Haryana Vet. (March, 2020) **59(SI),** 74-78

Research Article

STUDIES ON EFFICACY AND SAFETY OF ATROPINE-ACEPROMAZINE- BUTORPHANOL - THIOPENTONE- SEVOFLURANE ANAESTHESIA IN BUFFALOES UNDERGOING DIAPHRAGMATIC HERNIORRHAPHY

MOHIT JAMDAGNI*, ASHOK KUMAR, R.N. CHAUDHARY, DEEPAK KUMAR TIWARI, NEERAJ ARORA, SANDEEP KUMAR and VIKAS KISHORE
Department of Veterinary Surgery and Radiology, College of Veterinary Sciences,
Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar-125004, India

Received: 19.07.2018; Accepted: 16.10.2018

ABSTRACT

This study was undertaken for evaluation of efficacy and safety of atropine-acepromazine-butorphanol-thiopentone-sevoflurane anaesthesia in six buffaloes undergoing diaphragmatic herniorrhaphy. After premedication with atropine (0.04 mg/kg) -acepromazine (0.02 mg/kg) -butorphanol (0.03 mg/kg), induction and maintenance of anaesthesia was performed with thiopentone (5 mg/kg) and sevoflurane (0-6%), respectively. Scores for induction, maintenance and recovery were good while scores for premedication sedation, analgesia and muscle relaxation were fair. The weak time and down time were 15.33±0.33 min and 36.67±1.67 min, respectively. The mean time for intubation, extubation and standing with ataxia were 5.67±0.42 min, 16.00±1.53 min and 37.33±2.96 min, respectively. No significant change was observed in heart rate and rectal temperature during the entire period of anaesthesia. A significant decrease in respiratory rate at 15 min of acepromazine, PCV at 15 min of sevoflurane administration, ,however a significant increase in systolic BP at recovery and neutrophil percentage at 5 min of thiopentone administration than the values before pre-medication were recorded. Significant decrease in globulin and calcium was found at 30 min of sevoflurane and 24 hours of recovery, respectively.

Keywords: Acepromazine, Atropine, Butorphanol, Buffalo, Diaphragmatic herniorrhaphy, Sevoflurane, Thiopentone

Diaphragmatic hernia is a serious digestive disorder of buffaloes, with high prevalence reported especially from North India. Treatment of diaphragmatic hernia requires surgery in two stages. The first stage involves a laparo-rumenotomy that enables the surgeon to assess the location and extent of herniation, retract and remove foreign bodies, if any, and evacuate the rumen contents. During the second stage of surgery, the repair of the diaphragmatic defect is done under general anaesthesia using controlled ventilation (Singh *et al.*, 2006). Buffaloes suffering from diaphragmatic hernia fall under category IV of ASA classification and the buffaloes generally have compromised physiological status. So, there is always a need for an anaesthetic combination having least depression on the cardiopulmonary system, as the cardiovascular system determines the ability of the buffalo to tolerate alterations imposed on the system (Mirakhur *et al.*, 1983). Atropine is a naturally occurring anticholinergic agent and tachycardia is a dominant effect after its administration (Adams, 2001). Acepromazine used as tranquillizer decrease dopamine levels and depress some portions of the reticular activating system and produce sedation.

Opioids (eg. butorphanol) are the drugs of choice for the treatment of moderate to severe pain and may be used as part of balanced anaesthetic technique to provide preemptive analgesia. Thiopentone sodium is commonly used as general anaesthestic for induction and maintenance in buffaloes (Krishnamurthy *et al.*, 1980). Sevoflurane is non-irritant and has lower blood/gas partition coefficient, which provide more rapid induction and recovery from anaesthesia and a rapid alteration of anaesthetic depth (Kazama and Ikeda, 1988). There is little information on the use of sevoflurane in the buffaloes undergoing diaphragmatic herniorrhaphy. Therefore, the present study was undertaken for evaluation and safety of atropine-acepromazine-butorphanol-thiopentone-sevoflurane anaesthesia in buffaloes affected with diaphragmatic hernia.

*Corresponding Author: mohitjam32@gmail.com

MATERIALS AND METHODS

The study was conducted in six buffaloes suffering from diaphragmatic hernia. During diaphragmatic herniorrhaphy, after premedication with atropine (0.04 mg/kg) s/c; 15 min later acepromazine (0.02 mg/kg) was administered i/m and 30 min later butorphanol (0.03 mg/kg) was administered i/v. Induction and maintenance of anaesthesia was performed with thiopentone (5 mg/kg) i/v and sevoflurane (0-6%), respectively. The study was divided into six divisions: Signalment and general clinical observations, quality of anaesthesia, behavioural observations, physiological and haemodynamics study, haematological study and blood biochemical study.

Scoring for evaluation of quality of anaesthesia was done by assigning numerical values; starting from 1 to 4 (1-poor, 2-fair, 3-good, 4-excellent) for premedication, induction, maintenance and recovery quality and 0 to 3 (0-no effect, 1-mild effect, 2-moderate effect, 3-deep effect) for sedation, analgesia and muscle relaxation. Blindfold

study was performed to overcome individual variance. Behavioural changes namely, muzzle dryness, weak time, down time, various body reflexes and recovery time were observed. Rectal temperature, heart rate and respiratory rate, noninvasive blood pressure and SpO_2 were recorded prior to any drug administration, 5, 10 and 15 minutes after administration of atropine and acepromazine, after 15 and 30 minutes of sevoflurane administration and at recovery using Edan veterinary monitor (iM8 vet).

Blood samples were collected from jugular venipuncture before doing lapro-rumenotomy and on next day before drug administration, at 5 min. of induction of anaesthesia, and then at 15 and 30 min. of sevoflurane administration, at recovery and at 24 hours of recovery and used for haematological andbiochemical studies. Haematological parameters were estimated in automatic analyser MS4-S. Biochemical parameters were analyzed with EM 200TM analyzer using commercially available Transasia XLsystem pack kits procured from M/S Transasia Biomedical Limited, Mumbai. Sodium and potassium were analyzed by flame photometer machine.

The statistical analysis of data was done by one-way-anova using Duncan's multiple range test (Duncan, 1955) and paired t-test.

RESULTS AND DISCUSSION

Signalment and general clinical observations

All the buffaloes were grouped in ASA Category IV of physical status having illness since 15 to 30 days (Mean 23.0±3.0 days). Inappetance, decreased rumination, history of tympany, black hard and scanty faeces and decreased milk yield were clinical observations found in buffaloes. Four buffaloes were young heifers of 4 years age and two buffaloes were lactating (2^{nd} to 3^{rd} lactation). Two buffaloes were pregnant (3 months to 6 months) and four were non pregnant. The buffaloes had a mean body weight of 298.00±15.21 kg. Presence of potential metallic foreign bodies (nails and wires) in three-fourth cases, indicate foreign bodies to be the main cause and absence in one-fourth cases suggest that forces during pregnancy and parturition, and inherently weak diaphragm may be the other responsible causes which also justify the right-ventral position of hernial rings in 75% cases (Krishnamurthy and Rao, 1985)

Quality of anaesthesia

Overall score for induction, maintenance and recovery was good while score for premedication, sedation, analgesia and muscle relaxation was moderate. Acepromazine blocks dopamine receptors in the CNS and depresses the reticular-activating system, resulting in fair

Table 1

Means and standard errors (±) in time format of minutes for different behavioural characteristics of onset of CNS depression and recovery from CNS depression induced by administration of atropine-acepromazine -butorphanol-thiopentone-sevoflurane combination in buffaloes undergoing diaphragmatic herniorrhaphy

Parameters	Mean ±SE (Minute)
Muzzle dryness°	12.00±0.52
Weak time°°	15.33±0.33
Down time°°	36.67±1.67
Loss of palpebral reflex*	1.83±0.31
Relaxation of jaw muscle*	2.83±0.31
Loss of tongue reflex*	3.17±0.17
Loss of swallowing reflex*	3.50±0.34
Intubation*	5.67±0.42
Extubation†	16.00±1.53
Regaining of muscle tone†	19.33±1.93
Regaining of head righting reflex†	23.83±1.89
Return to sternal recumbency†	31.17±2.09
Standing with ataxia†	37.33±2.96
Complete recovery†	65.67±3.80
Premedication	2.87±0.15
Induction	3.01±0.08
Maintenance	3.24±0.10
Recovery	3.13±0.10
Sedation	2.05±0.09
Analgesia	2.11±0.08
Muscle relaxation	2.16±0.16

° After administration of Atropine, °° After administration of Acepromazine, * After administration of Thiopentone, † After discontinuation of Sevoflurane

sedation (Baldessarini and Tarazi, 2005). Butorphanol tartrate is a centrally acting synthetic morphine derivative exhibiting partial agonist and antagonist activity at the μ-opioid receptor, as well as partial agonist activity at the κ-opioid receptor. Induction and recovery scores in group was good as thiopentone results in rapid and smooth induction due to rapid redistribution in muscle tissues and localization in the body fat. The maintenance quality in group was good as balanced anaesthetic combination used results in fair sedation, analgesic and muscle relaxation properties along with diminishing side effects of each other.

Behavioural observations

Muzzle and nostrils became dry in all the animals after atropine administration as atropine is a non-selective muscarinic receptors antagonist (Lemke, 2007). A decrease

in spontaneous activity with ataxia was seen in buffaloes at 15.33±0.33 min. of acepromazine administration. All the buffaloes were restrained in lateral recumbency at 36.67± 1.67 min. of acepromazine administration. Mean dose of thiopentone administered was 5.00 mg/kg. Loss of palpebral reflex (at 1.83±0.31 min.) occurred after intravenous administration of thiopentone. Intubation was performed after loss of tongue reflex and swallowing reflex and relaxation of jaw. Time elapsed between loss of swallowing reflex and intubation was the time taken to apply mouth gag to the animal (Table 1). Sevoflurane was administered by semi-closed re-breathing circuit system with vaporizer setting starting at 4.50±0.37% and maintained on 2.50± 0.40%. Extubation was performed at 16.00±1.53min. after sevoflurane discontinuation, when buffalo starts chewing endotracheal tube after regain of tongue reflex and swallowing reflex. All the buffaloes returned to sternal recumbency at 31.17±2.09 min.; with regain of muscle tone andhead righting reflex. All buffaloes stood with some assistance at 37.33±2.96 min. and started walking with ataxia. Complete recovery took 65.67±3.80 min. after discontinuation of sevoflurane administration (Table 1).

Physiological and Haemodynamics Study

There was no significant change in heart rate and rectal temperature during the entire period of experiment (Table 2). There was a significant decrease in respiratory rate at 15 min. of acepromazine as compared to the base value. The respiratory depression action of acepromazine could be due to direct depression of central nervous system and reticular activating system. Systolic blood pressure was found to be significantly higher at recovery as compared to the base value which might be due to loss of anaesthetic state responsible for hypotension. SpO2 value was found to be significantly lower at 30 min of sevoflurane as compared to base value which might be due to overall effect of anaesthetic combination.

Haemato-biochemical Study

No significant difference was recorded in haematological values except packed cell volume and neutrophils (Table 3). There was a significant decrease in packed cell volume at 15 min. of sevoflurane

Table 2

Effects of atropine-acepromazine-butorphanol-thiopentone-sevoflurane on rectal temperature, heart rate, respiratory rate, blood pressure, SpO2 in six buffaloes undergoing diaphragmatic herniorrhaphy (Mean ± S.E.)

Parameters (units)	Diaphragmatic herniorrhaphy							
	Ambient Temp. (ºC)	Rectal Temp. (ºC)	Heart Rate (beats/min)	Respiratory rate (breaths/min)	NIBP	NIBP (systolic)	NIBP (diastolic)	SPO_2 (Mean)
Before Rumentomy	16.32^{a}± 0.81	37.30^{a}± 0.19	58.67^{a}± 0.84	15.00^{b}± 0.85	----	----	----	----
Before Drug Admn.	16.15^{a}± 0.80	37.30^{a}± 0.14	60.3^{a}± 1.41	14.50^{a}± 0.34	136.00^{ab}± 16.66	103.67^{a}± 13.69	115.00^{a}± 14.67	98.16^{c}± 0.30
At 5 min. of atropine	16.15^{a}± 0.80	37.32^{a}± 0.15	61.33^{a}± 1.12	14.33^{a}± 0.80	136.67^{ab}± 6.71	100.0^{a}± 7.93	110.10^{a}± 8.00	97.0^{bc}± 0.44
At 10 min. of atropine	16.15^{a}± 0.80	37.43^{a}± 0.17	62.00^{a}± 0.89	14.00^{a}± 0.52	136.33^{ab}± 7.68	99.17^{a}± 7.04	108.67^{a}± 5.60	96.16^{bc}± 0.16
At 15 min. of atropine	16.15^{a}± 0.80	37.47^{a}± 0.18	62.33^{a}± 0.61	14.33^{a}± 0.95	138.17^{ab}± 9.39	98.17^{a}± 8.15	114.33^{a}± 6.91	95.66^{bc}± 0.55
At 5 min. of acepromazine	16.15^{a}± 0.80	37.53^{a}± 0.24	60.33^{a}± 1.20	13.67^{a}± 0.61	133.17^{ab}± 7.42	94.50^{a}± 8.54	116.50^{a}± 9.24	95.83^{bc}± 0.65
At 10 min. of acepromazine	16.15^{a}± 0.80	37.40^{a}± 0.21	58.33^{a}± 0.95	13.33^{a}± 0.67	135.50^{ab}± 6.38	94.17^{a}± 6.13	106.17^{a}± 6.58	95.66^{bc}± 0.42
At 15 min. of acepromazine	16.15^{a}± 0.80	37.57^{a}± 0.25	55.33^{a}± 0.71	13.00^{a}± 1.00	138.33^{ab}± 12.46	86.17^{a}± 15.25	110.67^{a}± 9.53	95.66^{bc}± 0.33
At 15 min. of sevoflurane	16.15^{a}± 0.80	38.02^{a}± 0.35	56.17^{a}± 6.27	14.50^{a}± 2.87	125.50^{ab}± 13.10	85.17^{a}± 11.21	99.00^{a}± 11.53	94.5^{b}± 2.09
At 30 min. of sevoflurane	16.15^{a}± 0.80	37.92^{a}± 0.36	51.33^{a}± 3.77	15.67^{bc}± 3.52	145.17^{ab}± 11.16	102.00^{a}± 10.16	117.50^{a}± 10.05	88.66^{a}± 2.07
At recovery	16.33^{a}± 0.80	37.28^{a}± 0.21	61.33^{a}± 9.36	16.17^{b}± 0.40	159.50^{b}± 15.85	115.33^{a}± 11.11	130.83^{a}± 12.91	94.83^{b}± 0.40

Means with different superscripts vary significantly in column ($p<0.05$)

Table 3

Effects of atropine-xylazine-butorphanol-thiopentone-sevoflurane on blood haemato-biochemical parameters in six buffaloes undergoing diaphragmatic herniorrhaphy (Mean ± S.E.)

Parameters	Before rumentomy	Diaphragmatic herniorrhaphy					
		Before drug admn.	At 5 min. of thiopentone	At 15 min. of sevoflurane	At 30 min. of sevoflurane	At recovery	At 24 hrs. of recovery
Haemoglobin (g/dl)	8.80^{a}±0.42	9.20^{a}±0.77	8.22^{a}±0.35	7.75^{a}±0.25	9.00^{a}±0.66	9.23^{a}±0.65	9.53^{a}±0.73
Packed cell volume (%)	38.12^{ab}±2.70	35.48^{ab}±2.83	33.52^{ab}±3.50	30.82^{a}±4.07	32.78^{ab}±2.47	36.70^{ab}±2.08	40.43^{ab}±2.00
TEC ($x10^{6}/mm^{3}$)	6.50^{a}±0.56	6.07^{a}±0.37	6.09^{a}±0.39	5.58^{a}±0.45	6.27^{a}±0.28	6.53^{a}±0.52	6.82^{a}±0.45
TLC ($x10^{3}/mm^{3}$)	4.92^{a}±0.96	4.89^{a}±0.95	4.78^{a}±0.76	4.65^{a}±0.81	3.86^{a}±0.55	4.56^{a}±0.78	5.12^{a}±0.87
N (%)	52.50^{a}±3.30	60.33^{ab}±2.11	61.33^{b}±1.76	58.50^{ab}±2.80	56.33^{ab}±2.99	54.33^{a}±2.89	54.00^{a}±2.62
L (%	44.00^{a}±4.53	38.00^{a}±2.03	36.67^{a}±1.52	39.50^{a}±2.62	41.67^{a}±2.80	43.50^{a}±2.83	43.33^{a}±2.62
M (%)	1.83^{a}±0.17	1.67^{a}±0.21	2.00^{a}±0.37	2.00^{a}±0.26	2.00^{a}±0.26	2.17^{a}±0.17	2.67^{a}±0.49
Total platelets count ($x10^{3}/mm^{3}$)	202.67^{a}±29.35	255.83^{a}±53.11	219.67^{a}±41.73	184.50^{a}±28.95	161.83^{a}±27.13	180.83^{a}±23.82	190.50^{a}±26.07
Glucose (mg/dL)	116.13^{a}±37.37	113.77^{a}±25.19	124.07^{a}±33.21	125.53^{a}±32.87	120.88^{a}±30.13	111.77^{a}±27.53	113.80^{a}±28.76
Cortisol (nmol/L)	107.98^{a}±36.68	87.74^{a}±24.59	78.17^{a}±21.57	94.51^{a}±38.81	96.41^{a}±30.29	92.63^{a}±20.49	100.33^{a}±19.41
Total proteins (g/dL)	7.08^{a}±0.29	6.69^{a}±0.31	6.85^{a}±0.21	6.35^{a}±0.27	6.67^{a}±0.22	6.94^{a}±0.09	6.74^{a}±0.19
Albumin (g/dL)	2.87^{a}±0.20	2.70^{a}±0.23	2.84^{a}±0.14	2.63^{a}±0.15	2.69^{a}±0.15	2.85^{a}±0.15	2.66^{a}±0.15
Globulin (g/dL)	4.22^{b}±0.15	3.99^{ab}±0.12	4.01^{ab}±0.14	3.73^{a}±0.19	3.99^{ab}±0.10	4.09^{ab}±0.09	4.08^{ab}±0.12
Sodium (mmol/L)	137.36^{a}±5.41	139.19^{a}±4.77	137.62^{a}±5.11	137.47^{a}±3.88	130.01^{a}±3.78	130.31^{a}±3.62	132.79a±2.03
Potassium (mmol/L)	3.40^{a}±0.38	3.68^{a}±0.26	3.50^{a}±0.38	3.26^{a}±0.31	3.86^{a}±0.46	3.99^{a}±0.36	3.57^{a}±0.17
Calcium (mmol/L)	1.77^{b}±0.09	1.74^{b}±0.08	1.75^{b}±0.09	1.68^{ab}±0.07	1.68^{ab}±0.07	1.66^{ab}±0.07	1.59^{a}±0.06
BUN (mg/dL)	65.28^{a}±9.97	76.85^{a}±10.44	60.03^{a}±5.11	67.25^{a}±8.01	67.47^{a}±8.83	68.78^{a}±7.77	71.92^{a}±7.45
Creatinine (mg/dL)	2.38^{a}±0.17	2.40^{a}±0.17	2.44^{a}±0.16	2.42^{a}±1.07	2.34^{a}±0.15	2.18^{a}±0.16	2.11^{a}±0.14

Means with different superscripts vary significantly in row ($p<0.05$)

administration. The decrease in PCV during anaesthesia or sedation may be caused by shifting of the fluid from the extracellular compartment to the intravascular compartment in order to maintain normal cardiac output (Wagner *et al.*, 1991). There was a significant increase in neutrophil at 5 min. of thiopentone administration as compared to base value which might be due to surgical stress caused by major surgeries as well as by the preanaesthetic and anesthetic drugs leading to subsequent stimulation of adrenal glands (Chaudhary, 2016). No significant difference was recorded in biochemical values except globulin and calcium (Table 3). Significant decrease in globulin was found at 15 min of sevoflurane as compared to base value. The decrease in values may be due to shifting of fluid from the extracellular compartment to intravascular compartments to maintain normal cardiac output (Brock, 1994) and mainly due to fluid therapy causing haemodilution during intraoperative period.

Significant decrease in calcium was found at 24 hours of recovery as compared to base value. Decreased calcium may result from decreased negatively charged proteins and therefore of protein bound calcium (Stockham and Scott, 2008) or may be due to acidosis induced by anesthesia (Potaliya, 2015).

On the basis of above clinical and hemato-biochemical observations it was concluded that balanced anaesthetic combination of atropine (0.04mg/kg) –acepromazine(0.02mg/kg) -butorphanol (0.03mg/kg)-thiopentone(5mg/kg) for induction and sevoflurane (0-6%) for maintenance is effective as well as safe for buffaloes undergoing diaphragmatic herniorrhaphy.

REFERENCES

Adams, H.R. (2001). Veterinary Pharmacology and Theraupetics. (8th Edn.), Iowa State University Press, Ames. pp. 130-132.

Baldessarini, R.J. and Tarazi, F.I. (2005). Pharmacotherapy of psychosis and mania. In: Goodman & Gilman's Pharmacological Basis of Therapeutics. (9th Edn.), L.L. Brunton (Edt.). New York, McGraw. pp. 399-430.

Brock, N. (1994) Acepromazine revisited. *Can. Vet. J*. **35**: 458-459.

Chaudhary, R.N. (2016). Comparative evaluation of Isoflurane and sevoflurane as maintenance agent with different balanced anaesthetic combinations for buffaloes undergoing diaphragmatic herniorrhaphy. Ph.D. thesis, submitted to Lala Lajpat Rai University of Veterinary and animal Sciences, Hisar, India.

Duncan, D.B. (1955) Multiple range and multiple F test. *Biometrics*, **11**: 15-18.

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

Krishnamurthy, D., Deshpande, K.S., Nigam, J.M., Peshin, P.K. and Singh, S.C. (1980). Repair of diaphragmatic hernia in bovine-transthoracic approach. *Indian J. Vet. Surg.* **1**: 7-11.

Krishnamurthy, D. and Rao, A.R. (1985). Biochemistry In: Physiology and Biochemistry. In: Monograph on diaphragmatic hernia in bovines (Krishnamurthy, D., Nigam, J.M., Peshin, P.K., Sharma, D.N. and Tyagi, R.P.S.) (Edts.) Haryana Agricultural University, Hisar (India) p. 24.

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

Mirakhur, K.K., Sobti, V.K., Prasad, B., Ramakumar, V., Sharma, S.N., Khanna, A.K. and Kohli, R.N. (1983). A modified combination of anaesthesia for diaphragmatic herniorrhaphy in buffaloes-a clinical report. *Indian Vet. J*. **60**:720-726.

Potliya, S. (2015). Evaluation of balanced anaesthetic combinations for anaesthetic management of buffaloes undergoing diaphragmatic herniorrhaphy. Ph.D. thesis submitted to Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, India.

Singh, J., Fazili, M.R., Chawla, S.K., Tayal, R., Behl, S.M. and Singh, S. (2006). Current status of diaphraghmatic hernia in buffaloes with special reference to etiology and treatment: a review. *Indian J. Vet. Surg*. **27**: 73-79.

Stockham, S.L. and Scott, M.A. (2008). Fundamentals of Veterinary Clinical Pathology. (2nd Edn). Blackwell Publishing, Ames, Iowa, USA.

Wagner, A.E., Muir, W.W. and Hinchiff, K.W. (1991). Cardiovascular effects of xylazine and detomidine in horses. *Am. J. Vet. Res*. **52**: 651-57.