Journal of Animal and Veterinary Advances 10 (9): 1184-1186, 2011
ISSN: 1680-5593

Effect of Ephedrine on the Onset Time of Succinylcholine in Cats

[1]Kamil Saglam and [2]Abdullah Tas
[1]Department of Agriculture, Istanbul, Turkey
[2]Department of Agriculture, Malatya, Turkey

Abstract: The aim of this study was to investigate the effect of ephedrine administered prior to induction of anesthesia on the onset time of succinylcholine for endotracheal intubation in cats. Cats were randomly assigned to receive either 70 μg kg^{-1} of ephedrine (Group I; n = 7) or saline (Group II; n = 7) 3 min before induction of anesthesia. Anesthesia was induced with intravenous administration of ketamine (5 mg kg^{-1}), midazolam (0.2 mg kg^{-1}), succinylcholine (1 mg kg^{-1}). Onset and intubation times were recorded after succinylcholine injection. Heart rates were also measured. The onset time of succinylcholine and intubation times were significantly ($p<0.01$) shorter in group I, as compared with the group II (17±3, 20±3; 31±5, 36±2 sec, respectively). Heart rates were higher in the group I than in the group II at the measurement times of 1 min after ephedrine injection and 1, 3 and 5 min after succinylcholine injection. As a result, ephedrine accelerated the onset time of succinylcholine without significant adverse clinical effects and it may be an alternative in clinical conditions requiring rapid intubation in cats.

Key words: Succinylcholine, ephedrine, cat, intubation, clinical condition, Turkey

INTRODUCTION

Feline endotracheal intubation intubation has become a safe, routine procedure for the administration of general anaesthetics. This procedure is difficult in cats owing to laryngospasm and to their more pronounced laryngeal and pharyngeal sensitivity (Wong and Brock, 1994). The cats' larynx is also a small and delicate structure easily damaged by rough attempts at intubation. Atraumatic intubation is therefore essential and greatly facilitated by the use of Neuromuscular Blockers (NMB) which relax the jaw muscles and prevent the larynx from going into spasm (Hall *et al*., 2001).

Neuromuscular blocking agents usage for intubation causes the risk of hypoxia and pulmonary aspiration in the patients. Since succinylcholine, a short onset depolarizing muscle relaxant has adverse effects, various strategies have been used to shorten the onset time of muscle relaxants for rapid intubation (Soltanimohammadi and Seyedi, 2007).

Traditionally, succinylcholine has been the NMB of choice because of its rapid onset of action (Cook, 2000; Levins, 2002). It has been used as a depolarizing NMB in small animal anaesthesia for many years. The use of succinylcholine to facilitate endotracheal intubation in the cat deserves special consideration (Brouwer, 1990). It can however be associated with many side effects including cardiac dysrhythmias such as sinus bradycardia, junctional rhythm, sinus arrest (Cook, 2000; Hall *et al*., 2001) muscle pain (Goulden and Hunter, 1999; Hall *et al*., 2001), raised intraocular (Cook, 2000) and intracranial pressure (Giffin *et al*., 1985). For this reason, many researchers preferred to use non depolarising agents with fewer side effects and tried ephedrine pre-treatment to accelerate onset time of these drugs in human beings (Munoz *et al*., 1997; Szmuk *et al*., 2000). The onset time of muscle relaxants is partially determined by muscle blood flow and cardiac output. Ephedrine can increase cardiac output and muscle blood flow (Soltanimohammadi and Seyedi, 2007; Lawson and Meyer, 2001). Ephedrine pre-treatment has been shown to decrease the onset time of several non-depolarizing agents such as rocuronium and vecuronium (Munoz *et al*., 1997; Szmuk *et al*., 2000).

Ephedrine administration prior to succinylcholine injection for endotracheal intubation in cats has not been previously reported. Researchers think that side effects of succinylcholine will be minimised if onset time can be shortened. The aim of this present study was therefore to evaluate the effect of ephedrine administered prior to anesthesia induction on the onset time of succinylcholine for endotracheal intubation in cats.

MATERIALS AND METHODS

About 14 healthy adult cats of either gender were included the study. The weights ranged from 3.3-4.9 kg with a mean of 3.4 kg and their ages from 2-5 years with a mean of 3.8 years. All cats were considered to be

Corresponding Author: Kamil Saglam, Deparment of Agriculture, Istanbul, Turkey

Table 1: Modified intubating condition score for cats

Score	Condition	Laryngoscopy finding
1	Bad	Visualization of larynx difficult, vocal cords closed, intubation not possible
2	Poor	Visualization of larynx difficult, vocal cords moving, reaction of vocal cords on intubation with moderate bucking or coughing
3	Good	Visualization of larynx easy, vocal cords relaxed and open, easy passage of endotracheal tube with slight bucking or coughing
4	Excellent	Visualization of larynx easy, vocal cords relaxed and open, easy passage of the endotracheal tube without bucking or coughing

healthy on the basis of results of physical examination. Feed was withheld for 12 h before admittance for anaesthesia. Water was withheld for a few hours. Cats were not given any drug other than those administered during the study.

The animals were restrained in the right lateral recumbent position. A 22 G catheter was placed in the vena saphena medialis for administration of the fluids (Lactated ringer solution) and drugs. Cats were randomly assigned to receive either 70 μg kg^{-1} of ephedrine (Group I) or saline (Group II) 3 min before induction of anesthesia. A combination of ketamine hydrochloride (Ketalar®, Parke-Davis) at 5 mg kg^{-1} and midazolam (Dormicum®, Roche) at 0.2 mg kg^{-1} was used as the intravenous induction agent in the both groups. All cats were breathing spontaneously at this stage.

A 1 mg kg^{-1} bolus of succinylcholine was injected two minute after induction of anesthesia. Respiration was maintained manually as positive pressure ventilation. A non-cuffed endotracheal tube (3-4 mm outer diameter) was placed to trachea. Intubating conditions were scored (Table 1) according to a modification by Goldberg *et al.* (1989) and Krieg *et al.* (1980). All intubations were carried out by the first author blinded to the study drug and measurement of heart rate.

Onset time was defined as cessation of spontaneous breathing following succinylcholine administration. A chronometer was used to measure onset time of the agent. Intubation time was recorded as the time interval between succinylcholine injection and placement of the tube in the trachea. Heart rate was measured by use of a stethoscope placed on the lateral aspect of the left thorax at the following measurement times; baseline (before ephedrine injection), 1 min after ephedrine pre-treatment and 1, 3 and 5 min after succinylcholine injection, then every 5 min until the neuromuscular blockade reversed. Statistical analysis was performed with Mann-Whitney U and Kolmogro-Smirnov tests. Repeated measurements were analyzed with one way ANOVA followed by Tukey HSD.

RESULTS AND DISCUSSION

Onset time of succinylcholine and intubation times were significantly ($p<0.01$) shorter in group I, compared

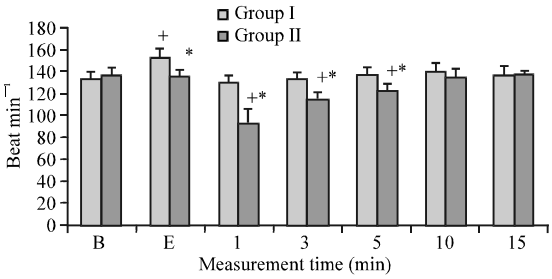

Fig. 1: Mean heart rates of the group I (Ephedrine) and group 2 (saline) (+$p<0.05$ significant difference from baseline, *$p<0.05$ when compared B: Baseline; E: 1 min after ephedrine

with the group II (17±3, 20±3; 31±5, 36±2 sec, respectively). Mean heart rate of the group I was significantly ($p<0.05$) higher than that of group II at all measurement times, except for 10 and 15 min after injection of succinylcholine. After ephedrine injection, there was significant ($p<0.05$) increase in group I when compared with the baseline value. Otherwise, heart rates measured at 1, 3 and 5 min following succinylcholine injection in the group II were significantly ($p<0.05$) decreased, compared with baseline values (Fig. 1). Intubating conditions scores were similar (3.5±0.5; 3.6±0.3) between two groups.

Shortening effect of ephedrine used before neuromuscular blocking agents such as vecuronium, atracurium, rocuronium and succinylcholine have been expressed (Soltanimohammadi and Seyedi, 2007). Munoz *et al.* (1997) also found that co-administration of ephedrine with rocuronium reduced the onset time of neuromuscular blockade. Rapid onset time of succinylcholine obtained in the current study is consistent with Munoz *et al.* (1997) findings. The combination of ephedrine with succinylcholine accelerated the onset time of succinylcholine without significant adverse clinical effects. Researchers found that ephedrine reduced the onset time of succinylcholine by almost 50%. Besides, several studies (Munoz *et al.*, 1997; Szmuk *et al.*, 2000) noted the shortening effect of ephedrine pre-treatment on the onset times of vecuronium and rocuronium.

As a matter of the fact (Ezri *et al.*, 2003) has also reported that pre-treatment with ephedrine appears to affect the onset time of rocuronium by altering cardiac output as measured with the non-invasive cardiac output monitor. Succinylcholine, despite its negative effects including muscle pains, bradycardia, increased plasma potassium concentration and raised intraocular pressure has been used as the standard neuromuscular blocking drug to facilitate tracheal intubation. Its popularity reflects the lack of viable alternatives with rapid onset (McCourt *et al.*, 1998; Cook, 2000). Nevertheless of all these side effects, bradycardia is outstanding effect of

succinylcholine. In the current study, ephedrine counteracted that succinylcholine induced bradicardia, increasing heart rate. This effect of ephedrine can be attributed with direct alpha and beta adrenergic receptor stimulation and also indirectly by releasing noradrenalin (Lee *et al*., 2002).

CONCLUSION

In the study, ephedrine given before induction of anesthesia, reduced the onset time of succinylcholine without significant adverse effects. This combination can be valuable when the shortest possible time from loss of consciousness to tracheal intubation is desirable.

REFERENCES

Brouwer, G., 1990. Clinical use of Neuromuscular Blocking Agents in Dogs and Cats. In: Practice Handbooks Small Animal Practice, Boden, E. (Ed.). Bailliere Tindall, Glasgow, pp: 281-300.

Cook, D.R., 2000. Can succinylcholine be abandoned? Anesth Analg, 90: S24-S28.

Ezri, T., P. Szmuk, R.D. Warters, R.E. Gebhard, E.G. Pivalizza and J. Katz, 2003. Changes in onset time of rocuronium in patients pretreated with ephedrine and esmolol: The role of cardiac output. Acta Anaesth. Scand, 47: 1067-1072.

Giffin, J.P., B. Litwak, J.E. Cottrell, J. Hartung and C. Capuano, 1985. Intracranial pressure, mean arterial pressure and heart rate after rapid paralysis with atracurium in cats. Can. J. Anesth., 32: 618-621.

Goldberg, M.E., G.E. Larijani, S.S. Azad, M. Sosis, J.L. Seltzer, J. Ascher and J.N. Weakly, 1989. Comparison of tracheal intubating conditions and neuromuscular blocking profiles after intubating doses of mivacurium chloride or succynilcholine in surgical outpatient. Anesth. Analg., 69: 93-99.

Goulden, M.R. and J.M. Hunter, 1999. Rapacuronium (Org 9487): Do we have a replacement for succinylcholine. Br. J. Anesth., 82: 489-494.

Hall, L.W., K.W. Clarke and C.M. Trim, 2001. Anaesthesia of the Cats. In: Veterinary Anaesthesia, Hall, L.W., K.W. Clarke and C.M. Trim (Eds.). 10th Edn., W.B. Saunders, London, pp: 441-461.

Krieg, N., L. Mazur, L.H. Booij and J.F. Crul, 1980. Intubation conditions and reversibility of a new non-depolarizing neuromuscular blocking agent, Org-NC45. Acta Anesthesiol. Scand., 24: 423-425.

Lawson, N.W. and J. Meyer, 2001. Autonomic Nervous System: Physiology and Pharmacology. In: Clinical Anesthesia, Barash, P.G. (Ed.). 4th Edn., Lippincott-Raven, Philadelphia, pp: 282-283.

Lee, Y.H., K.W. Clarke, H.I.K. Alibhai and D.Y. Song, 2002. The effects of ephedrine on intramuscular blood flow and other cardiopulmonary parameters in halothane-anesthetized ponies. Vet. Anesth. Analg., 29: 171-181.

Levins, T.T., 2002. Neuromuscular blockers: Less is more. Nursing, 32: 10-14.

McCourt, K.C., L. Salmela, R.K. Mirakhur, M. Carroll and M.T. Makinen, 1998. Comparison of rocuronium and suxametonium for use during rapid sequence induction of anesthesia. Anesthesia, 53: 867-871.

Munoz, H.R., A.G. Gonzalez, J.A. Dagnino, J.A. Gonzalez and A.E. Perez, 1997. The effect of ephedrine on the onset time of rocuronium. Anesth. Analg., 85: 437-440.

Soltanimohammadi, S. and M. Seyedi, 2007. Effects of ephedrine on the onset of neuromuscular block and hemodynamic responses following priming by atracurium. Int. J. Pharmacol., 3: 367-370.

Szmuk, P., T. Ezri, J.E. Chelly and J. Katz, 2000. The onset time of rocuronium is slowed by esmolol and accelerated by ephedrine. Anesth. Analg., 90: 1217-1219.

Wong, W.T. and K.A. Brock, 1994. Tracheal laceration from endotracheal intubation in a cat. Vet. Rec., 134: 622-624.