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Clinical efficacy of fentanyl on propofol anesthesia in dog

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Abstract
This study aimed to assess the clinical efficacy of fentanyl on propofol anaesthesia in twelve clinical cases of dogs. These clinical cases were randomly divided into two equal groups (n=6) and pre-medicated with atropine sulphate at 0.04 mg/kg and xylazine at 0.5 mg/kg b.wt. I/M. In group 1 propofol @ 3 mg/kg and group 2 fentanyl @ 0.2 µg/kg followed by propofol @ 3 mg/kg intravenously were used for induction and maintained with an intermittent bolus of propofol alone. During the study, quality of anaesthesia, reflexes, clinico-physiological and haemato-biochemical parameters was recorded. The quality of anaesthesia and reflexes showed statistical difference ($p<0.05$) between the groups; however, the non-significant difference was noticed in clinico-physiological and haemato-biochemical parameters. In light of present research, it can be concluded that a combination of fentanyl-propofol provided rapid onset and stable cardiovascular function.

Keywords: propofol, fentanyl, xylazine, dog, general anaesthesia

Introduction
TIVA is the most widely used anaesthetic technique in dogs, for which different anaesthetic protocols for the premedication, induction and maintenance of general anaesthesia is used. Propofol is the most obvious choice for TIVA and is applied chiefly in combination with an analgesic agent. Fentanyl is a potent synthetic opioid with strong agonist properties at µ receptors having ultra-short action. In contrast, propofol is a non-opioid, non-barbiturate intravenous sedative-hypnotic agent which causes dose-related apnoea and cardiovascular depression. The association of propofol with an opioid seems to have better haemodynamic stability and a sparing effect (Hughes and Nolan, 1999) [6]. Moreover, fentanyl is often used as a co-induction agent to decrease the requirement of injectable anaesthetic (Okushima *et al.*, 2015) [11]. The combination of propofol and fentanyl were used frequently for TIVA due to their quick action and rapid elimination from the body (Bajwa *et al.*, 2010) [3]. The combination of propofol and fentanyl was used successfully as TIVA for major surgeries as TIVA and provided quiet and smooth recovery dogs (Yamashita *et al.*, 2004). Therefore, the study was outlined to assess the quality of anaesthesia, reflexes, clinico-physiological and hemato-biochemical parameters in dogs undergoing fentanyl-propofol anaesthesia.

Methodology
Twelve healthy clinical cases of dogs presented at Teaching Veterinary Clinical Complex, Parbhani for elective surgery were included in the study. The dogs were randomly divided into two equal groups *viz.*, Group 1 and Group 2. These dogs had fasted for 8-10 hrs before surgery and water was withheld for 6 hrs. The surgical site was prepared aseptically and cephalic vein was cannulated for administration of anaesthetic drugs. All dogs were premedicated with inj. atropine sulphate @ 0.04 mg/kg b.wt. I/M followed by inj. xylazine @ 0.5 mg/kg b.wt, I/M.

Group 1
The dogs of this group received propofol @ 3 mg/kg I/V for induction and maintenance was achieved by an intermittent bolus of propofol.

Group 2
In this group fentanyl @ 0.02 µg/kg b.wt. I/V was administered followed by propofol @ 3mg/kg b.wt. I/V for induction and maintained by an intermittent bolus of propofol.

Parameter studied
The clinical assessment of the anaesthetic protocol was done by quality of anesthesia, clinico-physiological, haematological parameters and biochemical parameters**.**

Recording of Parameters
Induction time
It was noted as the time in seconds taken from intravenous administration of anaesthetic agent till the loss of reflex.

Duration of Anaesthesia
It was noted as the time in minutes elapsed from the abolition of reflex to the time of appearance of reflex.

Recovery time
It was noted as the time elapsed (in minutes) from discontinuation of intravenous administration of propofol to the appearance of pedal reflex as recovery time.

Sternal recumbency time
As time elapsed (in minutes) from discontinuation of propofol administration to regain sternal recumbency by the dogs.

Standing time
As time elapsed (in minutes) from discontinuation of propofol administration to regain standing postion by the dogs, it was recorded as the standing time.

Jaw reflex
The evaluation of jaw reflex was done by a recording of jaw muscle relaxation as per Amarpal *et al.*, 1996 [1] depicted in Table no. 1

Table 1: Grading of jaw reflex score

Parameter Recorded	Description	Score
Jaw tone	Not allowed to open the jaws	0
	Resistance to opening the jaws and closed quickly	1
	Less resistance to opening the jaws and closed quickly	2
	No resistance and jaws remain open	3

Palpebral reflex
The palpebral reflex was recorded by observing the blinking of eyelids on touching the area around the eyes with the index finger. The evaluation of palpebral reflex was done as per the system adopted and modified by Amarpal *et al.*, 1996 [1] depicted in Table no. 2

Table 2: Grading of palpebral reflex score

Parameter Recorded	Description	Score
Palpebral reflex	Intact and strong (quick blink)	0
	Intact but weak (slow response)	1
	Very weak (very slow and occasional response)	2
	Abolished (no response)	3

Pedal reflex
The evaluation of pedal reflex was recorded and graded as per Amarpal *et al.*, 1996 [1] depicted in Table no. 3

Table 3: Grading of pedal reflex score

Parameter Recorded	Description	Score
Pedal reflex	Intact and strong (strong withdrawal)	0
	Intact but weak (animal responding slowly)	1
	Intact but very light (slow and occasional response)	2
	Abolished completely	3

Results and Discussion
Quality of anaesthesia
Induction and duration of anaesthesia
During the study, the dogs in group 1 took a significantly (p<0.01) longer period for induction than group 2 (Fig. 1). Similarly, the duration of anaesthesia in group 1 was significantly (p<0.01) shorter than the group 2 (Fig. 2). The rapid induction and longer duration in group 2 as compared to group 1 might be due to the lipophilic nature of drugs. Moreover, the synergism of propofol and fentanyl might favour rapid onset and longer duration in group 2. These findings are in accordance with Steagall *et al.* (2006) [13], Andreoni and Hughes (2009) [6] and Tomas *et al.* (2014).

Recovery time
Significant variation (p<0.01) in recovery time (Fig.3) was recorded in both groups. Group 1 showed faster recovery as compared to group 2. The mean duration for sternal recumbency (Fig. 4) and standing time (Fig. 5) in group 1 were significantly shorter than group 2. The prolonged recovery in group 2 might be due to the hindrance in the clearance of fentanyl due to inhibition of microsomal enzymes responsible for the metabolism of fentanyl, (Andreoni and Hughes, 2009) [6]. Longer recovery time in fentanyl–propofol treated dogs was also recorded by Gimenes *et al.* (2011) and Thejashree *et al.* (2018).

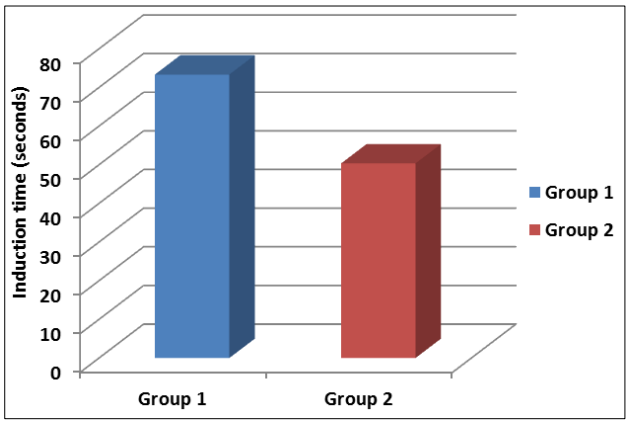

Fig 1: Induction time

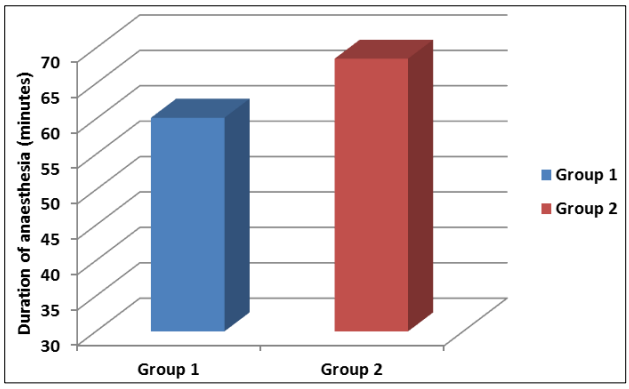

Fig 2: Duration of anaesthesia

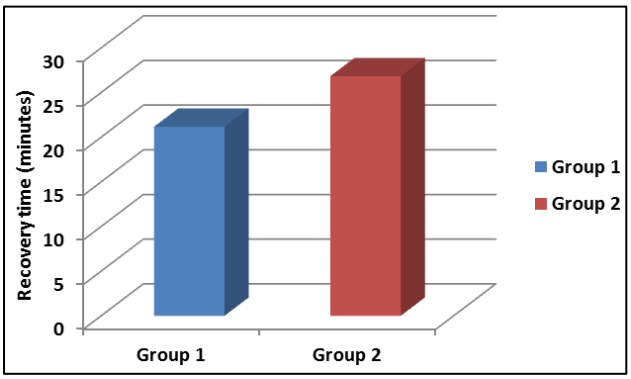

Fig 3: Recovery time

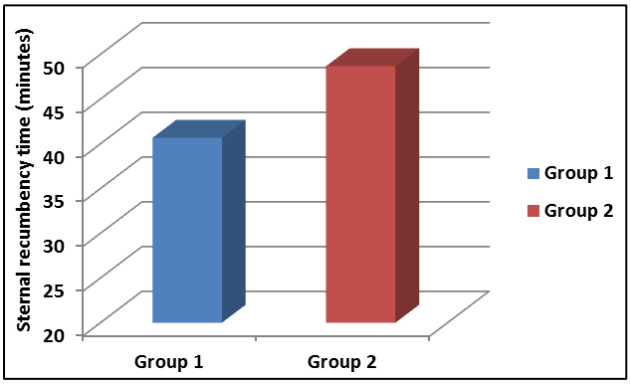

Fig 4: Sternal recumency time

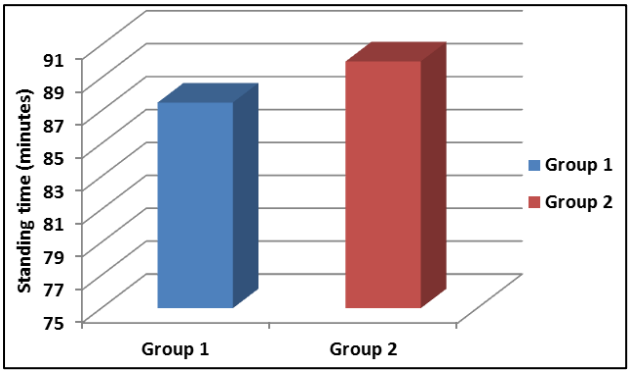

Fig 5: Standing time

Reflexes

The jaw reflex score showed mild relaxation in jaw muscle after induction (Fig. 6), which gets moderately relaxed after 5 minutes post-induction. Complete relaxation was noticed at 10 minutes onwards in both groups.

There was swift palpebral reflex with the sluggish movement of the eyeball, which started abolishing at 5 minutes intervals, and complete cessation was noticed 10 minutes onwards post-induction in both groups (Fig. 7).

The mean pedal reflex score increased significantly after induction towards the rest of the intervals, followed by complete abolishment after 10 minutes onwards (Fig. 8). The recorded values of jaw reflex, palpebral reflex, and pedal reflex showed significant differences ($p<0.01$) among various intervals, whereas non-significant variation was observed in groups 1 and 2.

Similar findings were also recorded by Hughes and Nolan (1999) [6], Nolan and Reid (1993) [10] and Mendes and Selmi (2003) [9].

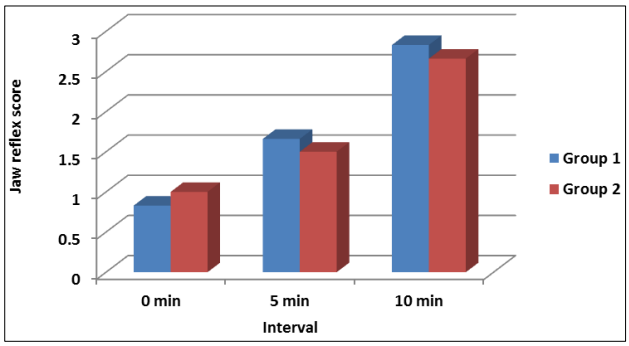

Fig 6: Jaw reflex score

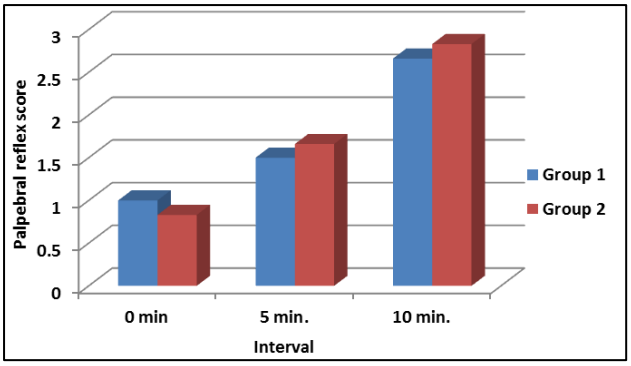

Fig 7: Palpebral reflex score

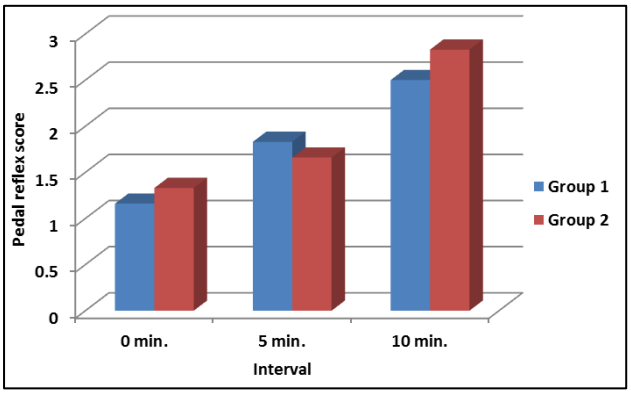

Fig 8: Pedal reflex

Clinico-physiological parameters

The mean heart rate, rectal temperature, and respiratory rate fluctuated non-significantly ($p>0.05$) in both groups. On the contrary, the fluctuations in group 2 were less adverse (Table 4.) than group 1. This might be due to fentanyl, which masks the deleterious effect produced by propofol alone. These findings are in accordance with Nolan and Reid (1993) [10] and Hughes and Nolan (1999) [6]. Hellebreakers and Sap (1997) and Crump and Murision (2008) [4]. Mendes and Selmi (2003) [9] and Steagall *et al.* (2006) [13].

Haemato-biochemical parameters fluctuated non-significantly within normal physiological limits in both groups.

Table 4: The mean ± SE values of different physiological parameters before induction, after induction, during surgery and after recovery

Parameter	Groups	BI	AI	DS	AR
Heart rate	Group-1	101.17 ±3.52	95.00±3.38	98.00 ± 3.23	100.00±3.33
	Group-2	109.00±2.92	101.33±2.49	103.83±2.38	104.50±2.74
Rectal temperature	Group-1	100.68±0.63	99.92±0.62	99.13±0.64	100.25±0.23
	Group-2	101.25±0.24	99.95±0.23	98.78±0.35	100.20±0.25
Respiration rate	Group-1	27.50±1.37	20.83±1.08	22.50±1.02	25.83±1.13
	Group-2	28.00±2.14	20.67±2.09	23.17±2.27	26.33±2.09

Group I: Propofol
Group II: Fentanyl-propofol

Conclusion

It can be concluded that propofol-fentanyl provides rapid and smooth induction with less marked adverse cardio-respiratory effects as compared to propofol alone. The combination of fentanyl and propofol as general anesthetic agent can be used for induction of general anesthesia in dogs.

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