RESEARCH ARTICLE

Clinical Evaluation of Xylazine-Zoletil Anesthesia in Equine under Field Conditions

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Abstract

The present study was conducted on eighteen horses divided into three groups, consisting of six horses in each irrespective of their size, breed and body weight. Horses from all groups were pre-anaesthetized with xylazine (1.1 mg/kg b.wt.) intravenously and anesthetized after 5 min with doses of zoletil (Tiletamine and zolazepam) @ 0.5 mg/kg, 0.8 mg/kg and 1.1 mg/kg BW in groups I, II and III, respectively. Evaluation of different parameters like time of induction of anaesthesia, quality of induction, duration of anaesthesia, degree of muscle relaxation, time and quality of recovery were evaluated and compared between the groups. Different haematological, biochemical and clinical parameters were studied before administration of pre-anaesthetic, during anaesthesia and after complete recovery. There was no significant difference noted for clinical, haematological, biochemical and anaesthetic parameters between the three groups. Quality of induction and anaesthesia was better in group II and group III than group I. Time required attaining sternal recumbency, standing and completing recovery were significantly longer in group III than group I and group II. Overall quality of recovery was better in group I and group II than group III. On the basis of this study, we can say zoletil at a dose rate of 0.8 mg per kg body weight provide better quality of field anaesthesia associated with smooth recovery for short term surgical procedures like gelding.

Key words: Anaesthesia, Equine, Gelding, Tiletamine, Zolazepam.

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Introduction

Under field conditions, intravenous anaesthesia is considered as primary means for producing general anaesthesia in horses. The inhalational anaesthesia in equines have more dark sides because of cost of equipment's, lack of potability, requirement of oxygen source along with waste scavenging system, and evidences of high mortality rates (Bettschart-Wolfensberger, 2012). However, TIVA (Total intravenous anaesthesia) has many advantages over inhalant anaesthesia like reduction in equipment cost, oxygen source requirement and lack of potential hazards due to release of volatile compounds in the environment (Yamashita and Muir, 2009). The xylazine and ketamine combination has been widely used in horses for short-term procedures, but the muscle relaxant effect and duration of anaesthesia was too short to do even short-term surgical procedures like gelding (Matthews *et al.,* 1991).

For adequate muscle relaxation a third drug known as guaifenesin is used along with xylazine and ketamine in the form of triple-drip technique. Triple-drip technique was one of the most commonly used methods for horses in field conditions for long-term procedures more than 30 min (Greene *et al.,* 1986). Prolonged recovery period of >1 h was noticed in case of triple-drip technique because of the use of central muscle relaxants which causes tissue damage in horses. Tiletamine (a phencyclidine derivative and dissociative anaesthetic) and zolazepam (benzodiazepine derivative) belongs to new generation anaesthetics which is the recently launched anaesthetic combination in India. It is available as a 1:1 combination of tiletamine hydrochloride and zolazepam hydrochloride and marketed under the trade name Zoletil™ 50. Administration of tiletamine-zolazepam combination to a horse sedated with xylazine produces anaesthesia which is characterized by longer duration and superior muscle relaxation than with xylazine-ketamine combination (Hubbell *et al.,* 1989; Short *et al.,* 1989). Tiletamine-zolazepam combination has been used abroad for various surgical procedures in equines, but there are no references available describing the use of this combination in horses in India. The objective of the present study was to evaluate xylazine-zoletil anesthesia in equine under field Conditions

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Materials and Methods

The present study was conducted on 18 Kathiawari horses of 3-10 years age and weighing between 250-500 kg presented at Matheran hill station under the umbrella of Department of Surgery and Radiology, Mumbai Veterinary College, Parel. The horses were randomly divided into three anaesthetic groups namely; group I, II, and III, consisting of six horses each, and operated for gelding.

Pre-surgical Procedure

A thorough bath was given to each horse one day prior to surgery. All the horses were kept fasting for 12 h and the water was withheld for 8-10 h before administration of anaesthesia. Horses were examined before surgery for physical parameters like rectal temperature, respiratory rate and heart rate. Haemato-biochemical analysis before surgery was done. Injections tetanus toxoid 1 (50 Lf) and Dicrysticine-DS 2.5 gm were administered to each horse intramuscularly 30 min prior to the surgery. Injection flunixin was administered 10 min prior to administration of pre-anaesthetic. Horses of all three groups were pre-anaesthetized with xylazine hydrochloride @ 1.1 mg/kg b.wt. intravenously and anaesthesia was induced after 5 min with different doses of tiletamine-zolazepam (Zoletil). Horses in group I, group II and group III were anaesthetized with tiletamine-zolazepam @ 0.5 mg/kg body weight, 0.8 mg/kg body weight and 1.1 mg/kg body weight, respectively. After administration of anaesthetic all the horses were left undisturbed near of soft beddings till they showed incoordination in limbs and loss of body control. Once the horses restrained in lateral recumbency under the anaesthesia on a soft bedding, the surgical site was prepared aseptically, gelding was performed using standard procedure and the horses were monitored properly for recovery from anaesthesia. Both anaesthetic and clinical parameters were recorded at different time interval (5, 10, 15, 20, 25, 30 min) and after complete recovery of animal from anaesthesia. Routine anesthetic and clinical parameters were recorded.

5 mL of whole blood was drawn from the jugular vein before induction of anaesthesia, during anaesthesia and after complete recovery for the estimation of different haematological and biochemical parameters with the help of erba semi-automated blood analyser. The data obtained was statistically analysed as per Snedecor and Cochran (1994).

Results and Discussion

Anaesthetic parameters pre, during and post-operative in horses undergoing anaesthesia with xylazine-tiletamine-zolazepam combination are presented in Table 1. No significant difference was observed in the induction time between and within the groups. Similar findings were observed by Abrahamsen *et al.* (1991). However, Matthews *et al.* (1991) reported much faster induction time following administration of xylazine (1.1 mg/kg) and tiletamine-zolazepam (1.1 mg/kg) to horses. Quality of induction was satisfactory in all three groups. In group I, two of the six horses showed slightly prolonged induction, while in group II one horse showed prolonged induction. All other horses of group I and group II showed rapid and smooth induction. All 6 horses in group III showed rapid and smooth induction. These findings are in agreement with Abrahamsen *et al.* (1991), Matthews *et al.* (1991), Phutthachalee *et al.* (2012) and Ceylan (2013), who recorded excellent quality of induction with xylazine and tiletamine-zolazepam combination.

Table 1: Grades of quality of anaesthesia in horses of group I, group II and group III

Horse No.	Group I	Group II	Group III
1	B	A	A
2	A	A	A
3	C	A	A
4	A	A	A
5	C	B	A
6	B	A	A

A = Partial satisfactory, B = Satisfactory and C = Excellent

Palpebral reflex and corneal reflex were maintained in all horses of all three groups indicating tiletamine-zolazepam does not affect palpebral and corneal reflexes. Nystagmus was observed in all animals approximately 20 min after induction. Our findings are supported by studies of Lin *et al.* (1993) and Romagnoli *et al.* (2018) during tiletamine-zolazepam anaesthesia. Loss of swallowing reflex was noticed in all horses of all three groups following induction of anaesthesia and persisted throughout the duration of surgery indicating sufficient relaxation of oesophageal and jaw muscles. Short *et al.* (1989), Bechara *et al.* (1998) and Phutthachalee *et al.* (2012) observed similar findings following xylazine-tiletamine-zolazepam anaesthesia in horses.

Quality of anaesthesia was excellent to partially satisfactory, excellent to satisfactory and satisfactory in group I, II and III, respectively (Table 1). Similar findings were recorded by Short *et al.* (1989) and Matthews *et al.* (1991) when tiletamine zolazepam was used along with xylazine in horses. Wan *et al.* (1992) also reported similar findings when detomidine was used as pre-anaesthetic instead of xylazine with tiletamine-zolazepam (1.1 mg/kg). All horses showed good quality of muscle relaxation, except one horse from group I in which muscle relaxation was acceptable with some muscular rigidity.

There were no significant differences between groups in time of induction, duration of anaesthesia, and time required for head up in lateral recumbency. Hubbell *et al.* (1989), Short *et al.* (1989) and Matthews *et al.* (1991) have recorded similar findings with three different doses of tiletamine-zolazepam with xylazine in horses. Vende (2005) recorded mean time of 6.4 ± 0.51 min for head up in xylazine-ketamine anaesthetized horse. Significant difference was observed between the

groups as well as within the group. Significantly ($p<0.01$) longer time was required to attain sternal recumbency in group III followed by group II and lowest in group I, which corroborated with report of Wan *et al.* (1992) (Table 2). This was probably due to increase in dose of tiletamine-zolazepam in group III as duration of anaesthesia is related to the dose of Zoletil (Phutthachalee *et al.,* 2012) and increasing the dosage of tiletamine-zolazepam significantly increases the duration of recumbency (Hubbell *et al.,* 1989). Significant difference was observed between the groups where time required for standing was significantly higher in group III than group I and II. Phutthachalee *et al.* (2012) and Ceylan (2013) have recorded shorter time to standing in xylazine-tiletamine-zolazepam anaesthetized foals, while Matthews *et al.* (1991) recorded longer mean time to standing when butorphanol was used along with xylazine-tiletamine-zolazepam in miniature donkeys.

Significant difference was observed for complete recovery between the groups and within the group (Table 2). Phutthachalee *et al.* (2012) recorded shorter time for compete recovery when xylazine was administered along with tiletamine-zolazepam in older foals. Smooth and fast recovery was observed in three animals of group I, three animals of group II and one animal from group III. All these horses stood on their legs in single attempt. Smooth and prolonged recovery was observed in one animal from group I and one animal from group III. Matthews *et al.* (1991) recorded similar findings where horses required mean 3 attempts to stand (range 1-5) when xylazine was used along with tiletamine-zolazepam (1.1 mg/kg) and showed ataxia after standing. Hubbell *et al.* (1989) have reported smooth recovery in horses when xylazine (1.1 mg/kg IV) was administered along with tiletamine-zolazepam (1.1, 1.65, 2.2 mg/kg IV) and rough recovery in two of six horses when xylazine (2.2 mg/kg) was given IM. No significant difference was observed in heart rate and respiratory rate between the groups and within the group. Similar findings were reported by Matthews *et al.* (1991) and Phutthachalee *et al.* (2012) when xylazine was administered along with tiletamine-zolazepam in horses and older foals. The older foals showed decreased respiratory rate 5 min after xylazine administration,

Table 2: Mean ± SEs of various anaesthetic parameters pre, during and post-operative in horses undergoing anaesthesia with xylazine-tiletamine-zolazepam combination

Parameters	Group I	Group II	Group III	P value
Time of induction of anaesthesia (sec)	69.83 ± 4.96	68.16 ± 4.37	67.66 ± 4.96	NS
Duration of anaesthesia (min)	23.83 ± 1.93	26.83 ± 1.40	28.83 ± 1.40	NS
Time required for head up in lateral recumbency (min)	5.00 ± 0.96	6.66 ± 1.47	6.83 ± 1.16	NS
Time required for sternal recumbency (min)	7.16 ± 1.66[a]	9.66 ± 2.55 [a]	16.66 ± 1.52[b]	**
Time required for standing (min)	11.16 ± 2.00[a]	12.50 ± 3.45[a]	21.33 ± 2.31[b]	*
Time required for complete recovery (min)	26.16 ± 3.51[a]	35.50 ± 4.44 [ab]	46.33 ± 4.49[b]	*

*p<0.05, **p<0.01; Means with different superscripts within the row differ significantly (p<0.05).

Table 3: Mean ± SEs of various haemato-biochemical parameters pre, during and post-operative in horses undergoing anaesthesia with xylazine-tiletamine-zolazepam combination

parameter	Group I			Group II			Group III			
	Pre anaesthesia	During anaesthesia	Post anaesthesia	Pre anaesthesia	Post anaesthesia	After anaesthesia	Pre anaesthesia	During anaesthesia	Post anaesthesia	P value
Hb (g/dL)	14.40 ± 0.77	13.66 ± 0.77	13.78 ± 0.81	13.46 ± 1.07	13.18 ± 1.13	13.56 ± 1.30	14.1 ± 1.28	13.21 ± 1.36	13.53 ± 1.17	NS
TLC (x 103/µL)	8.58 ± 0.50	7.93 ± 0.45	8.28 ± 0.27	8.58 ± 0.27	7.11 ± 0.6	8.73 ± 0.79	8.86 ± 0.73	9.25 ± 1.39	8.20 ± 0.50	NS
SGOT (IU/L)	489.50 ± 149.43	517.83 ± 146.37	508.00 ± 139.94	496.16 ± 146.20	512.10 ± 157.30	514.16 ± 136.70	509.30 ± 163.80	505.33 ± 141.70	496.00 ± 153.10	NS
SGPT (IU/L)	25.50 ± 4.21	26.83 ± 5.02	27.33 ± 4.78	27.50 ± 7.30	25.66 ± 6.20	23.50 ± 4.50	23.00 ± 5.60	26.00 ± 3.30	23.83 ± 3.04	NS
BUN (mg/dL)	18.51 ± 1.70	18.90 ± 1.60	19.13 ± 1.70	18.77 ± 0.59	18.63 ± 0.80	19.50 ± 0.69	18.41 ± 1.17	21.10 ± 3.46	19.53 ± 1.52	NS
Creatinine (mg/dL)	1.76 ± 0.08	1.86 ± 0.10	2.10 ± 0.19	1.66 ± 0.10	2.05 ± 0.13	2.28 ± 0.16	2.09 ± 0.19	1.74 ± 0.19	1.87 ± 0.20	NS

which further decreased during the first 5 min after induction with tiletamine-zolazepam and remained lower than that of the baseline until 20 min after induction (Phutthachalee *et al.,* 2012). No significant difference was observed between the groups, but temperature dropped significantly in all three groups after anaesthesia. Ceylan (2013) reported that the drop in temperature is due to the vasoconstriction caused by the anaesthetics administered, inhibition of the limbic-hypothalamic centres leading to disruption of thermoregulation and the disruption of body temperature haemostasis due to reduced metabolic activity. No significant difference was observed in the mean haemoglobin and total leucocyte count either within the group or between the groups (Table 3). Marntell (2004) reported similar findings when acepromazine-romifidine-butorphanol-tiletamine-zolazepam combination was used in horses. Li *et al.* (2012) and Spada *et al.* (2015) also reported non-significant decrease in haemoglobin value when xylazine-tiletamine-zolazepam was administered to cats. Khokhlova *et al.* (2017) recorded decrease in TLC value following xylazine-tiletamine-zolazepam anaesthesia in mice. No significant difference was observed in the mean SGOT, SGPT, BUN and serum creatinine values either within the group or between the groups (Table 3). Yaralioglu-Gurgoze *et al.* (2005) have reported no change in SGOT enzyme activity in gazelles anaesthetized with xylazine-tiletamine-zolazepam. Li *et al.* (2012) also observed non-significant changes in SGPT and BUN values following administration of xylazine-tiletamine-zolazepam combination in cats. Kwon *et al.* (2003) observed similar findings of serum creatinine in dogs anaesthetized with xylazine and tiletamine-zolazepam.

Conclusion

The xylazine-tiletamine-zolazepam combination used for short term surgical procedures like gelding in horses under field conditions had least effect on clinical, haematological and biochemical parameters during and after complete recovery from anaesthesia. Induction with tiletamine-zolazepam in group II (0.8 mg/kg BW) provided excellent quality of anaesthesia with good muscle relaxation and was associated with smooth recovery and hence this combination can be used for short term surgical procedures like gelding in horses safely without any complications. Tiletamine-zolazepam can be used as suitable substitute to ketamine or propofol anaesthesia for gelding in horses under field conditions.

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