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Research Article

STUDY OF BEHAVIOURAL PARAMETERS IN TOTAL INTRAVENOUS AND INHALATION ANAESTHESIA IN BUFFALOES

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ABSTRACT

This study was conducted in 36 buffaloes suffering from diaphragmatic hernia (DH), which were randomly categorized in six groups and subjected to general anaesthesia for diaphragmatic herniorrhaphy. All animals were categorized as American Society of Anaesthesiologist (ASA)-IV with compromised physiological status. After premedication with atropine sulphate (anti-cholinergic), xylazine (α2-agonist) and butorphanol (opioid), these buffaloes were induced with propofol (PP, PI and PS groups) and thiopentone (TT, TI, TS groups) while maintenance of anaesthesia was done with propofol (propofol TIVA group), thiopentone (TT group), isoflurane (PI and TI inhalation groups) and sevoflurane (PS and TS inhalation groups). Significant variation was observed among all groups in extubation time, return to sternal position, standing with ataxia and complete anaesthetic recovery time, while values of other parameters varied non-significant. It was concluded that animals maintained with inhalant anaesthetics had fast recovery as compared to TIVA groups, also animals maintained with sevoflurane recovered fast as compared to isoflurane irrespective of induction agent.

Keyword: Buffalo, Inhalant anaesthesia, Isoflurane, Sevoflurane, Thiopentone, Propofol, Total intravenous anaesthesia

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Diaphragmatic hernia (DH) has frequently been reported in bovine since 1960s (Naik and Mahandale 1969) and is a type of internal hernia causing serious digestive disorder that occurs due to diaphragm rupture at the musculo -tendinous junction, resulting in herniation of abdominal viscera into thoracic cavity. The buffaloes reported for diaphragmatic herniorrhaphy usually categorized as American Society of Anaesthesiologist (ASA) Type IV and key factor in physiologically compromised patients undergoing general anaesthesia is assessment of anaesthetic safety during and after surgery. Balanced anaesthesia is a combination of various anaesthetics drugs including both injectable and inhalants to achieve anaesthetic triad and to moderate undesirable effects of one or many drugs on animal body (Thurmon and Short, 2007). Ruminants are poor subject to general anaesthesia and diaphragmatic hernia is one of the surgical interventions that require surgical plane of anaesthesia, So, this study was planned keeping buffaloes suffering from diaphragmatic hernia as a study model.

MATERIAL AND METHODS

This study was conducted in 36 clinical cases in female buffaloes presented at Veterinary Clinical Complex, suffering from diaphragmatic hernia. These animals were randomly divided into six groups, each group having six animals. All animals on the day of herniorrhaphy premedicated with atropine sulphate (0.045 mg/kg), after 15 min of atropinisation, xylazine (0.05 mg/kg), was injected and after 15 min of α2 agonist administration, butorphanol (0.02 mg/kg, i.v.) was administered. When animals become recumbent, induction was done. In three groups induction was done with propofol (PP, PI and PS) @1.7 mg/kg while rest of three groups were induced with thiopentone (TT, TI and TS) @ 6 mg/kg. After induction and application of mouth gag, intubation was done with suitable sized endotracheal tube and connected with large animal anaesthesia machine to deliver O_2 irrespective of type of group. Maintenance was done with propofol (CRI @ 0.25 mg/kg/min) in PP TIVA group and with thiopentone (CRI @40 µg/kg/min), in thiopentone TIVA group. In PI and TI groups (isoflurane inhalant groups) isoflurane while in PS and TS groups (sevoflurane inhalant groups) sevoflurane was used as maintenance agent using semi-closed breathing circuit. Different concentrations of inhalant anaesthetics were used in groups maintained between inhalation agents; In isoflurane-maintained groups, initially vaporizer was set at 5% and then maintained on 1.5-2.5% while in sevoflurane groups initially vaporizer was set at 6% and then maintained on 2-3.5%, depending on body reflexes. Anaesthesia whether TIVA or inhalant, discontinued as soon as last skin suture was placed and only oxygenation continued until extubation.Weak and down time were calculated after α2 agonist administration till onset of ataxia to onset of sternal or lateral recumbency, respectively. While extubation, body reflexes (Eyelid dropping, loss of palpebral reflex, eyeball rotation and intubation time) were calculated after induction with respective induction agent. Return to sternal recumbency (time elapsed between extubation to sternal recumbency),

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Table 1. Showing comparative effect on behavioural parameters (Mean ± S.E. in minutes) due to different anaesthetic protocols in buffaloes undergoing diaphragmatic herniorrhaphy

Parameters/Groups	PP	PI	PS	TT	TI	TS
Weak Time*	17.17±2.24	14.00±1.53	17.83±2.32	19.17±1.89	15.50±2.03	15.00±2.42
Down Time*	24.17±2.92	24.67±1.36	23.67±3.18	24.67±2.6	22.67±1.54	22.17±2.44
Eyelid dropping**	3.33±0.49	4.17±0.48	4.33±0.96	3.17±1.22	2.82±0.17	2.83±0.31
Loss of palpebral reflex**	2.33±0.49	3.33±0.42	3.83±0.95	2.33±1.33	2.33±0.76	2.33±0.56
Loss of corneal reflex**	3.67±0.49	4.33±0.62	4.83±0.87	2.67±0.76	2.33±0.21	3.33±0.49
Eyeball rotation**	3.50±0.43	4.17±0.7	4.00±0.97	3.00±1.69	2.83±0.31	2.82±0.40
Loss of tongue reflex**	3.50±0.5	3.50±0.76	3.40±1.21	3.20±0.45	3.91±0.26	2.17±0.48
Loss of swallowing reflex**	3.17± 0.48	3.33± 0.8	3.20± 1.33	2.18± 0.18	2.19± 0.33	2.86± 0.5
Loss of jaw tone**	3.33± 0.56	3.87± 0.83	3.17± 1.33	2.17± 0.17	2.83± 0.31	2.82± 0.4
Intubation**	5.00±0.45	5.50±0.67	5.40±1.52	4.17±0.17	4.00±0.37	4.26±0.52
Extubation†	14.17^{ab}±3.69	13.33^{ab}±2.69	11.83^{a}±1.58	31.67^{c}±4.19	24.00^{bc}±3.28	24.00^{bc}±4.29
Return to sternal recumbency†	30.50^{a}±5.72	24.67^{a}±3.21	23.83^{a}±5.86	47.17^{bc}±2.60	60.00^{c}±10.73	41.17^{abc}±8.51
Standing with ataxia†	56.33^{ab}±3.27	45.67^{abc}±5.43	33.00^{a}±6.04	135.33^{d}±18.19	86.00^{c}±11.31	65.83^{bc}±9.14
Complete recovery†	78.83^{ab}±4.09	71.50^{ab}±7.68	67.67^{a}±3.76	193.83^{d}±25.5	127.17^{c}±12.19	111.00^{bc}±15.28

Means with different superscripts (a/b/c/d) in column shows statistically significant difference between groups (P<0.05).
*After administration of Xylazine **After induction †After weaning from anaesthesia

standing with ataxia (time elapsed between extubation to time of standing of animal with assistance) and complete recovery time were calculated after discontinuation form anaesthesia to time when animal become fully alert.

RESULTS AND DISCUSSION

There was no significant variation observed in weak time however, the non-significant variation present might be due to difference in physical status of animals due to variable duration of illness. A decrease in spontaneous activity with ataxic gait was a common observation in all buffaloes undergoing herniorrhaphy after xylazine administration. Xylazine has sedative and muscle relaxant property and causes decreased perception to painful stimuli mediated via stimulation of central α2-receptors distributed centrally in the brain (Lemke, 2007) or inhibition of the release of catecholamine and hence prevents neural transmission in dose dependent manner (Sinclair, 2003). Animals became recumbent when butorphanol was administered intravenously. Body reflexes (drooping of eyelid, rotation of eyeball, loss of corneal, palpebral, tongue and swallowing reflex) recorded after induction were not having significant variation. However non-significantly lower values of these parameters were observed in thiopentone induced groups might be due to rapid onset of action of thiopentone as compared to propofol. Loss of palpebral reflex with ventral rotation of eyeball due to propofol and thiopentone were also reported by Kaur and Singh (2004) and Genccelep *et al.* (2005) in adult bovine and calves, respectively. However, Singh *et al.* (2013) reported mild

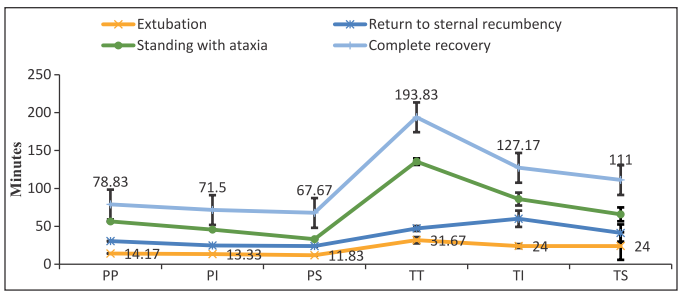

Fig. 1. Effect of different anaesthetic protocols on behavioural parameters in which significant variation was observed with Mean ± S.E.

response to corneal reflex in buffaloes during xylazine-fentanyl-thiopentone-isoflurane anesthesia.Endotracheal intubation was done after abolishment of tongue and swallowing reflexes, and loss of jaw muscle tone. Time taken for abolishment of swallowing reflexes followed by relaxation of jaw was non-significantly low in thiopentone group as compared to propofol TIVA group, might be due to rapid onset of action of thiopentone. Intubation time was also low in thiopentone induced groups (TT, 4.17 ± 0.17; TI, 4.00 ±0.37; TS, 4.26 ± 0.52) as compared to propofol induced groups (PP, 5.00 ± 0.45; PI, 5.50 ± 0.67; PS, 5.40 ±1.52).

Anaesthesia in both TIVA groups were maintained with constant rate infusion irrespective of drug used. Time taken for extubation, standing with ataxia and complete recovery were recorded after weaning from anaesthesia and were significantly high in thiopentone TIVA group might be due to redistribution and uptake of drug by CNS. Ninu *et al.* (2015) also reported delayed recovery during thiopentone as maintenance agent after glycopyrrolate

(anti-cholinergic)-acepromazine (phenothizine)-xylazine (α2 agonist) premedication in buffaloes undergoing diaphragmatic herniorrhaphy. Significantly ($p<0.05$) lower values of these parameters were observed in group maintained on sevoflurane after induction with propofol might be due to low solubility of sevoflurane which expeditedits fast wash out from body as well as rapid redistribution and metabolism of propofol. Propofol being ultra-short acting might get metabolized during period of maintenance of anesthesia with sevoflurane. Standing time with ataxia (45.67±5.43 min) of group PI was in agreement with 44.80±9.62 min as reported by Potliya (2015) in buffaloes anaesthetized with glycopyrrolate-xylazine-propofol-isoflurane. The time for extubation, returning to sternal position, standing with ataxia and complete recovery was least in the groups induced with propofol and maximum in groups induced with thiopentone. Also, time taken for these parameters were high in groups maintained on isoflurane as compare to sevoflurane, irrespective of induction agent. Substitution of chlorine with fluorine in sevoflurane decreases its blood solubility that allows a rapid increase in MAC during induction and a faster decrease during recovery, thus shorter recovery times (Stoelting, 1999). Similar observation has also been reported in horses, sheep and dogs (Kazama and Ikeda, 1988; Mutoh *et al.*, 1995; Johnson *et al.*, 1998; Hikasa *et al.*, 2000) while comparing sevoflurane and isoflurane.

Higher maintenance concentration of sevoflurane was used because sevoflurane has lower blood-gas partition coefficient than isoflurane and the MAC of sevoflurane in different species are higher than isoflurane (Natalini, 2001; Aida *et al.*, 1996; Steffy and Mama, 2007) requiring higher concentration of sevoflurane to be maintained than isoflurane for surgical plane of anesthesia.

CONCLUSION

The buffaloes which were anesthetized with thiopentone have delayed recovery as compared to anesthetized with propofol. The recovery in buffaloes, maintained on inhalant anesthetics (isoflurane/ sevoflurane) was faster in comparison to those maintained on total intravenous anesthesia (propofol/ thiopentone).

REFERENCES

Aida, H., Mizuno, Y., Hobo, S., Yoshida, K. and Fujinaga, T. (1996). Cardiovascular and pulmonary effects of Sevoflurane anaesthesia in horses. *Vet. Anes.* **25**: 164-170.

Genccelep, A.L., Aslan, A., Sahin, A. and Sindak, N. (2005). Effect of propofol anaesthesia in calves. *Indian Vet. J.* **82**: 516-518.

Hikasa, Y., Saito, K., Takase, K. and Ogasawara, S. (2000). Clinical, cardiopulmonary, haematological and serum biochemical effects of Sevoflurane and isoflurane anaesthesia in oxygen under spontaneous breathing sheep. *Small Rumin. Res.* **36**: 241-249.

Johnson, R.A., Striler, E., Swayer, D.C. and Brunson, D.B. (1998). Comparison of isoflurane with Sevoflurane for anesthesia induction and recovery in adult dogs. *Americ. J. Vet. Res.* **59**: 478-481.

Kaur, A. and Singh, S.S. (2004). Clinical effects of midazolam-ketamine and midazolam-thiopentone anaesthesia in bovines. *Indian J. Vet. Surg.* **25(2)**: 80-82.

Kazama, T. and Ikeda, K. (1988). Comparison of MAC and the rate of rise of alveolar concentration of sevoflurane with halothane and isoflurane in the dog. *Anesthesiol.* **68**: 435-437.

Khan, I., Kumar, A., Singh, J., Peshin, P.K. and Singh, S. (2007). Evaluation of glycopyrrolate as an anticholinergic in buffalo calves (Bubalus bubalis). *Italian J. Ani. Sci.* **6(2)**: 1007-1010.

Lemke, K.A. (2007). Anticholinergics and sedatives. In: Lumb and Jones' Veterinary anaesthesia and analgesia (4th Edn.), Edts. Tranquilli, W.J., Thurmon, J.C. and Grimm, K.A.), Blackwell publishing Ames, Iowa, USA. pp. 203-239.

Mutoh, T., Nishimura, R., Kim, H.Y., Matsunaga, S. and Kadosawa, T. (1995). Rapid inhalation induction of anaesthesia by halothane, enflurane, isoflurane and sevoflurane and their cardiopulmonary effects in dogs. *J. Vet. Med. Sci.* **56**: 1007-1013.

Naik, P.V. and Mahandale, S.S. (1969). A case of diaphragmatic hernia in buffalo. *Indian Vet. J.* **46**: 62.

Natalini, C.C. (2001). Sevoflurane, desflurane and xenon new inhaled anaesthetics in veterinary medicine. *Ciencia Rural.* **31(1)**: 177-183.

Ninu, A.R., Tayal, R., Kumar, A., Behl, S.M. and Chawla S.K. (2015). Comparison of thiopentone and ketamine as induction and maintenance agents in buffaloes undergoing diaphragmatic herniorrhaphy. *J. Appli. Anim. Res.* **43(4)**: 462-67.

Potliya, S., Kumar, A., Kumar, S., Singh, S. and Kumar, S. (2015). Evaluation of efficacy and safety of glycopyrrolate-xylazine-propofolanesthesia in buffalo calves. *Vet. World.* **8(3)**: 251-256.

Sahil (2023). Evaluation of transcription factors associated with diaphragmatic weakness in buffalo. MVSc thesis submitted to Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India.

Sinclair, M.D. (2003). A review of the physiological effects of alpha-2 agonists related to chemical use of medetomidine in small animal practice. *Can. Vet. J.* **44(11)**: 885-97.

Singh, H., Singh, T., Raghunath, M., Mohindroo, J., Verma, P., Saini, N.S. and Singh, S.S. (2013). Blood gas, acid base and electrolyte changes during diazepam, midazolam premedication and halothane anaesthesia in buffaloes subjected to diaphragmatic herniorrhaphy. *Indian J. Anim. Sci.* **83(7)**: 693-696.

Steffey, E.P. and Mama, K.R. (2007). Inhalation anaesthetics. In: Lumb and Jones' Veterinary anaesthesia and analgesia. (4th Edn.), Edts. Tranquilli, W.J., Thurmon, J.C. and Grimm, K.A.) Blackwell publishing Ames, Iowa, USA. pp. 355-393.

Stoelting, R.K. (1999) Inhaled anaesthetics. In: Pharmacology and physiology in anaesthetic practice. (ed. Precy, R.C.) Lippincott-Raven, Philadelphia. pp. 36-76.

Thurmon, J.C. and Short, C.E. (2007). History and overview of veterinary anaesthesia. In: Tranquilli, W.J., Thurmon, J.C. and Grimm, K.A. (Edts). Lumb and Jones' Veterinary Anaesthesia and Analgesia. (4th Edn.), Blackwell Publishing Ltd, Oxford. pp. 3-6.