

COMPARATIVE EVALUATION OF CARDIOVASCULAR PARAMETERS OF PROPOFOL / ETOMIDATE FOR ABDOMINAL SURGERIES IN CALVES

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ABSTRACT

The calves presented with abdominal affections requiring surgical interventions were randomly divided into group I and group II with seven animals in each group. All the animals were premedicated with dexmedetomidine at 2 µg/kg body weight, pentazocine at 1 mg/kg body weight and midazolam at 0.2 mg/kg body weight intravenously. In group I and group II, anaesthetic induction was carried out with propofol at 2 mg/kg body weight and etomidate at 0.25 mg/kg body weight intravenously, respectively. Both the groups were maintained in Isoflurane anaesthesia with modified oro-endotracheal tube. The cardiovascular parameters such as heart rate, mean arterial blood pressure, systolic and diastolic blood pressure were monitored during different stages of anaesthesia in both the groups. In both the groups, a significant decrease in heart rate was noticed after premedication and anaesthetic induction. A significant increase was noticed in systolic blood pressure values after anaesthetic induction and 10th minute of anaesthesia in group I and a highly significant increase was noticed after induction up to 10 minutes in group II. A highly significant increase in diastolic blood pressure was noticed after induction and 10th minute in group I, whereas significant increase was noticed in mean arterial pressure after induction and 15th minute of anaesthesia in group II animals. The cardiovascular parameters recorded in the present study concluded etomidate produced better cardiovascular stability and minimal respiratory depression compared to propofol throughout the anaesthetic period.

Keywords: Dexmedetomidine, pentazocine, propofol, etomidate, oro-endotracheal tube

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INTRODUCTION

Standing sedation or anaesthesia is commonly employed in ruminant clinical settings for restraining purposes during physical examinations and minor surgical procedures. However, for major surgical

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interventions, the use of general anaesthesia becomes necessary. Recognizing that a single anaesthetic drug may not comprehensively fulfill the requirements of the anaesthetic triad (loss of consciousness, analgesia and effective muscle relaxation), the concept of balanced anaesthesia has evolved. Propofol, known for its rapid and smooth anaesthetic induction, has demonstrated the ability to maintain cardiovascular and pulmonary parameters within the physiological range. It also facilitated uncomPLICATE doro-endotracheal intubation (Bodh *et al.*, 2013). On the other hand, etomidate, a less commonly used short-acting non-barbiturate and carboxylated imidazole derivative, exhibited rapid onset of action, quick recovery, and enhanced cardiovascular stability following anaesthetic induction (Masoudifar and Beheshtian, 2013). 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 notable dearth of literature comparing the two drugs concerning their effects on cardiovascular parameters in calves. Hence, this study was conducted to assess and compare the cardiovascular effects of propofol and etomidate as induction agents for abdominal surgeries in calves.

MATERIALS AND METHODS

Fourteen crossbred bovine calves of either sex presented with abdominal affections requiring surgical interventions were randomly divided into two groups. Animals

in both groups received dexmedetomidine and pentazocine as pre-anaesthetics at the dose rate of 2 µg/kg and 1 mg/kg body weight intravenously, respectively. After adequate level of sedation, midazolam was administered at the dose rate of 0.2 mg/kg body weight intravenously in both the groups 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. After induction of anaesthesia, oro-endotracheal tube intubation was performed with modified endotracheal tube using murphy cuffed type endotracheal tubes size 7 and 8, by external digital palpation of the larynx and the tube was connected to the breathing circuit of anaesthetic machine. General anaesthesia was maintained with isoflurane with rebreathing system. Heart rate was monitored before and after premedication, after induction, during maintenance and after recovery in both groups and mean arterial pressure, systolic and diastolic blood pressure were monitored from after induction and during maintenance of anaesthesia.

RESULTS AND DISCUSSION

In both groups, a significant decrease ($P<0.05$) in heart rate (Table 1) was noticed after premedication and it could be attributed to the potent cardiovascular depressant effect of dexmedetomidine by activation of postsynaptic α_2 -adrenoceptors in the central nervous system (CNS) resulting in the inhibition of sympathetic activity, thereby reducing the heart rate and was concurred with

the findings of Khattri *et al.* (2013). The heart rate further decreased significantly ($P<0.05$) after anaesthetic induction up to 5 minutes of anaesthesia followed by a highly significant decrease ($P<0.01$) from 10 and 30 min of anaesthetic period from the baseline value in group I animals. In group II, a significant ($P<0.05$) decrease was noticed after anaesthetic induction followed by a non-significant decrease from 15 and 25 min of anaesthesia. In both groups, a non-significant increase was noticed after anaesthetic induction up to 5 min in group I and 10 min in group II. These findings concur with Chaudhary *et al.* (2022). The decrease in heart rate after induction was due to anaesthetic drugs induced vasodilation, which lowered systemic vascular resistance, but the values comparatively remained stable and maintained near the baseline value in group II than group I due to cardiovascular stability of etomidate after administration and the findings concur with Paul *et al.* (2019).

A non-significant increase in mean arterial pressure (Table 2) was noticed after anaesthetic induction up to 10 minutes of anaesthesia followed by a gradual decrease throughout the anaesthetic period in group I, whereas in group II, a significant ($P<0.05$) increase was noticed after induction and 15th minute and a gradual decrease was noticed up to 30 minutes of anaesthesia. The decrease might be due to decrease in stroke volume and peripheral vascular resistance produced by anaesthetic drugs and results concur with the findings of Chamanvali *et al.* (2022).

In group I animals, a significant increase ($P<0.05$) in systolic blood pressure was noticed between after induction and 10th minute followed by a gradual decrease and reached below the baseline values at 30th minute of anaesthesia. In group II animals, a highly significant increase ($P<0.01$) in systolic blood pressure (Table 2) value was noticed from anaesthetic induction to 10 minutes of anaesthesia. After that, a gradual decrease was noticed and the values remained below and near the baseline value till the end of anaesthesia.

In group I, a highly significant ($P<0.01$) increase in the diastolic blood pressure (Table 2) was noticed between after anaesthetic induction and 10th minute, whereas, in group II, a non-significant increase was noticed after induction up to 10 min. In both groups, a gradual decrease in values was noticed throughout the anaesthetic period. Suthar *et al.* (2018) and Dar *et al.* (2019) also observed this gradual decrease in their anaesthetic study and they opined that propofol, etomidate and isoflurane produced arterial and venous vasodilatation, decreased peripheral vascular resistance and myocardial depression that caused decreased myocardial contractility and decreased sympathetic outflow which caused hypotension.

In the present study, etomidate produced minimal fluctuations in cardiopulmonary parameters, produced better cardiac stability and respiratory depression than propofol and is safer for anaesthetic induction in calves.

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

Time interval (in min)	I	II
Before premedication	76.00±3.33 ^{Aa}	73.43±3.78 ^a
After premedication	67.86±2.86 ^b	65.57±2.86 ^b
After induction	68.29±2.69 ^b	65.86±3.02 ^b
5 th minute	68.71±3.22 ^b	67.00±3.48
10 th minute	66.14±2.24 ^B	68.43±3.85
15 th minute	64.00±1.97 ^B	67.71±4.03
20 th minute	63.29±2.55 ^B	67.57±3.78
25 th minute	63.14±3.39 ^B	67.71±3.37
30 th minute	64.71±2.69 ^B	68.14±3.63
After recovery	69.71±2.63	70.57±3.37

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

Row-wise group means (±SE) with different superscripts (AB) differ highly significantly (P<0.01)

Table 2. Mean±SE values of mean arterial pressure, systolic blood pressure and diastolic pressure at different time intervals in group I and group II

Time interval	Parameters					
	Mean arterial pressure (mm Hg)		Systolic blood pressure (mm Hg)		Diastolic blood pressure (mm Hg)	
	I	II	I	II	I	II
After induction	80.29±2.81	89.57±9.37 ^a	109.83±4.65 ^a	111.86±6.48 ^{Aa}	64.57±2.76 ^{Ab}	72.00±7.53 ^a
5 th minute	84.86±2.63	91.57±9.34	113.57±4.13 ^A	119.86±6.09 ^B	71.57±2.90	78.29±7.71
10 th minute	87.43±2.51 ^a	98.71±8.80	118.43±3.11 ^{Ab}	120.86±6.63 ^B	73.71±2.27 ^{aB}	82.71±7.39 ^b
15 th minute	85.86±2.13	99.86±8.30 ^b	115.71±3.10 ^{Ab}	118.14±6.12 ^b	72.29±2.07 ^a	82.57±6.96 ^b
20 th minute	83.29±2.56	97.57±8.37	111.57±3.66	117.00±6.57	70.86±2.50 ^a	81.71±6.98 ^b
25 th minute	81.57±2.86	93.86±8.29	108.57±3.76 ^a	112.57±6.94 ^{Aa}	67.00±2.72	76.57±7.05
30 th minute	77.86±2.64 ^b	91.86±7.56	102.71±4.04 ^B	109.29±6.28 ^{Aa}	64.71±2.66 ^{Ab}	75.57±6.75

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

Row-wise group means (±SE) with different superscripts (AB) differ highly significantly (P<0.01)

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