

**COMPARATIVE EVALUATION OF RESPIRATORY AND ANAESTHETIC PARAMETERS OF PROPOFOL AND ETOMIDATE FOR INDUCTION IN DEXMEDETOMIDINE-PENTAZOCINE-MIDAZOLAM PREMEDITATED CALVES FOR ABDOMINAL SURGERIES**

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**ABSTRACT**

*Fourteen crossbred bovine calves presented to Veterinary Clinical Complex, VC&RI, Orathanadu with abdominal affections requiring surgical interventions were randomly divided into group I and group II with seven animals in each group. Dexmedetomidine, pentazocine and midazolam were given as premedication at the dose rate of 2 µg/kg body weight, 1 mg/kg body weight and 0.2 mg/kg body weight intravenously, respectively. Induction of anaesthesia was performed with propofol at 2 mg/kg body weight and etomidate at 0.25 mg/kg body weight intravenously in group I and group II, respectively. All the calves were intubated using modified oro-endotracheal tubes and anaesthesia was maintained with isoflurane with variable vaporizer setting. Respiratory rate and anaesthetic parameters such as quality of sedation, induction, degree of muscle relaxation and recovery were assessed and recorded in both the groups. A significant decrease in the respiratory rate was noticed in group I animals, whereas group II animals showed a non-significant decrease in the respiratory rate after premedication, followed by a non-significant increase in respiratory rate at five minute of anaesthesia in both groups. The intubation and myoclonus scores were comparatively lower in group I than in group II animals. No significant difference was observed in the quality of recovery from anaesthesia between the groups. The anaesthetic parameters recorded in the present study concluded that propofol produced rapid anaesthetic induction and smooth recovery with ease of oroendotracheal intubation compared to etomidate in calves.*

**Key words:** Dexmedetomidine, pentazocine, propofol, etomidate, modified oro-endotracheal tube

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## INTRODUCTION

In ruminant surgery, physical restraint combined with local or regional anaesthesia along with sedation is routinely applied for minor surgical and diagnostic procedures. However, for major surgical interventions general anaesthesia is preferred to provide complete unconsciousness, antinociception, good muscle relaxation and loss of motor functions. The concept of balanced anaesthesia has come into the light to fulfil the requirements of the anaesthetic triad (loss of consciousness, analgesia and effective muscle relaxation), since most of the drugs cannot produce all the above-mentioned effects alone. In recent years, intravenous anaesthetic like propofol and etomidate have gained popularity in ruminant surgeries for their quick onset of action, rapid redistribution and clearance and early recovery. Propofol provides uncomplicated oroendotracheal intubation (Bodh *et al.*, 2013), whereas enhanced cardiovascular stability following anaesthetic induction (Masoudifar and Beheshtian, 2013) was exhibited by etomidate. Despite the similarities between propofol and etomidate, such as rapid onset of action, induction-related apnoea, short duration of action, and quick recovery, there is a lack of literature available on comparing these two drugs

regarding their anaesthetic effects in calves. Hence, this study was conducted to assess and compare the anaesthetic effects of propofol and etomidate as induction agents for abdominal surgeries in calves.

## MATERIALS AND METHODS

Fourteen crossbred bovine calves of either sex presented to Veterinary Clinical Complex, VC&RI, Orathanadu with abdominal affections requiring surgical intervention were randomly divided into group I and group II, consisting of seven calves each. Dexmedetomidine and pentazocine were administered as pre-anaesthetics at doses of 2 µg/kg and 1 mg/kg body weight, respectively, intravenously in both groups. Both the groups received midazolam at the dose rate of 0.2 mg/kg body weight intravenously after adequate level of sedation, followed by propofol at the dose rate of 2 mg/kg body weight intravenously as induction agent in group I and etomidate at the dose rate of 0.25 mg/kg body weight intravenously as induction agent in group II animals. Two cuffed endotracheal tubes of sizes 7 and 8 were joined together by heat sealing and air leak tests were done using soap water and used for oroendotracheal intubation as modified endotracheal tube with longer length. After anaesthetic induction, oroendotracheal tube intubation was performed by external digital palpation of the larynx with modified endotracheal tube and the tube was connected to the breathing circuit of the anaesthetic machine. General anaesthesia was maintained under isoflurane (1.5 % - 2.0 %) with rebreathing system. In both groups,

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respiratory rate was monitored before and after premedication, after induction, during maintenance, and after recovery. Anaesthetic parameters such as quality of sedation, induction, muscle relaxation and quality of recovery were assessed and recorded in both the groups. The statistical analysis was carried out with the obtained values using one-way ANOVA, with the assistance of Graph Pad Prism® 4 software package.

## RESULTS AND DISCUSSION

The respiratory rate in both the groups was monitored and recorded before premedication, after premedication, after induction, during maintenance at 5 minutes interval and presented in Table 1. The respiratory rate in calves in group I decreased significantly after premedication with dexmedetomidine and pentazocine, whereas in group II the respiratory rate decreased non-significantly. The decrease might be due to depression of the central nervous system caused by  $\alpha_2$ adrenoceptor stimulation and the *current* findings concurred with Oguntoye *et al.* (2022).

A non-significant increase in respiratory rate was noticed at 5<sup>th</sup> minute of anaesthesia in both the groups, during which the animal were on fresh gas flow only. Due to the rapid onset of action and short half-life of propofol and etomidate, there was initial recovery and increased respiratory rate was observed in both groups. After administration of isoflurane, the respiratory rate gradually decreased and adequate plane of surgical anaesthesia was attained and cardiopulmonary functions were maintained

below the baseline value in both groups and the findings were in concurrence with the research outcomes of Chaudhary and Tayal (2020).

The sedation and induction score for all the calves in both groups were recorded and presented in Table 2. The synergistic action of  $\alpha_2$  agonists, dexmedetomidine and opioid analgesics, pentazocine resulted in profound sedation and analgesia in all the animals. These findings correlate with observations of Ahmad *et al.* (2011). There was no significant change in the sedation score as both groups received dexmedetomidine, pentazocine and midazolam. The above drug combination decreased the dose of individual drugs and their adverse effects after sedation in the present study.

In both the groups, the quality of induction was assessed and graded based on the intubation and myoclonus scores and presented in Table 2. The intubation score was lower in calves in group I induced with propofol compared to calves in group II where anaesthesia was induced with etomidate. This could be due to smooth induction and ease of intubation produced by propofol compared to etomidate and this observation concur with the findings of Bodh *et al.* (2013) and Aguilera *et al.* (2020).

The quality of anaesthesia was assessed based on muscle relaxation, salivation and movement in response to surgical stimuli and was recorded in both groups and presented in Table 3. The presence of laryngeal and swallowing

reflexes with moderate relaxation of jaw muscles resulted in higher intubation score in etomidate group and these difficulties were encountered by Chaudhary *et al.* (2021) during oroendotracheal intubation in dogs induced with etomidate. The myoclonus score was comparatively higher in group II than in group I calves. These brief episodes of myoclonus and tremors after etomidate administration were due to subcortical disinhibition. The above finding was in concurrence with the observations of Fresno *et al.* (2008) and Dar *et al.* (2019) where the authors reported myoclonus in ewes and dogs, respectively, after administration of etomidate.

None of the calves in either group exhibited signs of pain throughout the surgical procedures. It could be due to the balanced anaesthetic approach applied in the present study that resulted in excellent muscle relaxation, unconsciousness and antinociceptive effects and the findings correlate with the observations of Kantia *et al.* (2022). Mild degree of salivation observed in one animal in group I and two animals in group II was due to increased relaxation of jaw and decreased swallowing reflex produced by midazolam-propofol and midazolam-etomidate in groups I and II, respectively and this finding correlates with the observations of Bodh *et al.* (2013).

The anaesthetic parameters such as time for extubation in minutes, time for head raising, time for sternal recumbency and time for unassisted standing in minutes, were recorded in both groups and presented in Table 4. Early recovery was observed, with no significant difference in time of extubation, head raising, sternal recumbency and unassisted standing between the two groups. This could be attributed to the rapid redistribution of induction agents from brain to other tissues, the low solubility of isoflurane and the rapid elimination half-life of propofol and etomidate could have resulted in quick recovery after discontinuation of anaesthesia. This concurs with the findings of Yaygingul *et al.* (2017). Animals in both groups had smooth recovery without any complications.

In the present study, propofol provided rapid induction and smooth recovery with ease of oroendotracheal intubation compared to etomidate and was found to be safer for anaesthetic induction in calves.

**Table.1. Mean±SE values of respiratory rate at different time intervals in group I and group II**

Time interval (in min)	I	II
Before premedication	27.14±0.98 <sup>a</sup>	36.57±2.09
After premedication	24.00±0.81 <sup>b</sup>	31.86±1.77
After induction	25.86±1.88	33.00±1.46
5 <sup>th</sup> minute	29.00±1.81	34.29±1.53
10 <sup>th</sup> minute	28.71±0.94 <sup>a</sup>	33.43±1.55
15 <sup>th</sup> minute	27.29±0.92	33.14±1.41
20 <sup>th</sup> minute	26.71±0.60	31.43±1.38
25 <sup>th</sup> minute	25.29±0.94	31.57±1.24
30 <sup>th</sup> minute	25.57±1.03	32.00±1.41
After recovery	26.14±0.96	33.14±1.65

Row-wise group means (±SE) with different superscripts (ab) differ significantly (P<0.05)

**Table.2. Mean (±SE) scores for quality of sedation and induction**

Group	Sedation score (min)	Induction score	
		Intubation score	Myoclonus score
I	3.00±0.00	0.14±0.13	0.14±0.13
II	3.00±0.00	0.57±0.28	0.57±0.28

**Table.3. Data on quality of anaesthesia recorded during the study**

Group	Quality of anaesthesia					
	Muscle relaxation		Salivation		Movement in response to surgical stimuli	
	Adequate	Inadequate	Present	Absent	Present	Absent
I	7	0	1	6	0	7
II	7	0	2	5	0	7

**Table.4. Mean ( $\pm$ SE) extubation time, time for head raising, time for sternal recumbency and time for unassisted standing recorded during the study**

Group	Time of extubation (min)	Time for head raising (min)	Time for sternal recumbency (min)	Time for unassisted standing (min)
I	10.14 $\pm$ 1.42	27.43 $\pm$ 2.19	41.86 $\pm$ 2.43	52.86 $\pm$ 2.30
II	10.86 $\pm$ 1.04	30.57 $\pm$ 2.58	46.57 $\pm$ 1.94	57.86 $\pm$ 2.89

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