

Anesthetic Effects of Medetomidine-Tiletamine/Zolazepam Combination in Green Iguanas (*Iguana iguana*)

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Abstract: This study was performed to investigate the anesthetic effects of intramuscularly administered medetomidine-tiletamine/zolazepam (Zoletil®) in the green iguana. The doses of medetomidine were 50, 100 and 150 µg/kg in each groups and tiletamine/zolazepam was administered at doses of 10 mg/kg in all groups. Heart rate, respiratory rate and body temperature were measured. Anesthetic depth was evaluated by righting reflex. In all study groups, heart rate and respiratory rate significantly decreased at 5 minutes after anesthetic administration, and gradually increased after 30 minutes. The present study suggested that the combination of 100 µg/kg of medetomidine and 10 mg/kg of tiletamine/zolazepam provided rapid, safe, and effective anesthesia for the green iguana.

Key words : Medetomidine, tiletamine/zolazepam, green iguana.

Introduction

Reptile anesthesia didn't have general protocol¹⁴. Reptiles differently respond to anesthetic agents because of their unique anatomy and physiology³. A variety of anesthetic agents have been used in lizard anesthesia¹⁷. Inhalation agents have many advantages such as airway control, fast recovery, and easy control of the depth of anesthesia. However, inhalation anesthetics need a long induction period, because green iguanas can hold their breath for up to 4.5 hours^{4,19}. Injection anesthesia is clinically preferred to inhalation anesthesia in wildlife medicine. In addition, intramuscular administration is more common than intravenous or intraosseous administration. Nevertheless, most injectable anesthetics have poor analgesia, long induction period, long recovery period, and short anesthesia period^{1,5}. Medetomidine is the most effective agent among α_2 -adrenergic receptor agonist. As it does not alone produce complete anesthesia, medetomidine has been usually used with other anesthetic agents such as ketamine or tiletamine/zolazepam (Zoletil®). Recently, there were reports about medetomidine-ketamine (MK) or medetomidine-tiletamine/zolazepam (MZ) combination to anesthetize wild animals^{7,11,13}. However, it has not been reported about using MZ combination in green iguanas. Thus, this study evaluated the anesthetic effects of MZ combination in green iguanas (*Iguana iguana*).

Material and Methods

Animals

Ten healthy green iguanas (420-490 g) were used in this experiment. All iguanas were kept in indoor enclosures. Natural sunlight, heat lamp, ultraviolet lamp, various leafy greens

and vegetables were provided to reduce environmental stress. They were allowed their body temperature to equilibrate to ambient temperature (24°C) for at least 4 hours before the administration of MZ combination. They were not received no food for 12 hours prior to being anesthetized. Water was supplied *ad libitum*. Washout period was two weeks among each experiment.

Anesthesia and Experimental procedure

Anesthetic agents were used the medetomidine(Domitor®, Orion) and tiletamine/zolazepam(Zoletil50®, Virbac) and administered intramuscularly at the triceps muscle. Experimental groups were divided into three groups; MZ50 group (medetomidine 50 µg/kg + tiletamine/zolazepam 10 mg/kg), MZ100 group (medetomidine 100 µg/kg + tiletamine/zolazepam 10 mg/kg) and MZ150 group (medetomidine 150 µg/kg + tiletamine/zolazepam 10 mg/kg). All agents were injected into fore-limb because reptile has renal and portal system. Heart rate was obtained by electrocardiogram, respiratory rate was measured by expansion and contraction of the ribs and body temperature was obtained using a rectal thermometer inserted into the cloaca. Induction time was defined as the interval from administration of anesthetics to loss of the righting reflex. The examinations were assessed at five-minute intervals following administration of MZ combination for 70 minutes⁴.

Statistical analysis

Arithmetic means and standard deviations were determined for induction, anesthesia, recovery period and physiologic parameters (heart rate, respiratory rate and body temperature). One-way ANOVA was used to compare difference of induction, anesthesia period within treatment groups. Repeated ANOVA was used to compare difference of heart rate, respiratory rate, and body temperature within groups with time. student t-test was used to return normal range of heart rate, respiratory rate and body temperature. The significance level

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of all tests was set at $p < 0.05$.

Results

Heart rate was significantly decreased compared with the baseline value in all groups. Although it gradually increased again after 30 minutes, it did not recover to the value of baseline. In addition, heart rate of MZ150 group was significantly lower than that of MZ100 group and MZ50 group from 30 minutes after anesthetic injection (Fig 1). In all groups, respiratory rate was significantly decreased 5 minutes after anesthetic administration (Fig 2). Although it was gradually increased after 30 minutes administration, respiratory rate did

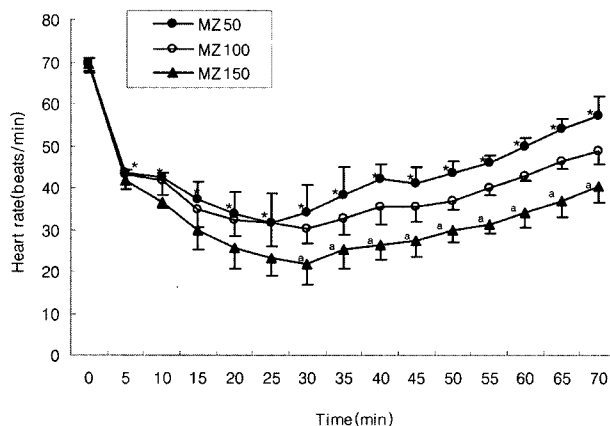


Fig 1. Changes of heart rate after administration of the combination of medetomidine-tiletamine/zolazepam in the iguana. MZ50: 50 $\mu\text{g}/\text{kg}$ medetomidine + 10mg/kg tiletamine/zolazepam; MZ100: 100 $\mu\text{g}/\text{kg}$ medetomidine + 10mg/kg tiletamine/zolazepam; MZ150: 150 $\mu\text{g}/\text{kg}$ medetomidine + 10mg/kg tiletamine/zolazepam. 0 minute: time of injection of the medetomidine-tiletamine/zolazepam combination.

*: significantly different from the value of 0 minute, $p < 0.05$.

^a: significantly different from the value of MZ50 group, $p < 0.05$.

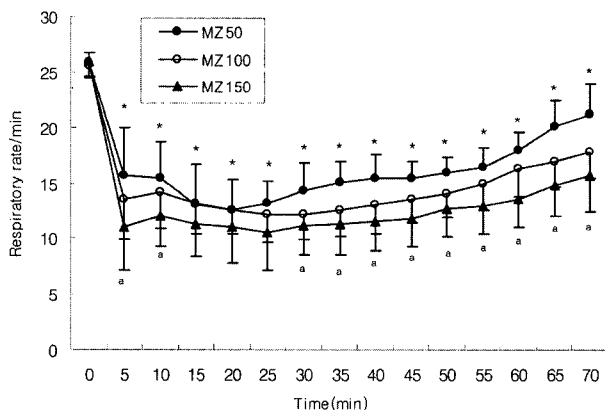


Fig 2. Changes of respiratory rate after administration of the combination of medetomidine-tiletamine-zolazepam in the iguana.

*: significantly different from the value of 0 minute, $p < 0.05$.

^a: significantly different from the value of MZ50 group, $p < 0.05$.

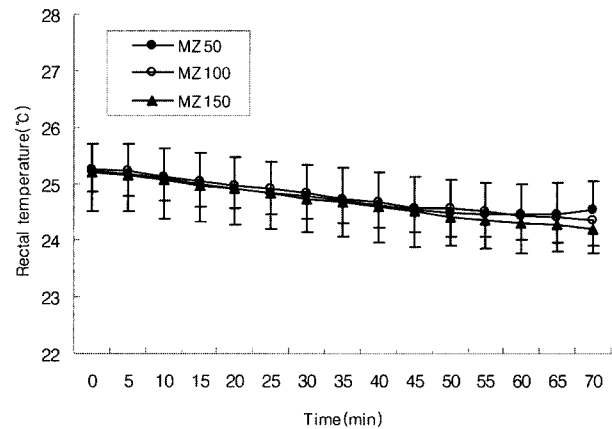


Fig 3. Changes of body temperature after administration of the combination of medetomidine-tiletamine-zolazepam in the iguana.

Table 1. Induction and anesthetic period after administration of medetomidine-tiletamine/zolazepam combination

Period	Group		
	MZ50	MZ100	MZ150
Induction	12.4 \pm 2.1 ^{bc}	10.0 \pm 2.1	8.5 \pm 1.1
Anesthetic	58.3 \pm 15.9 ^{bc}	76.2 \pm 16.3 ^{ac}	95.6 \pm 15.5 ^{ab}

All data are given as mean \pm SD. Induction period: a period from MZ combination administration to loss of righting reflex. Anesthetic period: a period from loss of righting reflex to recovery of righting reflex. ^{a, b, c} $p < 0.05$.

not return to the baseline value during experiment period. Body temperature was gradually decreased regardless of the anesthetic administration. It was within range of normal temperature. Moreover, there was no significant difference in body temperature among the groups (Fig 3). An induction period of MZ150 group and MZ100 group was significantly shorter than that of MZ50 group ($p < 0.05$), however there were no difference between MZ150 and MZ100 groups (Table 1). An anesthetic period of MZ150 group was significantly longer than that of MZ100 and MZ50 groups. An anesthetic period of MZ100 group was also significantly longer anesthetic period than that of MZ50 group ($p < 0.05$). In pre-anesthetic neurological examinations including the evaluation of righting reflex, all iguanas showed normal reflexes. Righting reflex was consistently the first reflex lost and the last to return during the anesthetic period. Righting reflex disappeared during anesthetic period in MZ150 and MZ100 groups, while they did not disappear completely during anesthetic period in MZ50 group.

Discussion

For many diagnostic procedures of green iguanas, chemical restraint or general anesthesia is required. Injective agents or inhalation anesthetic agents are used to sedate or anesthetize iguanas. However, there have been many problems such

long induction, recovery period, poor analgesia for procedures in iguanas. Medetomidine has become increasingly popular in wildlife medicine for sedation and maintenance of anesthesia. Medetomidine has been combined with ketamine or tiletamine/zolazepam for the anesthesia of wildlife animals. Medetomidine-ketamine combination has been used more often than medetomidine-tiletamine/zolazepam combination in exotic animals²⁰. However, tiletamine/zolazepam was more effective anesthetic agent than ketamine. Cattet *et al*^{6,7} reported that medetomidine-tiletamine/zolazepam combination anesthesia for polar bear was more effective than medetomidine-ketamine combination. Fifty-one hundred fifty 150 µg/kg dose of medetomidine was used to anesthetize or to sedate crocodile, lizard, tortoises and turtles^{8-10,13,17,18}. A single administration of tiletamine/zolazepam (Zoletil 50) at a dose of 10 mg/kg was used for anesthesia of iguana^{3,5}. Normal heart rates can vary markedly according to external temperature. This reason, the external temperature should also be considered before recording heart rate²¹. In this study, ambient temperature was maintained 24°C. Heart rate decreased at 5 minutes after administration of MZ combination in all groups. Heart rate decreased dependently according to the dose of medetomidine. Heart rate was significantly decreased during the whole anesthetic period in MZ150 group. In MZ50 and MZ100 groups, heart rate was decreased significantly after 30 minutes. The body temperature in reptiles can vary markedly according to ambient temperature because of poikilothermal animals. In this study, all iguanas were allowed to equilibrate their body temperature to ambient temperature (24°C) for at least 4 hours before each experiment. Although body temperature gradually decreased, it did not relate to ambient temperature in all groups. Any statistically significant difference of body temperature didn't result from dose dependent of medetomidine. Iguanas lack a diaphragm and move tidal volume by expansion and contraction of the ribs in iguanid^{2,19}. Respiratory rate was measured by observing the rib movements in this study. The respiratory rate significantly decreased at 5 minutes after MZ combination administration in all study groups. The respiratory rates in MZ100 and MZ150 groups were not significantly different. However, respiratory rate was less decreased comparing with propofol or inhalation anesthesia^{4,12,16}. Induction and maintenance period were defined by righting reflex⁴. All iguanas were maintained in sternal recumbency during induction of anesthesia⁴. MZ50 group had long induction time and short anesthesia time than MZ100 group and MZ150 group in this study. An anesthetic period of MZ150 group was significantly longer than that of MZ100 and MZ50 groups.

Conclusion

This study was performed to examine the anesthetic effect of medetomidine-tiletamine/zolazepam combination in the green iguana (*Iguana iguana*). In all study groups, heart rate and respiratory rate were decrease dependently according to

the dose of medetomidine 5 minutes after anesthetic administration. Any significant difference of body temperature was not shown by different dose of medetomidine. Intramuscular administration of 50 µg/kg of medetomidine and 10 µg/kg of tiletamine/zolazepam didn't produce sufficient anesthesia. However, intramuscular administration of 100 or 150 µg/kg of medetomidine and 10 µg/kg of tiletamine/zolazepam produced sufficient anesthesia. However, MZ150 group was too longer anesthetized than that of MZ100.

This study suggests that intramuscular administration of 100 µg/kg of medetomidine and 10 µg/kg of tiletamine/zolazepam combination anesthesia provides rapid, safe and effective anesthesia in the green iguana.

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그린 이구아나에서 Medetomidine-Tiletamine/Zolazepam의 병용마취효과

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요약: 그린 이구아나에서 medetomidine과 tiletamine/zolazepam의 병용마취효과를 알아보기 위하여 본 실험을 실시하였다. Medetomidine은 MZ50, MZ100 및 MZ150 군에서 각각 50, 100 및 150 µg/kg를 사용하였다. Tiletamine/zolazepam (Zoletil[®])은 모든 군에서 10 mg/kg을 적용하였다. 10마리의 건강한 이구아나 (420-490 g)를 2주 간격으로 3회 실험 하였다. 심박동수, 호흡수 그리고 체온을 측정하였으며 righting reflex를 통해 마취 심도를 평가하였다. 모든 군에서 심박동수와 호흡수는 마취주사 5분 후에 유의성 있는 감소를 보였으며 ($p < 0.05$) 30분 후에는 지속적으로 증가하는 양상을 보였다. 본 연구결과 medetomidine 100 µg/kg과 tiletamine/zolazepam 10 mg/kg의 병용이 그린이구아나에서 빠르고 안정적이며 효과적인 마취를 제공한다고 생각된다.

주요어: Medetomidine, tiletamine/zolazepam, 그린 이구아나