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Evaluation of neonatal viability in dogs using APGAR scores: A clinical study

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Abstract

The neonatal survival following caesarean section in bitches induced with propofol (group I) and etomidate (group II) were compared in the present study. Out of 21 in group I, seven puppies (33.33%) had APGAR scores between 4-6 indicating moderately stressed and 14 (66.67%) had scores between 7-10, were healthy and active. Out of 25 puppies in group II, three puppies (12%) had APGAR scores between 4-6 indicating moderately stressed and 22 (88%) were healthy and active with scores between 7-10. Thus, from the above results it appeared that etomidate had least adverse effects on foetus when compared to propofol. The adequate maternal ventilation, isoflurane sparing effect of induction agents, maternal blood pressure and high oxygen saturation of the tissues in the present study might be the reasons for higher rate of neonatal survival recorded in the present study.

Keywords: Neonate, caesarean, APGAR, canine

Introduction

The anaesthetic goal for caesarean section in bitches is similar for all canine surgical patients, *viz.* delivery of the correct agents in a manner to ensure alleviation of pain and consciousness while affording minimal physiologic risk to the patient. Added factors for achieving the above task are the well-being of the foetuses, and a rapid, functional recovery of the dam to encourage appropriate mothering behaviour (Cain and Davidson, 2023) [2]. The commonly used drugs for routine surgeries cannot be used for caesarean section in bitches with live puppies (Raffe, 2015) [13]. The use of thiopental, ketamine, xylazine and methoxyflurane has been associated with increased puppy mortality and/or decreased puppy vigour or survival (Moon *et al.*, 2000, Moon-Massat and Erb, 2002 and Luna *et al.*, 2004) [11, 12, 9]. Drugs like midazolam, ketamine and enflurane rapidly cross the placenta and accumulate in the foetus and cause foetal depression. Ketamine in neonates causes neural degeneration (Fredriksson *et al.*, 2004 and Kuttan, 2015) [4, 8]. Hence, in the present study, a comparison was made between the two induction protocols using propofol and etomidate for undertaking caesarean section in bitches.

Materials and Methods

Assessment of the viability of the puppies was done by APGAR scoring system as suggested by Veronesi *et al.*, (2016) [18]. The Apgar score is an acronym for the following five factors that were used to evaluate the health status of new borne puppies. The APGAR scores were measured 5 minutes after birth. The details of APGAR scoring system are given in table 1.

- A: Appearance: The puppy's skin colour
- P: Pulse: The puppy's heart rate
- G: Grimace: The puppy's reaction to stimulation, also known as reflex irritability
- A: Activity: The puppy's muscle tone or movement
- R: Respiration: The puppy's breathing rate and effort

Table 1: Apgar score for canine newborn viability evaluation (Veronesi *et al.*, 2016) [18]

Parameter	Score		
	0	1	2
Color of mucous membrane	Cyanotic	Pale	Pink
Heart rate (bpm)	<180	180-220	>220
Reflex irritability	Absent	Grimace	Vigorous
Motility	Flaccid	Some flexions	Active motion
Respiratory efforts	No crying <6	Mild crying 6-15	Clear crying >15

On the base of the final sum, three classes of neonatal viability were defined: when the score is less than 3, the neonatal condition is considered as critical and the newborn need medical assistance; when the score is between 4 and 6, the condition of the newborn is considered as low, and the newborn should be supervised or submitted to medical assistance; when the score is 7 to 10, the newborn clinical condition is normal, and the newborn need only routine care.

Results and Discussion

A total of 46 puppies were delivered through caesarean section in 12 bitches. The skin and hair coat were fully formed in all the foetuses. The heart rate was above 180 in many of the puppies. All the puppies had normal breathing and vocalization. In the present study, the early recovery from anaesthesia made the dams to feed their puppies at the earliest in both the groups, which is critical for neonatal survival, although the numerical values grade etomidate superior to propofol. Similar results with propofol of present study on neonatal survival are comparable to those of several authors including Kraus (2016) [7] and Melandri *et al.* (2019) [10]. The brief period of labour before presentation, lack of foetal distress and isoflurane sparing effect of anaesthetics might be responsible for the neonatal activity in the present study. Contrary to these results, maternal mortality rates were reported to be 1% even after 58% of the caesarean sections were performed on an emergency basis (Gendler *et al.*, 2007). In group I, 21 puppies and in group II, 25 puppies were delivered through caesarean section. The details of APGAR scores recorded in the present study, were given in the table 2. Out of 21 in group I, seven puppies (33.33%) had APGAR scores between 4-6 indicating moderately stressed and 14 (66.67%) had scores between 7-10, were healthy and active. Out of 25 puppies in group II, three puppies (12%) had APGAR scores between 4-6 indicating moderately stressed and 22 (88%) were healthy and active with scores between 7-10. Thus, from the above results it appeared that etomidate had least adverse effects on foetus when compared to propofol.

Doebeli *et al.* (2013) [3] recorded significantly higher Apgar scores at 5, 15, and 60 minutes post-delivery following alfaxalone anaesthesia. The results of the propofol on neonatal survival rate and APGAR scores in the present study were comparable to those of Short and Bufalari (1999) [17] and Vilar *et al.* (2018) [19] who used propofol as an induction agent for caesarean section in bitches and reported that puppies were bright and mother was alert enough to take care of her young following rapid recovery from anaesthesia. Moon-Massat and Erb (2002) [12] reported that isoflurane was routinely used for maintaining anaesthesia for caesarean section in dogs and was found positively associated with vocalization of puppies, a sign of vigour and good Apgar score. Ruiz *et al.* (2016) [15] compared isoflurane and

alfaxalone in bitches undergoing caesarean sections and concluded that puppies born under isoflurane were associated with higher Apgar scores. But in the present study, in both the groups, the concentration of isoflurane used was more than 2%.

Table 2: APGAR scoring system for the assessment of viability of puppies

Total number of puppies delivered	APGAR SCORES			
	Severely stressed (<3)	Moderately stressed (4-6)	Healthy and active (7-10)	
Group I	21	0	7 (33.33%)	14 (66.67%)
Group II	25	0	3 (12%)	22 (88%)

< 3, The neonatal condition is considered as critical and the newborn need medical assistance;

4 and 6, The condition of the newborn is considered as low, and the newborn should be supervised or submitted to medical assistance;

7 to 10, The newborn clinical condition is normal, and the newborn need only routine care.

Self (2019) [16] attributed hypoxia in puppies to the respiratory depression due to residual anaesthetic drugs, hypothermia, lack of physical stimulation from the vigorous licking by the mother, reduced uterine blood supply resulting from sympathetic stimulation caused by the pain and hypoxia of bitch. Antonczyk *et al.* (2023) [1] reported that prolonged foetal exposure to high concentrations of isoflurane worsened the condition of newborns and adversely affected the umbilical cord blood gas parameters. Robertson (1992) [14] considered etomidate as a good choice for induction of general anaesthesia in severe maternal compromise or maternal cardiac diseases with midazolam to reduce any excitatory side effects. The adequate maternal ventilation, isoflurane sparing effect of induction agents, maternal blood pressure and high oxygen saturation of the tissues in the present study might be the reasons for higher rate of neonatal survival recorded in the present study. The adequate maternal ventilation, isoflurane sparing effect of induction agents, maternal blood pressure and high oxygen saturation of the tissues in the present study might be the reasons for higher rate of neonatal survival recorded in the present study.

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