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Clinical trial of cat anesthesia by single anesthetic ketamine during major surgery

S. M. Hanif

Department of Medicine, Surgery and Obstetrics, Patuakhali Science and Technology University, Babugonj Campus, Barishal-8210, Bangladesh

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***Corresponding Author**

S.M. Hanif
smhanifdvm7@pstu.ac.bd

ABSTRACT

Ketamine is one of the most widely used anaesthetic medicines in veterinary practice world-wide. The study was conducted to make an effective guideline for the anesthesia of cat by using single anesthetic ketamine (due to lack of xylazine) during major surgery at the Teaching Veterinary Hospital, Faculty of Animal Science and Veterinary Medicine, Patuakhali Science and Technology University, Bangladesh. A total 15 cats were used dividing 3 groups (A, B and C). All the cats were premedicated by atropine sulphate @ 0.04 mg/kg, and sedated by ketamine @ 10 mg/kg, IM. Then they were anesthesized by ketamine @ 10 mg/kg (IM), 10 mg/kg (IV) and 15 mg/kg (IV) respectively in group A, B and C. Maintenance dose required in group A and B but not in C (except one operation). Average duration of anesthesia were 44.8, 33.0 and 27.8 minutes and average recovery period were 21.6, 7.0 and 3.4 hours respectively in group A,B and C. Based on maintenance dose requirement, duration of anesthesia and quick recovery the combination used in group C for major surgery of cat is best. The study can suggest anesthesiologist or veterinary surgeon to follow the guideline used in group C during surgery of cat.

INTRODUCTION

In the recent past pet animals were treated as street animals in Bangladesh but recently pets are rearing by city peoples for the purpose of physical, social and emotional well-being (Dohoo et al., 1998; Robertson et al., 2000). Pet animals have a great importance to guard the house, company with children and older persons, gift to special one and for economic purposes (Parvez et al., 2014).Cats are rearing as a loving pet in the entire city including Barishal. Many cat owners have a great interest to neuter their pet. Sarker et al. (2015) reported that, at Central Veterinary Hospital 9.33% cats performed general surgery and 6.67 % special surgery. An emerging animal lover society "Stands for Animals" in Barishal (conducted by students) also brings many injured patients (street dogs and cats) to our "Veterinary Teaching Hospital". In addition with this, many cat owner brings their cat for sterilization. So, we need to anesthetized cat for major surgery and to treat injured patients regularly.

Cats pose unique anesthetic and analgesic challenges to the practitioner because of their size, temperament, and unique physiology. General anesthesia is composed of unconsciousness, amnesia, muscle relaxation, and analgesia. Rarely will one single drug available to the feline practitioner provide all of these components at safe doses. The selection of a particular anesthetic regime in cats will be based on the animal's physical status, temperament, type of procedure, degree of pain, facility, experience, and cost of the anesthetic and analgesic agents.

Ketamine is one of the most widely used anaesthetic medicines in veterinary practice world-wide, and is also used for the provision of analgesia in certain circumstances. Limitation to

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its availability would be a major loss to animal welfare.

Andre et al., (2003) used combination of dexmedetomidine @ 10 µg/kg and ketamine @5 mg/kg to sedate cat. Cistola et al. (2004) used combination of tiletamine, zolazepam, ketamine and xylazine combination for surgical anesthesia of cats. Green et al. (1981) used Ketamine alone and combined with diazepam or xylazine and but stated a broad range of single ketamine 5-20 mg/kg.

Ketamine is a dissociative agent that produces analgesia, immobilization and general anesthesia (Cistola et al., 2004). Ketamine, in doses of 10-20 mg/kg, depressed the synaptic transmission (Chen et al., 1975). Lodge (1984) also stated that, ketamine selectively and reversibly decreased polysynaptic reflexes over a wide dose range.

Ketamine is a derivative of phencyclidine which is a distinct, centrally-acting drug. These drugs can induce amnesia, analgesia, catalepsy, anaesthesia and convulsions. Many investigators have focused their special attention on the epileptogenic properties of these agents (Mori et al., 1971; Kayama and Iwama, 1972; Winters et al.,1972). Mori et al., 1971 stated that, ketamine depress the effect of CNS by reducing spontaneous firing of neurons in the brain stem i.e. functional disorganization of CNS rather than CNS depression. Green et al., 1981 used 20-30 mg ketamine with 1-1·5 mg xylazine per kg im for surgical anaesthesia.

Ketamine, alone, or more usually together with a reversible sedative, given by the IM route, is the main form of anaesthesia used for domestic cats world-wide. Ketamine Hydrochloride Injection may be used in cats for restraint or as the sole anesthetic agent for diagnostic or minor, brief, surgical procedures that do not require skeletal muscle relaxation.

Any sedative or general anesthetic plan must include a provision for pain control. Modern feline anesthesia and analgesia requires familiarity with a variety of anesthetic drugs and drug categories. Safe use of these drugs requires an understanding of their clinical pharmacology. Whether sedation and analgesia are used alone or a full general anesthetic is required, attention to monitoring is essential to minimize anesthetic-related morbidity and mortality in the feline patient.

Most of the anesthesiologist used ketamine with the combination of xylazine. Unfortunately, we have no supply of xylazine. Therefore we made the experiment to prepare an effective protocol for cat anesthesia by ketamine before surgery and to evaluate the duration of anesthesia with the recovery of patients from anesthetic effects.

MATERIALS AND METHODS

The study was performed in the Veterinary Teaching Hospital at the Faculty of Animal Science and Veterinary Medicine, Patuakhali Science and Technology University, Bangladesh. A total of 15 cats (Male-4, Female-11) were used in this study which came to the hospital during the period from August, 2018 to July, 2019. The animals were randomly divided into three groups; A, B and C.

Patient Preparation

Healthy adult cats kept fasted for 6 to 8 hours prior to being anesthetized when possible. Water was allowed until just prior to anesthesia.

Treatment

All the cats were premedicated by atropine sulphate @ 0.04 mg/kg, IM and then sedated by ketamine @ 10 mg/kg, IM for preoperative preparation. Finally anesthetic and maintenance dose (whether necessary) were used to perform operation. Different reflexes, duration of anesthesia and recovery from anesthetic effects were recorded.

Table 1: Group A

Patients	Premedication (Atropine sulphate @ mg/kg, IM)	Sedative dose (Ketamine@ mg/kg, IM)	Anaesthetic dose(Ketamine @ mg/kg, IM)	Maintenance dose(Ketamine @ mg/kg, IM)	Total Ketamine mg/kg
1 (Spaying)	0.04	10	20	10	40
2 (Spaying)	0.04	10	20	10	40
3 (Spaying)	0.04	10	20	10	40
4 (Spaying)	0.04	10	20	10	40
5 (Spaying)	0.04	10	20	10	40
Average					40

Table 2: Group: B

Patients	Premedication (Atropine sulphate @ mg/kg, IM)	Sedative dose (Ketamine @ mg/kg, IM)	Anaesthetic dose (Ketamine @ mg/kg, IV)	Maintenance dose (Ketamine @ mg/kg, IV)	Total Ketamine mg/kg
1 (Spaying)	0.04	10	10	10	30
2 (Spaying)	0.04	10	10	10	30
3(Castration)	0.04	10	10	5	25
4 (Spaying)	0.04	10	10	10	30
5(Castration)	0.04	10	10	5	25
Average					28

Table 3: Group C

Patients	Premedication (Atropine sulphate@ mg/kg, IM)	Sedative dose (Ketamine @ mg/kg, IM)	Anaesthetic dose (Ketamine @ mg/kg, IV)	Maintenance dose (Ketamine @ mg/kg, IV)	Total Ketamine mg/kg
1 (Castration)	0.04	10	15	-	25
2 (Spaying)	0.04	10	15	5	30
3(Castration)	0.04	10	15	-	25
4 (Spaying)	0.04	10	15	-	25
5 (Spaying)	0.04	10	15	-	25
Average					26

RESULTS AND DISCUSSION

Ketamine had an onset of action of approximately 30-60 seconds after intravenous injection. On its own, muscle relaxation is poor with ketamine, salivary secretion is copious, and eyes remain open, predisposing to corneal drying. For all the patients, pedal reflex and corneal reflex diminishes while ketamine used in intravenous route. Pedal reflex moderately present in group A, slightly present in group B while anesthetic dose of ketamine is used intravenously, and become nearly absent group C while intravenous dose increased. In all cases, muscle relaxation does not occur as ketamine alone is not a good muscle relaxant (Green et al., 1981).

Following similar sedative dose (@10 mg/kg, IM) in all cases, anesthetic dose used 10 mg/kg (IM in group A), 10 mg/kg (IV, in group B) and 15 mg/kg (IV, in group C) where maintenance dose required in group A, and B but not in group C (except one operation). Total ketamine used 40, 28 and 26 mg/kg in group A, B and C respectively. Green et al. (1881) stated that 20-30 mg/kg ketamine for surgical anaesthesia in cat. Chen et al. (1975)

stated 20 mg/kg ketamine, both polysynaptic and monosynaptic responses were decreased to a single shock stimulation. Glen, 1973 stated 15-20 mg/kg ketamine required for surgical anaesthesia in the cat (Glen, 1973). So, we can conclude, the combination used in group C is best for surgical purpose.

Table 4: Group: A

Patients	Pedal reflex	Corneal reflex	Muscle relaxation	Duration of anaesthesia (minutes)	Recovery from anesthetic effect (hours)
1	++	+++	---	45.0	24.0
2	++	+++	---	48.0	22.0
3	++	+++	---	46.0	24.0
4	++	+++	---	41.0	20.0
5	++	+++	---	44.0	18.0
Average				44.8	21.6

(NB: ++ moderately present, +++ markedly present, --- no muscle relaxation)

Table 5: Group B

Patients	Pedal reflex	Corneal reflex	Muscle relaxation	Duration of anaesthesia (minutes)	Recovery from anesthetic effect (hours)
1	+	+	---	35.0	8.0
2	+	+	---	33.0	7.0
3	+	+	---	30.0	6.0
4	+	+	---	36.0	8.0
5	+	+	---	31.0	6.0
Average				33.0	7.0

(NB: +slightly present, --- no muscle relaxation)

Table 6: Group C

Patients	Pedal reflex	Corneal reflex	Muscle relaxation	Duration of anesthesia (minutes)	Recovery from anesthetic effect (hours)
1	-	- -	---	27.0	1.5
2	-	- -	---	30.0	4.0
3	-	- -	---	25.0	4.0
4	-	- -	---	28.0	4.0
5	-	- -	---	29.0	3.5
Average				27.8	3.4

(NB: - slightly absent, -- markedly absent, --- no muscle relaxation)

Duration of anesthesia varied markedly due to different dose and route. In group A, average duration of anesthesia is 44.8 minutes with prolong recovery (average 21.6 hours) while ketamine is used in intramuscular route. In group B, anaesthetic dose used through intravenous route. Here, average duration of anesthesia is 33.0 minutes with 7.0 hours of recovery. In group C, though anesthetic dose used through intravenous route but dose rate greater than group B. Here, average duration of anesthesia is 27.8 minutes and 3.4 hours of recovery. Green et al. (1981) stated that ketamine effect lasted for 30-40 min and

recovery took 8-12 hours in IM route and 4-5 hours in IV route. Chen et al. (1975) stated, ketamine depress polysynaptic and monosynaptic responses to a single shock stimulation which lasted more than 60 minutes but significant depression lasted for 30 minutes.

Overall ketamine had the advantage of cardiovascular stability by increasing heart rate, blood pressure and cardiac output. However, in some patients this increase in cardiac workload will not be ideal or tolerated. Recovery from ketamine anesthesia can be associated with hyperexcitability in cats because animal become hypersensitive to light, noise and handling. Preanesthetic and postanesthetic sedation will help attenuate these excitatory responses

CONCLUSION

Based on this clinical trial, it can be concluded that ketamine alone can be used for the anesthesia of cat before major surgery along with premedicant. At first ketamine should be used as sedative dose @ 10 mg/kg, IM and anesthetic dose @ 15 mg/kg, IV which anesthetized patients for about half hour and recovered from anesthetic effect within 4 hours.

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