

COMPARATIVE EFFICACY (SEDATIVE AND ANAESTHETIC) OF DETOMIDINE, KETAMINE AND DETOMIDINE-KETAMINE COCKTAIL IN PIGEONS (*COLUMBA LIVIA*)

UZMA F. DURRANI, M. ARIF KHAN¹ AND S. SALEEM AHMAD

Pet centre; University of Veterinary and Animal Sciences, Lahore;

¹Department of Clinical Medicine and Surgery,
University of Veterinary and Animal Sciences, Lahore, Pakistan

ABSTRACT

A study was conducted to compare the synergistic efficacy of detomidine, ketamine and their cocktail in pigeons (*Columba livia*). For this study, 15 adult and healthy pigeons were divided into three equal groups A, B and C. Birds of groups A and B were intramuscularly administered detomidine and ketamine @ 1.4 and 60 mg/kg b. wt., respectively. Pigeons of group C received detomidine + Ketamine cocktail @ 0.7 and 30 mg/kg b. wt. Induction of sedation and anaesthesia was smooth in all groups. Mean duration of induction was 11.1 ± 2.03 , 11.0 ± 1.49 and 1.6 ± 0.48 minutes in groups A, B, C, respectively. In groups A and B, smooth but light sedation and anaesthesia were observed accompanied by superficial analgesia, while in group C, birds showed deep anaesthesia alongwith deep analgesia. Birds in groups A and C elicited hypothermia, respiratory depression and bradycardia till complete recovery, while group B showed hyperthermia and tachycardia with rapid respiration. In group A, sedation persisted for 54.2 ± 21.82 minutes and mean recovery period was 49.9 ± 5.91 minutes, while groups B and C had anaesthesia for 47.7 ± 8.06 and 103.5 ± 27.52 minutes, and recovery periods were 52.6 ± 9.64 and 61.3 ± 17.26 minutes, respectively. Recovery was rough in group B and smooth in groups A and C. It was concluded that in pigeons, detomidine (alone) is safe for handling and for least painful procedures, while detomidine-ketamine cocktail is safe as intramuscular anaesthetic for major surgical procedures. However, ketamine is not a good anaesthetic to be used alone in pigeons.

Key words: Detomidine-ketamine cocktail, sedative, anaesthetic, analgesic, pigeons.

INTRODUCTION

Pigeons are very delicate birds and any mishandling can lead to immediate shock and death. Many times pigeons are received in hospital with critical condition, requiring a safe and painless surgery. In such situations, careful selection of an anaesthetic agent at safest dose is very important. There are many anaesthetic agents to be chosen for pigeons as solo agents or cocktail e.g. alpha-2-adrenoceptor agonists (detomidine, xylazine), pentothal sodium, isoflurane, ketamine and diazepam.

These days, alpha-2-adrenoceptor agonists are in common use as sedatives and anaesthetics for avian species because these are considered very effective, safe and easy to administer parenterally for surgical and non surgical procedures. Detomidine is a potent, non-narcotic, sedative, muscle relaxant and analgesic alpha-2- adrenergic agonist that has been used in a wide range of wild and domestic animals and birds. High doses of detomidine produce deep sedation, leading to loss of consciousness and a light plane of anaesthesia (Paddleford and Harvey, 1999).

Ketamine is a least potent dissociative anaesthetic agent because it lacks cardio-pulmonary depression

effect. Ketamine induces amnesia and anaesthesia of stages I and II but not stage III anaesthesia (Booth, 1988) and is a potent inhibitor of Gamma amino butyric acid (GABA) binding. This agent is rarely used alone because it is associated with poor muscle relaxation, muscle tremors, myotonic contractions, opisthotonus and rough recoveries and more commonly it is used with either alpha-2-adrenergic drugs, diazepam or azaperone, depending on the species involved (Valvered *et al.*, 1993).

Xylazine, detomidine and medetomidine are usually used in combination with ketamine (Christensen *et al.*, 1987). Detomidine and ketamine have synergistic effect, leading to reduction in dosages in blend. This combination results in smooth induction and recovery and better muscle relaxation (Heaton and Brauth, 1992). Use of detomidine-ketamine cocktail readily and smoothly induces loss of righting reflex, good muscle relaxation and hypoventilation, while corneal reflex persists during anaesthesia (Mohammad *et al.*, 1993). Their efficacy is enhanced while minimizing their untoward effects. The purpose of this study was to compare the synergistic efficacy of detomidine-ketamine anaesthesia with individual sedative and anaesthetic efficacy of detomidine and ketamine.

MATERIALS AND METHODS

Experimental birds

Fifteen adult and healthy pigeons of either sex (5 males and 10 females) were purchased from a local market (Lahore, Pakistan). Their body weights ranged from 150 to 250g. All the pigeons belonged to same flock and their ages were between 10 months and 2 years. All the birds were physically examined and found quite healthy and active. Male and female pigeons were kept separately in three spacious cages lying in Pet Center's Aviary, University of Veterinary and Animal Sciences, Lahore, Pakistan. Birds were retained in a clean and stress-free environment at a temperature of 25°C. All the birds were kept in isomanagerial and nutritional regimen, allowing the water and feed *ad-libitum*.

These pigeons were divided randomly into three equal groups i.e. group A (2 males and 3 females), group B (1 male and 4 females) and Group C (2 males and 3 females). They were examined closely to adjudge the health status before the commencement of trial. It included recording of body weight, temperature, respiration and heart rates, different body reflexes and looking for presence/absence of some minor or major injuries.

Drug administration

Water and feed were withheld 30 minutes prior to drug administration to minimize the chances of vomition. Then 1% injection Domosedan® (Detomidine, Farnos) and 5% injection Calypsol® (Ketamine HCl, Medimpex) were used with insulin syringe (I/M), as per protocol given in Table 1.

Table 1: Drug administration protocol in groups A, B and C

Group	Medicine
A	Detomidine @ 1.4 mg/kg b.wt.
B	Ketamine @ 60 mg/kg b.wt.
C	Detomidine-ketamine @ 0.7 mg/kg & 30 mg/kg b.wt.

Post treatment monitoring

After treatment, pigeons of all groups were kept under close observation for induction period, duration of sedation/anaesthesia, recovery period, degree and duration of analgesia. Body reflexes (righting reflex, toe pinch reflex, feather plucking reflex, palpebral reflex, table knock reflex, pharyngeal reflex), body temperature, respiration and heart rates were also recorded.

Respiration rate was recorded from sternal movements, while heart rate was recorded by stethoscope from left costal area and per rectum

temperature was noted using digital thermometer. Righting reflex was noted as the ability to restore normal sitting/standing posture.

Data analysis

The data thus obtained were subjected to standard statistical analysis using one way analysis of variance and statistical difference among various treatments was determined by Least Significant Difference test. Differences were considered to be significant at 5% level of significance.

RESULTS AND DISCUSSION

Induction of sedation and anaesthesia

Detomidine slowly induced a light sedation with slight muscle relaxation in all the birds. Birds were active during first 5 minutes, followed by standing quietly at one point. This is in line with the findings of Salonen (1986). Ketamine induced a slow, smooth but stage II anaesthesia without any muscle relaxation. All birds showed normal behaviour during initial 3-4 minutes and then became drowsy and remained quietly standing at one point. Detomidine-ketamine cocktail induced a fast, smooth, deep anaesthesia along with reasonable muscular flaccidity. Statistical analysis revealed a significant difference ($P < 0.05$) among induction periods (Table 2); values were higher for groups A and B than for group C, the difference between former two groups was non-significant.

Duration of sedation/anaesthesia

Detomidine sedation was smooth but light in all birds, except one bird that showed shivering and vomiting. All birds remained sitting with closed eyes when undisturbed and showed light hypothermia, hypoventilation and bradycardia. Ketamine induced stage II anaesthesia. Anaesthesia was light but smooth. All birds showed dorsal recumbency during anaesthesia. Eyes of all birds were closed during initial 10 minutes and then got opened. These findings are in close agreement with the observations of Salonen (1986) and Sandmeier (2000).

Ketamine elicited hyperthermia, tachycardia and hypoventilation during anaesthesia. Similar to the observations of Virtanen (1986) and Sandmeier (2000), detomidine – ketamine cocktail synergistically produced a deep anaesthesia accompanied by slight hypothermia, hypoventilation and bradycardia. Statistical analysis revealed a significant difference ($P < 0.05$) in duration of anaesthesia among three groups (Table 2); the duration of anaesthesia was higher in group C than groups A and B, the difference between the latter two groups was non-significant.

Recovery

In detomidine treated birds, recovery was smooth but slow. In ketamine treated birds, recovery was rough (severe convulsions and wing fluttering) that is in line with the findings of Lumeij and Deenik (2003). In group C, recovery was smooth. One bird showed vomiting 10 minutes after recovery. Statistical analysis revealed a significant difference ($P < 0.05$) among recovery periods (Table 2); the duration of recovery was higher in group C and lower in groups A and B.

Analgesia

Detomidine is known to produce a light and superficial analgesia (somatic and visceral) at low doses (Salonen, 1986; Sandmeier, 2000), while ketamine produces visceral analgesia. That is why detomidine and ketamine treated birds showed very mild and superficial analgesia. Detomidine-ketamine cocktail synergistically produced a deep analgesia of long duration sufficient for painful procedures that is in close agreement with the findings of Lumeij and Deenik (2003). Statistical analysis revealed a significant difference ($P < 0.05$) among analgesia duration in all groups (Table 2), the value was highest in group C and lowest in group B.

Body reflexes

Detomidine vanished feather plucking reflex only. Ketamine treated birds showed presence of all reflexes except three (righting reflex, feather plucking reflex and table knock reflex). Their combination (cocktail) acted synergistically to produce a deep analgesia along with the absence of all body reflexes studied (Table 3).

Temperatures

Detomidine and detomidine-ketamine cocktail treated birds suffered hypothermia, while ketamine treated birds suffered hyperthermia. Same observations were reported by Metehan *et al.* (2003) and Sandmeier (2000). Both hypothermia and hyperthermia restored till recovery or shortly after recovery (Table 4).

Respiration rate

All detomidine, ketamine and detomidine-ketamine cocktail treated birds suffered respiratory depression that persisted till recovery or shortly after recovery (Table 4). This is in line with the observations of Metehan *et al.* (2003).

Heart rate

Detomidine and detomidine-ketamine cocktail treated birds suffered bradycardia, while ketamine treated birds suffered tachycardia. Same results were quoted by Machin and Caulkett (1998). Both bradycardia and tachycardia restored till recovery or shortly after recovery (Table 4).

Drug safety

No untoward effect of any drug was noticed except typical side effects. Side effect of detomidine and detomidine-ketamine cocktail were hypothermia along with respiratory depression and bradycardia, while those of ketamine included hyperthermia, tachycardia and rough recovery because of lack of skeletal muscle relaxation. No mortality occurred in any group. All birds attained their physiological status after 24 hours. This is in line with the findings of Miller and Butrick (1999).

Conclusions

In pigeons, for least painful procedures and handling, detomidine (alone) can be used safely with proper thermoregulatory measures. However, for painful surgical procedures, use of detomidine-ketamine cocktail is safe and desirable. Ketamine alone is not a safe and desirable anaesthetic agent for pigeons at the dosage used in this study.

Acknowledgements

Authors are thankful to International Veterinary Information Service, Ithaca, New York, USA for provision of upto date information and the necessary knowledge.

Table 2: Duration of induction, sedation/anaesthesia and recovery period (min) in birds of three groups

Groups	Induction period	Duration of sedation/anaesthesia	Recovery period	Duration of analgesia
A-Detomidine	11.1 ± 2.03 ^a	54.2 ± 21.82 ^a	49.9 ± 5.91 ^a	70 ± 11.31 ^a
B-Ketamine	11.0 ± 1.49 ^a	47.7 ± 8.06 ^a	52.6 ± 9.64 ^b	45.5 ± 4.95 ^b
C-Detomidine & Ketamine cocktail	1.6 ± 0.48 ^b	103.5 ± 27.52 ^b	61.3 ± 17.26 ^c	107.5 ± 3.54 ^c

*Values having different superscripts within a column are significantly different from each other ($P < 0.05$).

Table 3: Response of body reflexes during sedation and anaesthesia in pigeons of different groups

Groups	Reflexes					
	Righting	Toe pinch	Feather plucking	Palpebral	Table knock	Pharyngeal
A	+	+	-	+	+	+
B	-	+	-	+	-	+
C	-	-	-	-	-	-

+: Body reflex present, - : Body reflex absent.

Table 4: Mean temperature, respiration and heart rate before, during and after sedation and anaesthesia in pigeons of different groups

Groups	During sedation/anaesthesia			After recovery		
	Temp. (°F)	Respiration rate/min.	Heart rate/min.	Temp. (°F)	Respiration rate/min.	Heart rate/min.
A	97.6 ± 2.67	37 ± 2.64	91 ± 9.64	102.6 ± 0.30	44 ± 3.80	128 ± 17.01
B	108.2 ± 0.35	30 ± 2.82	284 ± 8.71	106.8 ± 0.32	42 ± 3.31	225 ± 10.00
C	100.4 ± 0.52	36 ± 11.13	122 ± 7.09	103.4 ± 0.17	38 ± 4.94	118 ± 24.20

REFERENCES

- Booth, N. H., 1988. Intravenous and other parenteral anaesthetics. In: Booth, N. H. and L. E. McDonald's, Veterinary Pharmacology and Therapeutics. 6th Ed., Iowa State Univ. Press, Ames, Iowa, USA, pp: 253-264.
- Christensen, J., R. T. Fosse, O. J. Halvorsen and I. Moril, 1987. Comparison of various anaesthetic regimens in the domestic fowl. Amer. J. Vet. Res., 48(11): 1649-1657.
- Forester, H. S. and S. L. Courtot, 2000. Butorphanol/xylazine/ketamine immobilization of free ranging baird's tapirs in Costa Rica. J. Wild Dis., 36(2): 335-341.
- Heaton J. T. and S. E. Brauth, 1992. Effects of yohimbine as a reversing agent for ketamine-xylazine anesthesia in budgerigars. J. Lab. Anim. Sci., 42(1): 54-56.
- Lumeij, J. T. and J. W. Deenik, 2003. Medetomidine-ketamine and diazepam-ketamine anesthesia in racing pigeons (*Columba livia domestica*): a comparative study. J. Avian Med. Surg., 17: 191-196.
- Machin, K. L. and N. A. Caulkett, 1998. Cardiopulmonary effects of propofol and a medetomidine-midazolam-ketamine combination in mallard ducks. Amer. J. Vet. Res., 59(5): 598-602.
- Miller, W. and M. Buttrick, 1999. Current anaesthesia recommendations for companion birds. Iowa State Univ. Vets., 61(2): 67-75.
- Mohammad, F. K., M. S. Al-Badrany and A. M. Al-Hasan, 1993. Detomidine-ketamine anaesthesia in chicken. Vet. Rec., 133: 192.
- Paddleford, R. R. and R. C. Harvey, 1999. Alpha-2 agonists and antagonists. Vet. Clin. North Amer.: Small Anim. Pract., 29(3): 737-745.
- Salonen, J. S., 1986. Pharmacokinetics of detomidine. Acta Vet. Scand. Suppl., 82: 59-66.
- Sandmeier, P., 2000. Evaluation of medetomidine for short term immobilization of domestic pigeons (*Columba livia*) and Amazon parrot (*Amazona species*). J. Avian Med. Surg., 14(1): 8-14.
- Metehan, U., Y. Sedat, G. Atalan, M. Kaya and N. Sulu, 2003. Effects of medetomidine-ketamine combination anaesthesia on electrocardiographic findings, body temperature, and heart and respiratory rates in domestic pigeons. Turkish J. Vet. Anim. Sci., 27: 377-382.
- Valvered, A., D. Bienzle, D. A. Smith, D. H. Dyson and A. E. Valliant, 1993. Intra-osseous cannulation and drug administration for induction of anaesthesia in chicken. J. Vet. Surg., 22(3): 240-244.
- Virtanen, R., 1986. Pharmacology of detomidine and other alpha-2-adrenoceptor agonists in the brain. Acta Vet. Scand. Suppl., 82: 35-46.