatment response differed from the baseline. A value of $p < 0.05$ was considered significant.

RESULTS

Following ketamine administration, each chicken paced up and down, sat down and later rested on the keel, before finally turning over on its side, clapped the wings and stretched out the legs with the eyes initially closed for a short period and later opened.

The chickens in both groups showed response to wattle pinch throughout the anaesthetic period. Those in the K group showed response to skin pinch at the site of incision thus precluding them from surgery. However, there was no response to pain at the surgical site and during bowel manipulation for caecectomy in the K-L group. Onset of action was similar in both groups (Table 1). The duration of recumbency was significantly longer ($p < 0.05$) in the K-L than in the K group (Table 1). This difference in the duration of recumbency between the two groups is about 66.5 ± 10.4 sec (Table 1). The time to stand was significantly

Table 1: Selected anaesthetic indices of the chickens in K and K-L groups

Index	Treatment groups	
	K	K-L
Onset of action (min)	2.6±0.4	3.3±0.4
Duration of recumbency (min)	33.8±6.0	100.3±16.4*
Time to stand (min)	20.8±4.0	10±1.4*

*: $p < 0.05$; student t test for unpaired data

Table 2: Heart rate responses of the chickens in K and K-L groups

Time interval (min)	Heart rates (beats/min)	
	K group	K-L group
0	200.0±23.5	189.7±9.5
10	222.4±16.6	167.3±13.3
20	210.4±2.2	149.7±8.3
30	212.8±18.6	161.0±7.8
40	228.8±16.8	147.4±9.6
50	223.4±17.8	153.1±9.1
60	216.8±18.5	149.1±7.6

Table 3: Respiratory rate responses of the chickens in K and K-L groups

Time interval (min)	Respiratory (beats/min)	
	K group	K-L group
0	52.0±7.6	33.1±0.1
10	32.5±7.3	34.8±5.1
20	48.0±16.8	37.4±6.3
30	50.4±17.2	44.3±9.2
40	68.0±28.8	45.1±9.1
50	69.6±34.5	36.1±7.0
60	69.2±27.8	40.3±6.4

Table 4: Cloacal temperature of the chickens in K and K-L groups

Time interval (min)	Cloacal temperature (°C)	
	K group	K-L group
0	41.8±0.1	40.6±0.4
10	41.8±0.6	-
20	41.9±0.0	-
30	42.0±0.0	-
40	41.9±0.1	-
50	41.9±0.0	-
60	41.9±0.1	39.1±0.4

shorter ($p < 0.05$) in the K-L group than the K group (Table 1).

The mean heart rates of chickens in both groups are shown in Table 2. The mean respiratory rates of chickens in both groups are shown in Table 3. The mean cloacal temperatures of chickens in both groups are shown in Table 4.

DISCUSSION

The birds used for this study were fasted for 12 h (Coles, 2006) but they had access to water up to 1 h before anaesthesia. Although endotracheal intubation is recommended in most cases for maintenance of general anaesthesia in birds (Gandomani Javdani *et al.*, 2009), the dosage of ketamine used in this study was not adequate to abolish lingual and pharyngeal reflexes to enable intubation.

The low dose of ketamine (15 mg/kg) and lignocaine (4 mg/Kg) infiltration provided adequate chemical restraint and local analgesia for the laparocaecectomy procedure in the chickens studied. The cloacal temperature was interrupted for K-L group to prevent contamination of the surgical field during the surgery. Although previous studies had recommended the dosage of ketamine (Hall *et al.*, 2001) and lignocaine (Ludders, 1992) used in this study, to the authors knowledge, is the first report of their combination as described. There was no manifestation of toxic signs following 2% lignocaine (4 mg/kg) used in this study. Although toxicity was reported in budgerigars following lignocaine administration (Hall *et al.*, 2001), it was associated with gross over-dosage due to the small size of the birds (Hall *et al.*, 2001). Lignocaine has been recommended for bigger birds as risk of drug toxicity due to over dosage could easily be avoided (Franchetti and Klide, 1978; Coles, 2006; Hall *et al.*, 2001). Following ketamine administration, each chicken paced up and down, sat down and later rested on the keel, before finally turning over on its side, clapped the wings and stretched out the legs with the eyes initially closed for a short period and later opened. Similar behavioral characteristics have been reported in association with ketamine in a previous study (McGrath *et al.*, 1984) albeit during recovery. Ketamine has been associated with poor muscle relaxation, muscle tremors, myotonic contractions, opisthotonus and rough recoveries in some previous studies (Uzma *et al.*, 2008; Gandomani Javdani *et al.*, 2009). These observed effects of ketamine were however, not observed in the birds studied probably due to the low dosage administered. Besides, recovery was quite smooth in all the birds studied. The dosage of ketamine studied produced a

very poor analgesia as birds were sensitive to pain sensation precluding the K group from surgery. Ketamine has been reported to produce good visceral but poor somatic analgesia (Lumb and Jones, 1984).

Following lignocaine (4 mg/kg) infiltration an initial tissue contraction of the infiltrated area occurred causing little or no blood loss at the laparotomy site. Excessive blood loss could be fatal in birds (Hall *et al.*, 2001). The incorporated adrenaline in lignocaine produced an exaggerated effect in birds tissue compared with mammalian tissue and was of haemostatic advantage in this procedure. The birds could tolerate skin and peritoneal incision as well as caecal exteriorization, ligature, excision and laparotomy closure. The additive effect of visceral analgesia produced by ketamine and the somatic analgesia produced by lignocaine at the surgical site may have been responsible for the painless state and the longer duration of recumbency (Table 1). The longer duration of recumbency in the K-L group (a difference of 66.5 ± 10.4 sec in the duration of recumbency between the two groups (Table 1)) is significant and the duration of action of lignocaine in domestic chickens can be put at 66.5 ± 10.4 sec. The observed mild respiratory depression, bradycardia and fall in temperature in the K-L group compared with the K group may be associated with the additive effects of both drugs on the system.

CONCLUSION

In the absence of inhalatory anaesthesia, low dose ketamine and lignocaine infiltration may be a preferred for non-protracted procedures such as laparocaecectomy in birds.

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