OPEN ACCESS
Advances in Animal and Veterinary Sciences
Research Article

Comparative Efficacy of Injectable and Inhalation Anesthesia in Pigeons

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Abstract | Comparison of inhalation and injectable anesthesia for the evaluation of safe anesthetic for avian surgery and evaluation of effect of gas anesthesia on oxygen saturation of blood in pigeon. Pigeons (n=15, Male = 2 and female = 3) were divided in three equal groups A (Ketamine Hydrochloride 10ml; West ward Pharmaceuticals, USA), B (Xylaz 10ml; MyLab Pvt. Ltd, Pak) and C (Isoflurane 250ml; Piramal Critical Care Inc, USA). Ketamine and xylazine were administrated through pectoral muscles while isoflurane was administrated with face mask by using an anesthetic machine. Ketamine and xylazine alone produce significantly hypothermia, bradycardia and respiratory depression while hypothermia, bradycardia and respiratory depression produce by isoflurane was non-significant. Ketamine alone is used for that surgery in which there is no need of muscles relaxation. It produces undesirable anesthesia and recovery. It also causes hypothermia, bradycardia and respiratory depression. For minor surgery and handling of birds xylazine may be used successfully and without harm, while for major surgeries in which painful procedure are done then the choice of anesthesia is isoflurane, because it produced rapid and smooth induction and recovery both. The duration of anesthesia is desirable, it have negligible effect on temperature, pulse rate, respiratory depression and oxygen saturation in blood. For painful procedures isoflurane is a good anesthetic choice for experimental and field studies.

Keywords: Ketamine, Xylazine, Anesthesia, Isoflurane, Pigeons.

Received | June 26, 2020; **Accepted** | July 05, 2020; **Published** | September 05, 2020
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Citation | Rehman MU, Aslam S, Iqbal N, Durrani UF, Hussain N, Luqman Z, Jawad H (2020). Comparative efficacy of injectable and inhalation anesthesia in pigeons. Adv. Anim. Vet. Sci. 8(11): 1203-1210.
DOI | http://dx.doi.org/10.17582/journal.aavs/2020/8.11.1203.1210
ISSN (Online) | 2307-8316; **ISSN (Print)** | 2309-3331

INTRODUCTION

Veterinary anesthesia is used in different situation for animals as compared to humans because of their failure to cooperate with certain diagnostic or therapeutic processes. Veterinary general anesthesia is used for most of the species such as cattle, cats, dogs, horses, pigs, goats, sheep, and all other animals and birds who require veterinary care such as pocket pets, birds and wildlife. Commonly pet birds are divided into two major groups Passeriformes and Psittaciformes. Passeriformes are perching birds, such as finches and canaries. Psittaciformes join a wide range of hooked-bill or parrot species, such as budgerigars (commonly known parakeets), conures, cockatiels, African grays, Amazons, macaws, cockatoos, and others. Less frequently, the pigeons, doves, toucans, quails and poultry are also known as pet birds. So this study only focus on Passeriformes and Psittaciformes species, because Most of these species need anesthesia for their diagnosis and treatment. (Curro, 1998). The anesthetic protocol for birds is different from other animals, because of difference in physiology and anatomical structures (Lierz and Korbel, 2012). The bird's lungs are less mobile than other animals, there is unidirectional flow of air rather than backward and forward as in other animals; that helps in proper oxygenation of tissue. The gaseous exchange in avian species is

about ten times more than other animals such as bovine, equine and ovine (Degernes, 2008). There is no diaphragm in birds, and the abdominal cavity is in direct connection with thorax. Also, large numbers of pneumatic bones are connected to abdomen, thorax and alveoli. This immense alveolar system is spread throughout the avian body. The trachea in birds contain closed rings and there is no epiglottis. Therefore, Cole tubes are used for intubation instead of cuffed endotracheal tubes (Athar et al., 1995).

The general anesthesia is given to different bird's species through inhalation or injectable agents (Athar et al., 1995). Injectable anesthetics and sedatives can be injected through pectoral muscles which could reduce the accidental risk of drugs administered through intra venous and intra osseous routes (Harrison and Harrison, 1986). The combine effect of low dose of ketamine hydrochloride (HCL) and diazepam was better result than the result of ketamine alone, because this combination created good and more fastest induction of anesthesia, have long anesthesia duration, and also have good relaxation of muscles and slow and smooth recovery from anesthesia (Azizpour and Hassani, 2012). In most species ketamine alone has severe limitations, but proved valuable in combination (Green et al., 1981). The analgesic property of ketamine is good(RÃ et al., 2000). Benzodiazepines induced rapid and operational sedation in canaries while xylazine also produced sedation but not keep recumbency (Vesal and Zare, 2006). Xylazine muscle relaxation property is good and has smooth recovery but take long time (Allen and Oosterhuis, 1986). The side effect of xylazine was that it produced bradycardia and respiratory depression. It should be monitored during induction of anesthesia. It is not recomended as monoanesthetic agent (Lumeij and Deenik, 2003). Isoflurane has low blood-gas solubility and low metabolism. Mostly veterinarians uses inhalational anesthesia because the concentration of inhalational anesthesia could be adjusted to a desirable value (Chitty and Lierz, 2008). Injectable anesthesia are prepared where inhalational anesthesia are not available in field practices (Samour et al., 1984). Different injectable medicines are used in avian. They contain phenothiazine derivatives, barbiturates, alpha 2-agonists, chloral hydrate, propofol and ketamine (Sandmeier, 2000). Mostly birds feel less pain therefore anesthetic and analgesic practice are not observed in avian. But, in principle, pain receptor in avian is resembling to that of mammals (Hawkins, 2006). In addition for surgical intervention to remove pain, anesthesia is a significant tool to reduce stress in birds. TENS (Transcutaneous electrical nerve stimulation) methods used in avian patients for ophthalmologic, radiologic, and detailed physical inspection. In additionally, anesthesia is also used for restriction to move, anesthesia could be given in different methods to avian (Dutton et al., 2010). The use of anesthesia started in avian for last twenty years. Different types of gas anesthesia and injectable anesthetics have been recorded to be safe in large varying taxonomic classes. Further, the capability to maintain and monitor the normal cardiovascular and respiratory parameters are upgraded. This research stressed on ideas and equipment that are used for pet birds patients which were mostly observed in animal clinics; although, these information are also apply to wild bird anesthesia and in routine practices (Degernes, 2008). Mostly Isoflurane is used in avian anesthesia. Although the use of gas anesthesia is less in field practices. Gas anesthesia like isoflurane and sevoflurane were not metabolized and most of the drugs expelled through expiration (Hoerauf et al., 1999). Some surgical incision, such as resection of trachea, there may use injectable anesthesia if there is anesthetic machine is not available. In emergency situation intubation provides a sufficient airway that make possible easy control of ventilation. However, intubation are not used in very small birds. Soon recovery from anesthesia is better for birds because birds show very discomfort at the time of recovery and try to twist their neck and head and flap their wings. A soft towel is used for holding and restraining of birds. The bird kept in a warm, dark, quiet place is helpful in smooth recovery of anesthesia (Paul-Murphy and Fialkowski, 2001). Gas anesthesia was the choice anesthesia used in birds. Anesthetic drugs and different techniques used in pet birds (Gunkel and Lafortune, 2005). In birds the inhalational anesthesia was safe than injectable anesthesia but anesthetics machine are not available all the time, so therefore some injectable anesthetics and sedative drugs were used for anesthesia in birds (Boever and Wright, 1975).

MATERIAL AND METHODS

This study was designed to estimate the efficacy of different injectable (ketamine, xylazine) and inhalant (isoflurane) anesthetic drugs in pigeons. For this purpose fifteen healthy, active and adult pigeons (*Columba livia*) of either sex (6 males and 9 females) were bought from the local market (Lahore, Pakistan). The pigeons were randomly selected regardless of gender or age and subjected into three groups. All birds were thoroughly examined for their health status through complete clinical examination before the commencement of the trial. Normal body reflexes were checked and any injured pigeons was ruled out. Only healthy and active birds were used. Fifteen birds were subjected into three groups, 5 birds (2 male 3 female) in each group and then were kept in 3 separate cages in Pet Center University of Veterinary and Animal Sciences Lahore and dimension of cages was standard (86 × 76 × 86 cm). All the birds were kept in a clean, comfortable and stress-free environment for some days at 25 °C. All the birds were maintained on a nutritional routine allowing the water and wheat containing feed, (kabotar daana). The pigeons were carefully observed and monitored after anaesthesia admin-

istration and observation were recorded from start of anesthesia to full recovery with normal eating and standing of pigeons. In addition, observations were made at 15 minutes intervals for temperature, pulse rate and respiration rate. After administration of ketamine, xylazine and isoflurane following parameters were recorded. Temperature, Pulse rate, Respiration rate, Induction time, Anesthesia time, Recovery time, Oxygen saturation in blood, Reflexes,

Experimental Design

The all pigeons were randomly subjected into three groups (A, B, C). Five pigeons (2 male 3 female) were used in each group. Before experiment, fasting was performed for 1/2 hour prior to drug administration to minimise the chances of vomiting. Group A have Ketamine (Ketamine Hydrochloride 10ml; West ward Pharmaceuticals, USA) @ 60 mg/kg alone was injected in pectoral muscles by using 1mL insulin syringe. Group B have Xylazine (Xylaz 10ml; MyLab Pvt. Ltd, Pak) @ 16 mg/kg alone was injected in pectoral muscles by using 1mL insulin syringe. All treatments were administered intramuscularly using a 1 mL insulin syringe while Group C have Constant rate of 5% Isoflurane with 1L oxygen/minute for induction and 2-3% Isoflurane (Isoflurane 250ml; Piramal Critical Care Inc, USA) with 1L oxygen/minute for maintenance was administrated through face mask for 60 minutes. Anaesthesia was induced via a face mask. All birds of this group were healthy individuals based on normal physical examination.

Statistical Design

The data thus obtained was statistically analyzed by one way analysis variance and statistical difference among the various treatments were determined among the various treatments through least significant difference and oxygen saturation in group "C" were determined through pair T test.

RESULTS

This study was conducted on three groups of pigeons i.e. Group A (Ketamine), Group B (Xylazine) and Group C (Isoflurane), each group comprising of five pigeons. Temperature, pulse rate and respiratory rate in all groups while oxygen saturation of blood in group C was recorded at 3 different stages i.e. during induction of anesthesia, during anesthesia, and after recovery period. Following ketamine injection all birds remained active during the initial 3-5 minutes after that smooth onset of anesthesia started and the birds moved to stage II anesthesia with dorsal recumbency, in which the eyes of all pigeons were closed for 8-12 minutes. The duration of anesthesia was long lasted for 60-65 minutes. The recovery time was rapid but very rough. By administration of xylazine in group B, all birds were active during the first 15-20 minutes. The duration of anesthesia lasted for 35-45 minutes. Smooth recovery from anesthesia took place in 30-35 minutes. Isoflurane produced smooth and rapid induction and recovery both, in the majority of the pigeons. After administering isoflurane to group C through anesthetic machine by using face mask, the induction started rapidly in 2-4 minutes and all the pigeons became anesthetised and immobilized. Isoflurane through this technique can produce anesthesia for a desirable duration but in this trail isoflurane was administered for 60 minutes. There was smooth and fast recovery within 3-4 minutes.

The temperature slightly declined with administration of ketamine from 0 - 60 minutes in group A from 106 to 100 °F. While decline in temperature of pigeons in group B by administration of xylazine was significant from all other groups (107 to 97 °F), while there was minor change in temperature occurred in group C (107 to 102 °F) by administration of isoflurane. Variation of temperature in group A and group C were non-significant and in group B was significant ($P < 0.05$). The variation of temperature with administration of ketamine in group A, xylazine in group B and isoflurane in group C respectively are shown in the following Tables 1. The pulse rate was significantly decreased from 0-15 minutes in all groups (A, B and C). After that pulse rate was continuously fading up to 60 minutes with administration of ketamine, xylazine and isoflurane in group A, B and C respectively. While decreasing of pulse rate of pigeons in group C by administration of isoflurane was less as compared to group A and B. All the drugs used in the experiment affected the pulse rate of birds. The difference in pulse rate among groups after using ketamine, xylazine and isoflurane was significant ($p < 0.05$) during anesthesia (Table 2).

Table 1: Comparative Mean Values of Temperature for Group A, B And C

Days	Temperature (°F)		
	Group A	Group B	Group C
	Mean ± S.D	Mean ± S.D	Mean ± S.D
1	108.14± 0.76	107.52 ± 0.76	108.65± 0.89
3	108.84± 0.61	107.02 ± 0.53	107.97± 0.80**
5	108.54± 0.74*	106.93± 0.33	107.64 ± 0.97
10	108.14± 0.86*	106.85± 0.49	107.34± 0.74**
15	107.84± 1.19*	106.91± 0.52	107.17± 0.88
20	107.20± 1.25	106.70± 0.38	106.92± 0.67
25	106.85± 0.83	106.34± 0.40	107.07± 0.71
30	106.71± 1.23	106.37± 0.55	107.13± 0.95

*Dead bird of group A

** Dead bird of group C

Table 2: Comparative Mean Values Of Pulse For Group A, B and C

Days	Pulse (Beats / min)		
	Group A	Group B	Group C
	Mean ± S.D	Mean ± S.D	Mean ± S.D
1	181.4±5.80	180.2±4.82	180.6±5.68
3	178.7 ± 5.39	178.8 ± 4.59	178.8 ± 5.34**
5	176.9 ± 6.48*	181.4 ± 5.81	175.6 ± 5.57
10	178.2 ± 5.63*	178.6 ± 4.52	177.9 ± 4.80**
15	172.6 ± 5.12*	179.1 ± 5.32	179.1 ± 5.18
20	179.1 ± 4.14	179.7± 3.91	176.4 ± 4.26
25	172.4 ± 3.31	180.4 ± 4.65	175.7 ± 5.65
30	182.2 ± 5.52	181.7 ± 5.46	179.2 ± 3.56

*Dead bird of group A
** Dead bird of group C

Table 3: Comparative Mean Values of Respiration for Group A, B and C

Days	Respiration (Beats / min)		
	Group A	Group B	Group
	Mean ± S.D	Mean ± S.D	Mean ± S.D
1	43.9 ± 3.03	43.2 ± 3.54	42.8 ± 4.10
3	42.5 ± 3.82	42.6 ± 3.12	42.9 ± 3.78**
5	45.4 ± 3.10*	41.8 ± 3.19	42.9 ± 2.96
10	42.8 ± 2.84*	42.5 ± 2.68	41.7 ± 2.65**
15	41.5 ± 2.94*	41.7 ± 2.74	42.1 ± 3.68
20	44.6 ± 4.82	43.6 ± 3.12	42.6 ± 3.52
25	42.5 ± 3.12	39.9 ± 5.43	43.7 ± 5.12
30	43.7 ± 3.35	42.9 ± 3.78	41.6 ± 4.17

*Dead bird of group A
** Dead bird of group C

The respiratory rate of group A and B significantly ($p < 0.05$) decreased from 27 to 17/minute and from 28 to 13/minute after administration of drugs up to 60 minutes respectively while non-significant decrease in respiratory rate of group C was recorded (Table 3). The oxygen saturation was checked only in group C through pulse oximeter. The oxygen saturation level slightly decreased from 98 to 90 but this effect was negligible in all birds of group C. The oxygen saturation in blood of birds at different time intervals was noted, which was showed in Table 4. All the three drugs (ketamine, xylazine and isoflurane) have different onset time. The induction produced by Ketamine, xylazine and isoflurane were recorded as 5-13, 40-60 and 2-4 minutes respectively. All the drugs produced different duration of anesthesia. The duration of anesthesia with ketamine and xylazine was recorded as 60-65 minutes and 35-45 minutes respectively while the duration of isoflurane was desirable. The drugs administered in this trial had different duration of recovery. Recovery was slow by using ketamine and xylazine while recovery was fast and smooth by using isoflurane. Their induction time, duration and recovery was shown in the following Table 5.

Reflexes

Reflexes by using Ketamine: Some reflexes were present and there was not complete absence of reflexes after the administration of Ketamine at different time intervals in group A, shown in the Table 6.

Reflexes by using xylazine: By administration of xylazine in group B all reflexes were not absent till 45 minutes even at 60 minutes few reflexes remained present shown in Table 7.

Reflexes by using isoflurane: Isoflurane showed quick response and all reflexes were absent within 15 minutes and pigeons went in complete anesthesia. But after recovery all reflexes were exist. The reflexes are shown in Table 8.

DISCUSSION

Comparative study was done on the efficacy of injectable and inhalation anesthesia in pigeons. The main objectives of the trail were to assess the best anesthesia for birds. During our trail no abnormal case was recorded. In birds, two techniques were used for sedation and anesthesia. The one was injectable and the other was inhalational. Injectable anesthesia was given through intra muscular. As Freed and Baker (1989) used ketamine and xylazine combine in avian and give through I/M or I/V. For our trail we used only ketamine and xylazine separately as injectable drugs. We used isoflurane for our research as inhalational anesthetics. Isoflurane was administered through face mask with the help of closed circuit anesthetic machine. Our results showed that the use of ketamine for anesthesia caused hypothermia, bradycardia and respiratory depression. Our results are in accordance with the other scientist as Ketamine is used for inducing anesthesia before surgery or any other procedure which do not required muscles relaxation because it does not produce muscles relaxation due to the absence of skeletal muscle relaxation which caused excitement and multiple attempts to attain normal position. In birds ketamine alone is rarely used because it produce respiratory depression which may causes toxicity, in such a case supportive ventilation and administration of doxapram are provided to overcome the problem. Ketamine also produces an adverse complication like myoclonic jerking (Athar et al., 1995). The similar clarifications were reported by (Durrani et al., 2009), who conducted an experiment on the comparison of the clinical effects associated with xylazine, ketamine, and a xylazine-ketamine cocktail in pigeons (Columba livia) and also same with (Sandmeier 2000) who Xylazine provided sufficient muscle relaxation,

Table 4: Liquid, Food Intake and Defecation for Group A, B and C

Days	Liquid Intake			Food Intake			Defecation		
	A	B	C	A	B	C	A	B	C
1	No	No	No	Off Feed	Off Feed	Off Feed	Absent	Absent	Absent
3	Minor	Minor	**Minor	Off Feed	Off Feed	** Off Feed	Absent	Watery	**Absent
5	*Minor	Minor	Minor	*Minor	Minor	Minor	*Watery	Semi/S	Watery
10	*Minor	Normal	**Minor	* Minor	Normal	**Minor	*S. solid	Normal	**S. solid
15	*Normal	Normal	Normal	*Normal	Normal	Normal	*Normal	Normal	Normal
20	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
25	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
30	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal

* Dead bird of group A

** Dead bird of group C studied on the evaluation of an alpha-2-adrenergic agonist medetomidine for short-term immobilization of domestic pigeons and Amazon parrots.

Table 5: Mean Values for Body Weight (g) Of Group A, B and C

Days	Body Weight (grams)		
	Group A	Group B	Group C
	Mean ± S.D	Mean ± S.D	Mean ± S.D
1	296.62 ± 1.06	299.20 ± 0.92	296.25 ± 2.83
3	296.05 ± 1.84	297.27 ± 1.89	294.77 ± 1.79**
5	295.88 ± 2.05*	298.95 ± 0.90	294.09 ± 1.08
10	294.82 ± 1.97*	299.34 ± 1.88	293.23± 1.81**
15	291.73 ± 1.93*	299.91 ± 0.91	293.45± 1.66
20	292.37 ± 1.67	300.08 ± 1.56	294.19 ± 1.47
25	292.81 ± 1.35	300.25 ± 1.61	294.79 ± 1.18
30	293.45 ± 2.05	300.38 ± 1.76	± 1.34

*Dead bird of group A

** Dead bird of group C

Table 6: Wound Healing In Days in Group A, B and C

BIRD NO.	Group A						Group B						Group C					
	Wound Healing Time (Days)																	
	1	5	10	15	20	30	1	5	10	15	20	30	1	5	10	15	20	30
I	2	3	3	1	1	1	2	3	3	1	1	1	2	3	2*	2*	3	1
II	2	2	3	3	3	3	2	2	3	1	1	1	2	2	3	3	3	3
III	2	0	0	0	0	0	2	3	3	1	1	1	2	2	3	3	1	1
IV	2	2	3	3	3	3	2	3	3	1	1	1	2	2	2*	2*	2*	1
V	2	2	3	0	0	0	2	3	3	3	1	1	2	2	3	1	1	1
VI	2	2	3	3	1	1	2	2	3	3	1	1	2	0	0	0	0	0
VII	2	2	3	3	3	3	2	2	2	3	3	3	2	2	2	2	2	2
VIII	2	3	3	1	1	1	2	3	3	1	1	1	2	2	2	3	3	3
IX	2	2	0	0	0	0	2	3	1	1	1	1	2	2	0	0	0	0
X	2	2	3	3	3	3	2	3	3	3	3	3	2	3	1	1	1	1

Dead = 0

Wound healed = 1

Wound not healed = 2

Healing in progress = 3

Table 7: Physical Evaluation for Leakage in Days in Group A, B and C

BIRD NO.	Group A				Group B				Group C			
	Leakage Evaluation (Days)											
	1	5	10	20	1	5	10	20	1	5	10	20
I	0	0	0	0	0	0	0	0	0	1	0	0
II	0	1	0	0	0	0	0	0	0	1	1	1
III	0	2	2	2	0	0	0	0	0	0	0	0
IV	0	0	0	0	0	0	0	0	0	0	1	1
V	0	1	1	2	0	0	0	0	0	0	0	0
VI	0	1	0	0	0	0	0	0	0	2	2	2
VII	0	0	0	0	0	1	1	0	0	1	1	1
VIII	0	0	0	0	0	0	0	0	0	0	0	0
IX	0	1	2	2	0	0	0	0	0	1	2	2
X	0	0	0	0	0	0	0	0	0	0	0	0

Absent = 0
Present = 1
Dead = 2

Table 8: Post Mortem Finding Of Fibrosis In Group A,B And C

Bird No.	Group A		Group B		Group C	
	Fibrosis	Crop Stenosis	Fibrosis	Crop Stenosis	Fibrosis	Crop Stenosis
I	Minimum	1st Degree	Minimum	1st Degree	Minimum	1st Degree
II	Moderate	2nd Degree	Minimum	1st Degree	Moderate	2nd Degree
III	Dead at day 5	Dead at day 5	Minimum	1st Degree	Minimum	1st Degree
IV	Moderate	2nd Degree	Minimum	1st Degree	Severe	3rd Degree
V	Dead at day15	Dead at day15	Minimum	1st Degree	Minimum	1st Degree
VI	Minimum	1st Degree	Minimum	1st Degree	Dead at day 5	Dead at day 5
VII	Moderate	2nd Degree	Severe	3rd Degree	Severe	3rd Degree
VIII	Minimum	1st Degree	Minimum	1st Degree	Moderate	2nd Degree
IX	Dead at day10	Dead at day 10	Minimum	1st Degree	Dead at day 10	Dead at day10
X	Severe	3rd Degree	Minimum	1st Degree	Minimum	1st Degree

Fibrosis Parameters at Post-mortem
Minimum = Good quality of healing, **Moderate** = Average quality of healing, **Severe**= Poor quality of healing
Stenosis Parameters at Post-mortem
1st degree = Minimum narrowing of crop lumen, **2nd degree**= Moderate narrowing of crop lumen, **3rd degree** = Severe narrowing of crop lumen

sedation, and analgesia and smooth induction and recovery. They also suppress pain arising superficially or viscerally. Xylazine usually administered intra muscularly or intra venous. Xylazine produced induction of sedation very slowly but smoothly. The most common side effects associated with xylazine administration are include hypothermia, significantly decrease heart rate, hypotension and respiratory depression. During our trail sedation produced by xylazine, all the pigeons were suffered from hypothermia, bradycardia, and respiratory depression. So xylazine alone is not effective for anesthesia, it may be used with combination with other anesthetics drugs like ketamine etc. the result of our study indicate that there were hypothermia, bradycardia and respiratory depression, slow and smooth induction and recovery both. The same result was reported by (Freed and Baker, 1989) who study on Antagonism of xylazine hydrochloride sedation in raptors by yohimbine hydrochloride and also by (Durrani et al., 2009), who conducted an experiment on the comparison of the clinical effects associated with xylazine, ketamine, and a xylazine-ketamine cocktail in pigeons (Columba livia.). Isoflurane is an inhalant anesthetic drug commonly used for general anesthesia. Isoflurane is in liquid form at normal temperature, for administration of isoflurane a vaporizer is used. The vaporizer is calibrated for inhalant anesthesia to control the concentration of anesthesia which should be administered. For induction of anesthesia in pigeons it is recommended that the concentration of isoflurane should be 5% with 1L

oxygen/min usually produce surgical anesthesia. Anesthesia for surgical procedures may be maintained with 2-3% isoflurane with 1L oxygen flow per minute (Olsen et al., 1992). The induction was very rapid and smooth, the pigeons become anesthetized within 2-3 minutes. The duration of anesthesia was desirable. In our experiment the recovery was very rapid and smooth due to low blood-gas solubility and little metabolism of drug. The same result was obtained by (Sebel and Lowdon, 1989) who worked on Propofol, a new intravenous anesthetic. Isoflurane produces negligible or minor decrease in temperature, cardiac and respiratory depression as compared to ketamine and xylazine. The same result was founded by (Goodman et al., 1987) who worked on Some ventilatory effects of propofol as sole anesthetic agent. The blood oxygen saturation was not affected by using isoflurane. The oxygen saturation of blood was slightly decreased after 45 min, but then it became to its normal level after 60 min. After removal of isoflurane supply but not oxygen, all the birds recover to its normal position within 3-4 minutes. Ketamine and xylazine treated pigeons showed hypothermia, bradycardia and slow respiration while isoflurane treated birds have low effect on temperature, respiratory rate and negligible effect on heart rate. The hypothermia, bradycardia and hypo-respiration remained until complete recovery in group A and B. After complete recovery all the birds become to its normal physiological position after 24 hours and there was no mortality or any other unwanted effect of treatments was occurred during this trail in any group.

CONFLICT OF INTEREST

The authors declared no conflict of interest.

AUTHORS CONTRIBUTION

Mate Ur Rehman, Sadaf Aslam, Uzma Fareed Durrani, Nasir Iqbal: Experimental Trial and Revision. Naveed Hussain, Zubair Luqman, Hamza Jawad: Formatting, Setting and Revision.

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