

## Effects of Ascorbic Acid for Premedication of Cats Following Ketamine Anaesthesia

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**Abstract:** The cat is often a difficult subject to anaesthetize quietly and smoothly, for restraint may provoke violent struggling and sometimes frenzy. High amount of ascorbic acid probably has similar physiological properties as amphetamine in the central nervous system depression and impairment of nervous system functional have been reported due to deficiency of this water-soluble vitamin. Based on this background, this study was designed to determine the effects of ascorbic acid on Ketamine anesthesia in cats. The trial included 16 cats (9 males and 7 females) were used. They were randomized into 4 groups of four cats each (A-D) and Ketamine 5% (Trittau, Germany) (30 mg kg<sup>-1</sup>) was administered intravenously in to each cats in group D. Four cats each in groups A-C received 5, 10 and 20 mg kg<sup>-1</sup> of ascorbic acid, respectively. Five minutes after premedication with ascorbic acid, the animals were treated with Ketamine. The onset and duration of anesthesia as well as vital parameters were observed and recorded. The results are presented as means±SEM changes in the control and experimental values were compared for statistical significance using ANOVA and a probability level at 5% as levels of significant. There were significant decrease in the onset (A and B groups), heart rate (A, C and D) and respiratory rate (A and D groups), respectively (p<0.05). There was also observed significant increase in duration of anaesthesia (A-C groups), respectively (p<0.05). The change in the rectal temperature of cats treated was significant (p<0.05). This results suggest that ascorbic acid at 10 mg kg<sup>-1</sup> administration prior to Ketamine treatment could be use to decrease onset and increase the duration of anaesthesia in cats.

**Key words:** Ascorbic acid, premedication, ketamine, xylazine, cat

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### INTRODUCTION

The cat is often a difficult subject to anaesthetize quietly and smoothly, for restraint may provoke violent struggling and sometimes frenzy (Hall and Clarke, 1991). Anticholinergic drugs should generally be included in the premedication given to cats. Ketamine selectively and reversibly decreased polysynaptic reflexes over a wide dose range. The anaesthesia induced by cyclohexylamine derivatives in cats.

In spite of several studies, the actual physiological role of ascorbic acid (vitamin C) in the normal function of central nervous systems remains unclear, though it is known to be highly concentrated in the brain (Nuh, 2004; Sjostrand, 1970; Najafpour and Sadeghi, 2007). It is possess properties that exert modulating influence on the central nervous system either physiologically or pharmacologically. High amount of ascorbic acid probably has similar physiological properties as amphetamine in the central nervous system depression and impairment of nervous system functional have been reported due to deficiency of this water-soluble vitamin (Laurence *et al.*,

1997; Nuh, 2004; Najafpour and Sadeghi, 2007). High doses of ascorbic acid have been reported to induce sleep disturbance, headache and gut upset (Sjostrand, 1970). Combined effects of stress and anesthesia can result in cardio-respiratory arrests (Hautman *et al.*, 2003; Lukasik, 1999).

The prolonged inappetance characterized by frequent postoperative complication in animals can result in gastro-intestinal disturbance (Hautman *et al.*, 2003). Ketamine in higher dosages induces perfect immobilization, which may, however, be occasionally associated with undesirable effects, especially convulsions (Hautman *et al.*, 2003). Among the many methods of anesthetizing the rats described and the study a combination of several injectable drugs (pentobarbital, Ketamine/acepromazine and Ketamine/ diazepam) seems to be the most popular (Flecknell, 1991; Hautman *et al.*, 2003). When, ketamine is used as a sole anaesthetic agent it tends to cause hypertonus, poor muscle relaxation, persistent pain reflex responses and violent recovery from anaesthesia (Hautman *et al.*, 2003). To counteract these undesirable side effects various drugs such as Xylazine,

an  $\alpha_2$ -agonist compound, have been used in combination with Ketamine. Ketamine combined with Diazepam has been reported to produce good anaesthesia in the dog (Flecknell, 1991).

Based on this background, this study was designed to determine the effects of ascorbic acid on Ketamine anesthesia in cats.

## MATERIALS AND METHODS

**Animals and their health condition:** The trial included 16 cats (9 males and 7 females) were used. Animals were 9-20 months old with weights ranging from 2.5-5.5 kg. Clinical examination included examination colour of the mucosa, auscultation of the cardiovascular and the respiratory system was performed prior to inclusion in the trial and immediately before anesthetics. The animals were clinically healthy individuals. They were randomized into 4 groups of four cats each (A-D) and housed in the animal house of the Faculty of Veterinary Medicine, Islamic Azad University, Urmia branch.

**Experimental procedure:** Ketamine 5% (Trittau, Germany) ( $30 \text{ mg kg}^{-1}$ ) was administered Intravenously (IV) in to each cats in group D.

The vital parameters such as Body Temperature (BT), Heart and Respiratory Rates (HR, RR) were taken and recorded after Ketamine anesthesia. BT was obtained by a digital thermometer placed into the rectal and HR was auscultation by stethoscope and RR was valuated by the control of breast movements.

The onset and duration of sleep were also observed and recorded. Four cats each in groups A-C received 5, 10 and  $20 \text{ mg kg}^{-1}$  of ascorbic acid by intravenously injection, respectively. Five minutes after premedication with ascorbic acid, the animals were treated with Ketamine. The onset and duration of sleep as well as vital parameters were observed and recorded.

**Statistical and data analysis:** The results are presented as means $\pm$ SEM. Changes in the control and experimental values were compared for statistical significance using ANOVA and a probability level at 5% as levels of significant.

## RESULTS AND DISCUSSION

In group D onset and duration of Ketamine induced anesthesia was  $4.33\pm 0.57$  and  $79.66\pm 2.57$  min. Pre-treatment of cats with 5, 10 and  $20 \text{ mg kg}^{-1}$  (IV) of

ascorbic acid followed by Ketamine ( $40 \text{ mg kg}^{-1}$ ) (IV)) resulted significant ( $p<0.05$ ) decrease in the onset anesthesia by 46, 30 and 15%, respectively.

The decrease in onset and increase in the duration of anesthesia appear to be dose dependent in cats. Administration of ascorbic acid prior to administration of Ketamine also significantly decreased the heart rate, respiratory rate and body temperature ( $p<0.05$ ) (Table 1 and Fig. 1-3).

There were significant decrease in the onset (A and B groups), heart rate (A-D) and respiratory rate (A and D groups), respectively ( $p<0.05$ ). There was also, observed significant increase in duration of anaesthesia (A-C groups), respectively ( $p<0.05$ ). The change in the rectal temperature of cats treated was significant ( $p<0.05$ ).

Ketamine/Xylazine also significantly decreased the heart rate and respiratory rate ( $p<0.05$ ). In this present study did not significantly change the body temperature (Fig. 1-3).

Laurence *et al.* (1997) reported that high dose of ascorbic acid may cause sleep disturbances, headache and gut upset.

The decrease in the time of onset as well as the increase in the duration of anesthesia showed that at low doses the changes were insignificant, but significant at high dose. This may be explained by the fact that ascorbic acid acts by exerting modulating influences on the central nervous system inducing depression and impairment of the function of central nervous system when administered at high doses.

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Ketamine and ascorbic acid combination caused significant ( $p<0.05$ ) decrease in the heart and respiratory rates when compared to the control. Heart rate was significantly below the base line value during anesthesia in Ketamine groups for purposes of the Ketamine combination in cats, which is in agreement with the findings in dogs and cats (Cullen, 1996; Lodgd and Anis, 1984; Moens and Fargetton, 1990; Najafpour and Sadeghi, 2007; Versteegen *et al.*, 1991, 1989; Wright, 1992). The decrease in heart rates following ascorbic acid and Ketamine combination administration is worthy of note since Ketamine alone did not significantly reduce the heart rates.

The observed decrease may have resulted from ascorbic acid induced central nervous system depression

Table 1: Effect of ascorbic acid on Ketamine (K) anesthesia and vital signs of cats pre-medicated intra-venously with different doses of Ascorbic Acid (AA)

Groups	Number of cats			Drug treatment	Anaesthesia parameter (mean±SD)		Vital parameter (mean±SD)		
	Total	Male	Female		Onset of anaesthesia (min)	Duration of anaesthesia (min)	Heart rate (bpm)	Respiratory rate (per min)	Rectal temp. (°C)
A	5	3	2	5 mg kg <sup>-1</sup> AA + (K)	2.33±0.57*	106.00±6*	184.81±26.33*	32.68±14.06*	38.02±0.86*
B	5	3	2	10 mg kg <sup>-1</sup> AA + (K)	3.00±0.00*	115.33±11.2*	206.13±43.72	21.73±9.38	36.95±0.99
C	5	2	3	20 mg kg <sup>-1</sup> AA + (K)	3.66±0.57	117.33±5.2*	177.73±35.27*	24.47±12.01	37.14±1.24
D	5	2	3	K (30 mg kg <sup>-1</sup> ) + N	4.33±0.57	79.66±21.5*	217.64±14.78*	22.64±3.77*	37.31±0.96*

\*Difference with the data obtained from the corresponding positive control group (D) reached the level of statistic significance (p<0.05) (n = 16)

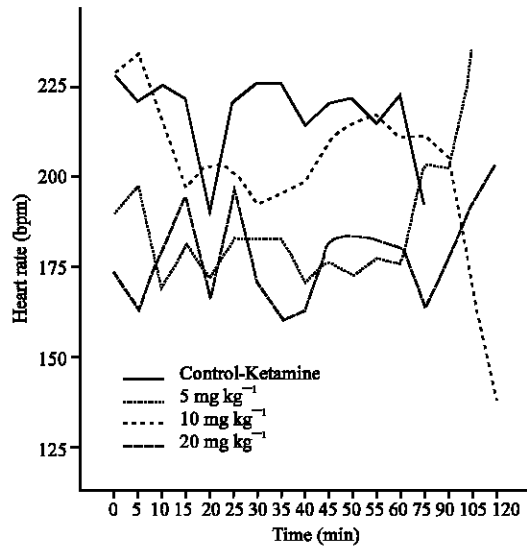


Fig. 1: Mean changes of heart rate (bpm)

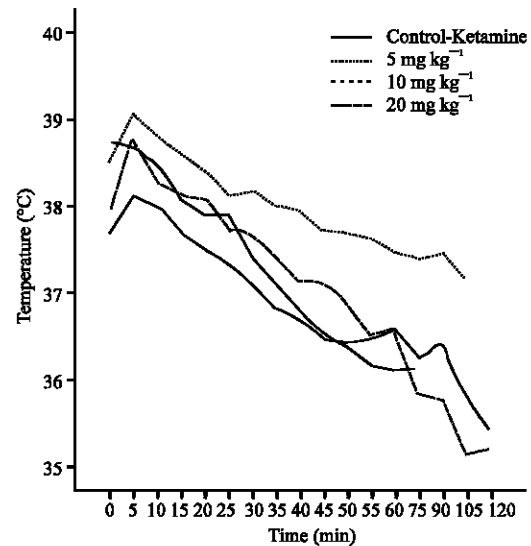


Fig. 3: Mean changes of rectal temperature (°C)

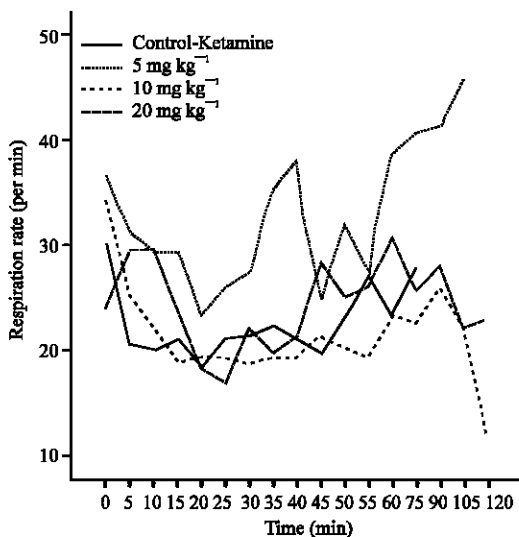


Fig. 2: Mean changes of respiratory rate (per min)

activity (Najafpour and Sadeghi, 2007). Nuh (2004) was of the opinion that normal dose of Ketamine/Xylazine dose cause significant respiratory depression, however, in the present study Ketamine at 30 mg kg<sup>-1</sup> in cats with or

without ascorbic acid induced significant respiratory depression, that present findings appear to be in agreement with those reported by Nuh (2004) Combination Ketamine and ascorbic acid in this present study did significantly reduce the body temperature. Rectal temperature is known to be decreased following the administration of general anesthetics like barbiturates by reduction of muscular activity and depression of thermoregulatory center (Flecknell, 1991; Klein and Klide, 1989).

### CONCLUSION

These results suggest that ascorbic acid administration prior to Ketamine treatment could be use to decrease in the onset of action and increase in the duration of anesthesia in cats.

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