

## **COMPARISON OF THE EFFECTS OF INTRAMUSCULAR AND INTRAOSSEAL ADMINISTRATION OF DETOMIDINE/ KETAMINE COMBINATION FOR GENERAL ANAESTHESIA IN QUAILS (*COTURNIX COTURNIX JAPONICA*)\***

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### **Abstract**

YAYLA, S., N. N. KAMILOGLU, A. KAMILOGLU, I. OZAYDIN and C. S. ERMUTLU, 2015. Comparison of the effects of intramuscular and intraosseal administration of detomidine/ ketamine combination for general anaesthesia in quails (*Coturnix coturnix japonica*). *Bulg. J. Agric. Sci.*, 21: 220-224

The aim of this study was to evaluate the quality of anesthesia and heart rate (HR), respiratory rate (RR) and cloacal temperature (CT) with the administration of the detomidine/ ketamine combination via intraosseous (IO) route and to compare this method with an intramuscular (IM) route in quails. Two groups in each have ten quails (n=10) were selected. Group I received 1.0 mg/kg detomidine-20 mg/kg ketamine IM, and Group II received the same dose via IO. Some hemodynamic parameters were monitorized. A statistically significant difference ( $p < 0.001$ ) was determined between the groups about the onset of anaesthesia in which Group I was on  $5 \pm 0.87$  minutes and Group II was on  $15 \pm 2.94$  seconds. There were no statistically significant difference between the groups about the duration of anaesthesia that found to be  $29.40 \pm 8.55$  minutes in Group I and  $24.30 \pm 3.05$  minutes in Group II. Statistically significant differences were not found between the Groups in terms of HR, RR and CT. The use of both the IM and the IO detomidine/ketamine was resulted in successful anaesthesia. However, it was concluded that intraosseous drug administration provided faster and effective anaesthesia and may be practical and functional for the birds requiring urgent surgical intervention.

*Key words:* detomidine, ketamine, intramuscular, intraosseous, quail

### **Introduction**

Many avian practitioners routinely perform variety of anaesthetic procedures. However, route of administration of anaesthetic agents and some physiological differences among avian species should be also taken into consideration, during surgical procedures requiring anaesthesia (Moghadam et al., 2009). In avian practices, surgeons use administration of either inhalant or parenteral injectable agent for a variety of surgical procedures in avian species (Harrison, 1986; Kamiloglu et al., 2008; Moghadam et al., 2009). The use of injectable anaesthetic agents may have the advantage of increased speed of induction of anaesthesia and requires low equipment and reduce cost (Forbes, 1998). Intramuscular (IM) administration is preferred to obtain anaesthesia in avian species for

easy to implement. The advantage of intraosseal (IO) drug application was noted as to be useful for the birds requiring urgent anaesthesia. Furthermore, recovery time was shorter than that of the IM administration (Kamiloglu et al., 2008).

In clinical veterinary practice there is demand for a safe and reliable injectable method of anaesthesia for use in routine surgery of short to intermediate duration. Ketamine HCl, a dissociative anaesthetic, has been used for this purpose. Ketamine produce poor muscle relaxation, good somatic analgesia and an increased sympathetic tone. The major problems occur during recovery and include tonic-clonic cramps and convulsion-like signs and also increase blood pressure. Therefore, to reduce its cataleptic and convulsogenic effects, ketamine is more commonly used together with xylazine, detomidine, medetomidine depending on the species involved (Aksoy et

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al., 2012; Gokhan, 2008; Kamiloglu et al., 2014; Yayla et al., 2012; Yayla et al., 2014).  $\alpha$ -2- adrenoceptor agonist, detomidine, is considerable more effective, safe and easy to administer parenterally for surgical and nonsurgical procedures for avian. Detomidine produces sedative and analgesic effects that mediated by activation of  $\alpha$ -2 catecholamine receptors and reduced production of excitatory neurotransmitters. Due to inhibition of the sympathetic nervous system, detomidine also has cardiac and respiratory effects.  $\alpha$ -2- adrenoceptor agonist detomidine have been used to immobilization of many species in combination with the dissociate anaesthetic ketamine to improve the quality of the anaesthesia. Among many anaesthetic agents were chosen as combination. Detomidine and ketamine combinations for parenteral administration in avian species to have an advantage such as rapid induction, good muscle relaxation, good analgesia and reduced bradycardia and the occurrence of psychomotor symptoms and also reduce dose of used anaesthetic agents (Durrani et al., 2005; Durrani et al., 2008; Gokhan, 2008; Ismaila and Onifade, 2009; Paddleford and Harvey, 1999).

The aim of this study was to evaluate the quality of anaesthesia and some physiological values with the administration of the combination of detomidine/ ketamine via intramuscular (IM) or intraosseous (IO) route in quails.

## Material and Methods

The study protocol was approved by the Animal Research Ethics Committee, School of Veterinary Medicine, Kafkas University (2012/04). This study was conducted on 20 adult, male,  $197.08 \pm 11.05$  g (as Mean  $\pm$  SD) body weight and clinically healthy mature (26 week old) quails (*Coturnix coturnix japonica*) with a normal cloacal temperature, apparently active in motion and have no sign of any gastrointestinal disorder. Birds were divided into two groups (IM and IO), each with 10 birds. The quails were provided from animal farming department of Kafkas University.

The study was carried out, after birds were kept in the same environment for a week. They were kept in a quite room to avoid possible stress-inducing factors during this period and fed with a wheat-based diet in accordance with the previous feeding regimen. Water and feed were not given 60 min prior to drug administration to minimize undesired effect.

### Study Protocols

The birds were allocated into two groups. Quails in Group I (n=10, BW= 196.1 $\pm$ 12.2) was administered intramuscularly (IM) detomidine at the dose rate of 1.0 mg/kg Detomidine (Domosedan® 5 ml, Pfizer-Finland) and 20 mg/kg Ketamine (Ketalar® 10 ml injectable, Pfizer-Turkey) with insulin sy-

ringe. Quails in Group II (n=10, BW=197.8 $\pm$ 10.6) was administered intraosseally (IO) detomidine and ketamine combination at the dose rate 1.0 mg/kg Detomidine and 20 mg/kg Ketamine with insulin syringe.

Detomidine-ketamine was diluted with 0.9 % NaCl solution in ratio of 1:1 to increase the volume of the injection and so making accurate measurement of the exact dose required more easily. Intramuscular injection was administered into the deep pectoral muscle. Intraosseous injection was made at the distal end of the left tibia using 14 to 20 gauge spinal needles depending the bird's size.

Quails were laid on lateral recumbency. The knee joint was positioned at flexion. Cannula has been entered medulla of tibia under aseptic conditions, was positioned the tibia tuberosity parallel to the diaphysis. When it was determined loss of resistance against the cannula was realized that needle in medullary region.

### Measurements

Each quail were monitored and recorded for heart rate (HR), respiratory rate (RR), cloacal temperature (CT) and ECG at initial, and on the 1, 3, 5, 10, 15, 20 and 30<sup>th</sup> minutes after injection. SBP, DBP and MAP were monitored using a multi-parametric monitor (Veteriner Monitör® MMED6000DP S6-V).

### Assessment of the clinical effect of anaesthesia

The induction period, duration of anaesthesia and recovery period were recorded quails in all groups. Onset and duration of anaesthesia was determined by using standard painful stimuli with a needle. A superficial (needle used to prick the skin) and deep pin-prick (needle inserted into the muscle) was performed. Also, other body reflexes (righting reflex, feather plucking reflex, palpebral reflex, pharyngeal reflex) were recorded.

### Statistical analysis

Data were evaluated using a commercial software program (Minitab-16), and reported as mean  $\pm$  standard deviation (SD) values, except where indicated. First of all, the data were subjected to the normality test (Anderson-Darling test). Then, statistical evaluation was conducted between the groups using the ANOVA method (One-way Analysis of Variance-Tukey's pairwise comparisons) for parametric values while the Kruskal-Wallis test was used on non-parametric values. Differences were considered significant at  $P < 0.05$ .

## Results

A statistically significant difference ( $p < 0.001$ ) was determined between the groups about the onset of anaesthesia in

which Group I was on  $5 \pm 0.87$  minutes and Group II was on  $15 \pm 2.94$  seconds. In contrast, there is no significant difference within groups. There were no statistically significant difference between the groups about the duration of anaesthesia that found to be  $29.40 \pm 8.55$  minutes in Group I and  $24.30 \pm 3.05$  minutes in Group II.

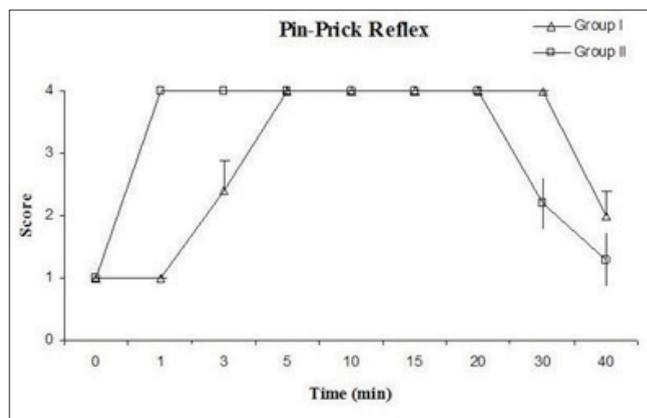
All body reflexes studied disappeared in two group's duration of anaesthesia. Changes in pin-prick reflex showed in Figure 1. Body reflexes (righting reflex, feather plucking reflex, palpebral reflex, pharyngeal reflex) during anaesthesia showed similar responses to the same time intervals as shown in Figure 2.

Changes in HR, RR and CT of the experimental groups according to time were shown in Figure 3 A, B and C respectively.

No statistically significant difference was found between the groups with regard to HR. On the other hand, compare to baseline values there was a significant decrease for HR within 5 to 20 minute for Group I ( $p < 0.05$ ). HR in Group II were significantly decreased at the 1 to 15 minute after intraosseal injection of anaesthetic combination ( $p < 0.001$ ) when compared baseline values.

Sinus rhythm was changed as bradycardia that indications of arrhythmia in all of the quails obtained from ECG data.

There were no statistically significant differences observed between the groups in point of RR. Also in comparison with baseline values RR were not changed and remained regular within both groups during aesthesia.



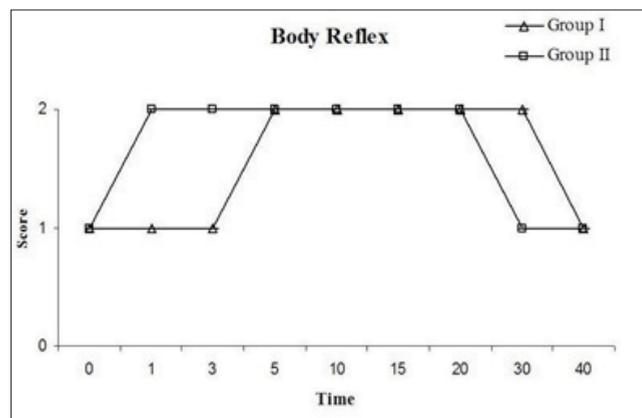
**Fig. 1. Evaluation of analgesia induced by intramuscular and intraosseous administration of detomidine/ketamine combination**

Median analgesic scores in response to standard noxious stimuli (pin-prick reflex). 1; no analgesia, 2; mild analgesia, 3; moderate analgesia and 4; complete analgesia. Group I received 1.0 mg/kg Detomidine and 20 mg/kg Ketamine by intramuscular route (IM) Group II received 1.0 mg/kg Detomidine and 20 mg/kg Ketamine by intraosseous route (IO)

CT values did not differ significantly between the groups. However, there were statistically significant difference ( $p < 0.05$ ) in CT occurred within both groups after at 10<sup>th</sup> min. The differences within the groups have been summarized in Figure 3C.

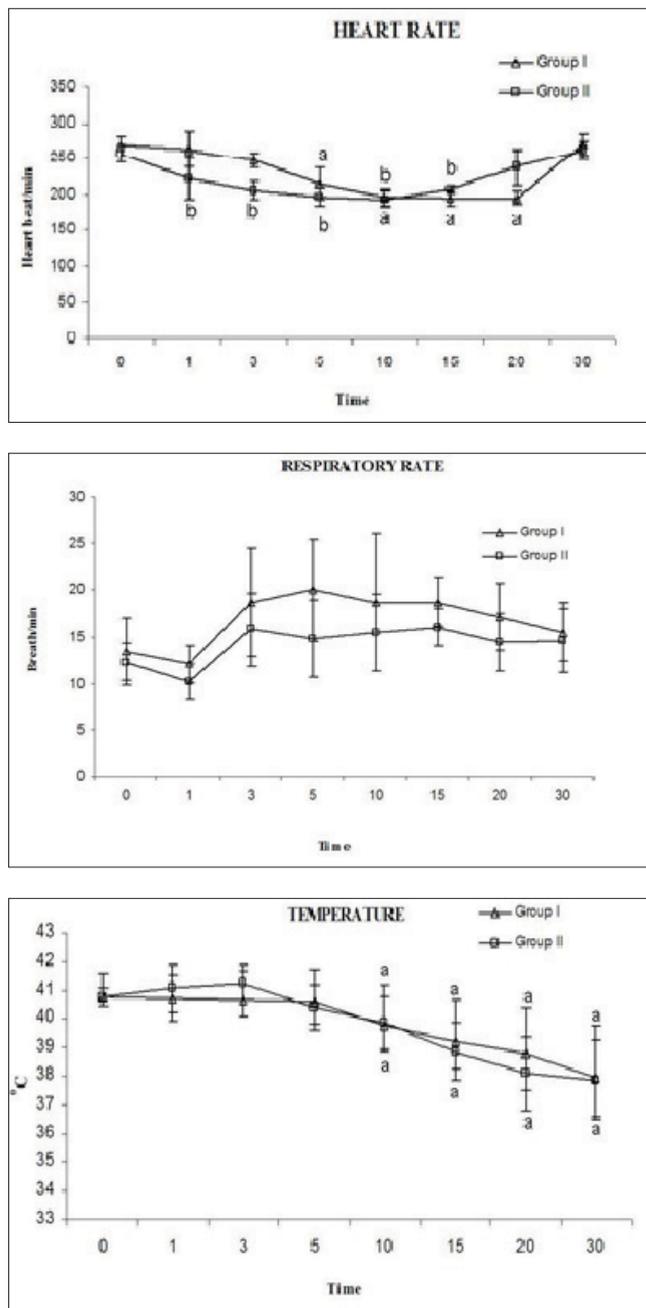
## Discussion

Earlier studies have shown that intraosseous drug administration in avian species were an alternative option to allowed sedation and anaesthesia (Kamiloglu et al., 2008; Taney et al., 2003; Yayla et al., 2014). However, researchers reported (Forbes, 1998; Harrison, 1986; Moghadam et al., 2009) that it is easy to use the administration of injectable agents throughout IM route in avian species to obtain anaesthesia. On the other hand, intraosseous drug administration should be applied when quick anaesthesia is required in avian practices. In addition, IO drug administration can be used safely for severely painful and urgent many surgical procedures. IO route produces a deep anaesthesia and analgesia with a smooth and rapid induction and smooth recovery as obtain with IM route (Kamiloglu et al., 2008). The present study indicated that anaesthesia induction via intraosseal drug injection was effective in quails with combination of detomidine and ketamine. In our study, onset and duration of anaesthesia with intraosseous application is obtained more quickly and short-termed ( $5 \pm 0.87$  min and  $29.40 \pm 8.55$  min, respectively) than IM application ( $15 \pm 2.94$  s and  $24.30 \pm 3.05$  min, respectively)



**Fig. 2. Assessment of analgesia based on reflex score (for righting reflex, feather plucking reflex, palpebral reflex, pharyngeal reflex)**

1; no analgesia, 2; complete analgesia. Group I received 1.0 mg/kg Detomidine and 20 mg/kg Ketamine by intramuscular route (IM) Group II received 1.0 mg/kg Detomidine and 20 mg/kg Ketamine by intraosseous route (IO)



**Fig. 3. Changes in some physiological values; A; HR, B; RR and C; CT**

Data were expressed as mean ± SD. No statistically significant difference was found between the groups in point of HR, RR and CR. a-b: Denotes significant changes from pre-anaesthetic values (a:  $p < 0.05$ , b:  $p < 0.001$ ). Group I received 1.0 mg/kg Detomidine and 20 mg/kg Ketamine by intramuscular route (IM), Group II received 1.0 mg/kg Detomidine and 20 mg/kg Ketamine by intraosseous route (IO)

which are in line with other studies (Kamiloglu et al., 2008; Valverde et al., 1993).

$\alpha$ - 2- adrenoceptor agonist detomidine is considerably more potent anaesthetic or immobilization agents combined with ketamine for birds (Durrani et al., 2005; Mohammad et al., 1993). Ismaila and Onifade (2009) showed that detomidine a good immobilizing agent in pigeons. Also, it is determined that for minor and least painful procedures in quails detomidine can be used alone, while for major and painful surgical procedures detomidine-ketamine combination should be preferred (Durrani et al., 2005). Researches (Forester and Courtot, 2000; Mohammad et al., 1993; Sandmeier, 2000) observed that combination of detomidine-ketamine provide a deep and long anaesthesia in birds and also produced sufficient painful procedures in pigeons (Durrani et al., 2008). It was reported (Durrani et al., 2008) that detomidine and ketamine compensates for the effect of each other and can be achieved a sufficient muscle relaxation when used as combination (Clarke et al., 1993; Dilipkumar et al., 1998; Durrani et al., 2008). Durrani et al. (2005) showed that the obtained data about hypothermia, hypoventilation and bradycardia was insignificant in IM detomidine-ketamine treated quails. In our study, it was obtained a safe and effective anaesthesia for short-term operations with anaesthetic doses used. It shows clearly from our results that combination of detomidine and ketamine has effect on physiological parameters like HR, RR and CT. However, there were no statistically significant differences observed between the IO and IM application in point of HR, RR and CT in this study.

The moderate cardiorespiratory depression was observed with IO and IM injection of the detomidine and ketamine combination, in agreement with previous reports about intravenous application in other animals (Aksoy et al., 2012; Gokhan, 2008; Thakur et al., 2011) and intramuscular use in birds (Durrani et al., 2005; Ismaila and Onifade, 2009) in this study. Also, we shown that there was a significant decrease for HR within 5 to 20 minute for IO application ( $p < 0.05$ ), and 1 to 15 minute for IM use ( $p < 0.001$ ). In addition, RR values were initially increased and then decreased and remained regular during anaesthesia, although no statistically significant difference observed within both groups.

Due to application of detomidine-ketamine combination causes the decrease in respiration and heart rate, birds suffered hypothermia with a decrease in body temperature (Durrani et al., 2008). There were many reports expressed that a significant reduction in body temperature in the use of many anaesthetic agents in birds (Durrani et al., 2005; Ismaila and Onifade, 2009; Kamiloglu et al., 2008). In our study, a statistically significant decrease in cloacal temperature was observed in both IO and IM groups from at 10<sup>th</sup> min to end of anaesthesia.

Because of the safe limits to be determined as administered dose and the same dose of the drug to be applied to the both groups, no remarkable difference occurred in measured physiological parameters except for induction and duration time of anesthesia.

In avian practices, intraosseous applications for anaesthesia and fluid or drug administration are effective, and usually ulna or tibia can be used for this purpose (Kamiloglu et al., 2008; Valverde et al., 1993). If time is limited and intravenous administration is not possible because of difficulties to identify the vessel, IO route can be preferred for application. IO application for fluid, drug and anesthetic administration is an alternative one to the preferred intravascular application. IO route is supplied to inject directly into the bone marrow connected with systemic venous system where absorption of anesthetic agent takes less time. So, any fluid and drug that can be possible to introduce via IV can be introduced via IO if necessary (Kamiloglu et al., 2008; Rosetti et al., 1985).

While some studies (Kamiloglu et al., 2008; Rosetti et al., 1985; Valverde et al., 1993) proved complications with inaccurate cannula placement, haemorrhage and bone fracture, in our study there were not any adverse situations during IO application. Thus, clinicians who know the anatomical configuration of the birds bone can be easily perform this application without major complications.

## Conclusion

In conclusion, we proved that detomidine-ketamine application either IM or IO resulted in a sufficient and appropriate anaesthesia in quails. Also, faster and more effective anaesthesia is obtained through IO application and might be useful for the birds requiring urgent operation.

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