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Research Article

EVALUATION OF ATROPINE - MIDAZOLAM - BUTORPHANOL - PROPOFOL - ISOFLURANE ANAESTHESIA IN BUFFALOES UNDERGOING DIAPHRAGMATIC HERNIORRHAPHY

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ABSTRACT

The present study was undertaken to evaluate efficacy and safety of atropine-midazolam-butorphanol-propofol-isoflurane anaesthesia in six buffaloes undergoing diaphragmatic herniorrhaphy. Premedication was done with atropine sulphate (0.02 mg/kg I/M), midazolam (0.1 mg/kg I/V) and butorphanol (0.02 mg/kg I/V); induction was done with propofol (1.3-1.7 mg/kg I/V) and maintained with isoflurane (0.8-1.5%). No significant difference was observed in physiological and haemato-biochemical values at different time intervals during the anaesthesia. Quality of anaesthesia was in between good to excellent during the entire surgery on basis of analgesia, muscle relaxation and unconsciousness. Both induction and recovery was smooth using this anaesthetic combination in buffaloes. So it was concluded that used anaesthetic protocol was effective as well as safe for buffaloes undergoing diaphragmatic herniorrhaphy.

Keywords: Buffalo, Diaphragmatic hernia, Isoflurane, Midazolam, Propofol

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Diaphragmatic hernia is a serious acquired digestive disorder in buffaloes; due to indiscriminate feeding habits leading to the ingestion of foreign bodies (Radostits *et al.*, 2007) or in females due to increased intra-abdominal pressure in advanced stage of pregnancy (Krishnamurthy *et al.*, 1985) that results in rupture of diaphragm. Inappetence, decreased or no rumination, history of recurrent tympany, black, hard and scanty faeces and decreased milk yield are the chief complaints (Kishore *et al.*, 2019). Buffaloes suffering from diaphragmatic hernia fall under category IVof ASA (American Society of Anaesthesiologists) classification and the buffaloes generally have compromised physiological status (Yadav *et al.*, 2021a). So, there is always aneed of an anaesthetic combination having least cardiopulmonary system depression, as the cardiovascular system determines the ability of the buffalo to tolerate alterations imposed on the system (Mirakhur *et al.*, 1983). Xylazine is mainly used as sedative agent during anaesthesia in buffaloes because of its economic price but that is not safe during late pregnancy and produces cardiac depression effect. Midazolam is widely used in heart surgery because of lease cardio-pulmonary depressant effect and in diaphragmatic hernia condition cardiac functions are already altered. Therefore, the present study was undertaken to evaluate atropine-midazolam-butorphanol-propofol-isoflurane anaesthesia in buffaloes undergoing diaphragmatic herniorrhaphy.

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MATERIALS AND METHODS

The present study was conducted in six clinical cases of diaphragmatic hernia in buffaloes. All the animals were premedicated with inj. atropine (@0.02 mg/kg) I/M; 15 min later inj. midazolam (@0.1 mg/kg) I/V and 5 min later inj. butorphanol (@0.02 mg/kg) I/V were administered. After inj. midazolam animal was taken into lateral recumbency followed by Inj. butorphanol. Induction and maintenanceof anaesthesia was performed using propofol (@1.3 to 1.7 mg/kg) I/V and isoflurane (0.8-1.5%), respectively. Signalment and general clinical condition of animals, behavioural changes, quality of anaesthesia, physiological and haemato-biochemical parameters were recorded during the 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 as per Kishore *et al.* (2019). Physiological and haemato-biochemical parameters were studied before laparo-rumenotomy and on next day before premedication, after 15 min. of induction of anaesthesia, and then after 30 min. of isoflurane administration, at recovery and after 24 hours of recovery. Haematological parameters were estimated using automatic analyser MS4-*S. Biochemical* parameters were analyzed with EM 200TM analyser using commercially available Transasia

XLsystem pack kits procured from M/S Transasia Biomedical Limited, Mumbai. The statistical analysis of data was done by Repeat Measure ANOVA at different time intervals within the group.

RESULTS AND DISCUSSION

All the buffaloes were grouped in ASA Category IV of physical status having illness since 15 to 90 days. Age of affected buffaloes were in between four to nine years having body weight in between 260-365 kg after rumenotomy. There was presence of potential metallic foreign bodies (nails and wires) found in five animals, however, one buffalo had pregnancy of 3 months while others were 1 to 4.5 months post-parturient. Total time taken for surgery was 40 to 60 minutes. A very good muscle relaxation and unconsciousness was recorded during the surgery. Complete recovery was taken place after 30 to 40 minutes after discontinuation of isoflurane administration. Overall score for quality of anaesthesia was in between good to excellent by this anaesthetic combination (Table 1). Complete recovery was taken place after 30 to 40 minutes after discontinuation of isoflurane administration and various reflexes to come and gone are discussed in Table 2. The maintenance quality in group was good as balanced anaesthetic combination used results in good sedation, analgesic and muscle relaxation during whole surgical procedure along with diminishing side effects of each other. Butorphanol results in enhanced level of sedation and analgesia with prolong recovery (Hall *et al.*, 2001). Preanaesthetic administration of midazolam reduces the induction dose of barbiturates and propofol and the concentration of isoflurane required to maintain anaesthesia during surgery (Stegmann and Bester, 2001). The use of butorphanol as an analgesic reduces the concentration of isoflurane required for surgical anaesthesia in buffaloes undergoing diaphragmatic herniorrhaphy (Yadav *et al.*, 2021). Atropine is a naturally occurring anticholinergic agent and tachycardia is a dominant effect after its administration (Adams, 2001) which was also observed in the present study. Midazolam has limited effects on cardiopulmonary function and this drug is an ideal sedative for many older or compromised animals. It can be used in combination with an opioid as a part of a balanced anaesthetic technique or as a preanaesthetic (Tranquilli *et al.*, 2007). Yadav *et al.* (2021b) found that atropine-xylazine-butorphanol-propofol-isoflurane combination is good and safe for buffaloes undergoing diaphragmatic herniorrhaphy.

Means and standard errors (±) in time format of minutes for different behavioural characteristics by administration of atropine-midazolam-butorphanol-propofol-isoflurane combination in buffaloes undergoing diaphragmatic herniorrhaphy presented in Table 2. Intubation was performed after loss of tongue and swallowing reflex. Isoflurane was administered by semi close breathing circuit with vaporizer setting in between 0.8 to 1.5%.There was no significant change in heart rate, respiration rate and rectal temperature during the entire period of anaesthesia (Table 3).

In the present study no significant difference was recorded in haemato-biochemical values at different time interval (Table 4 and 5). The SGOT level was increased non-significantly, respectively after rumenotomy that might be due to incision of muscles during rumenotomy and herniorrhaphy. SGOT is present in cytosolic and mitochondrial isoenzymes and is found in the liver, cardiac muscle, skeletal muscle, kidneys, brain, pancreas, lungs,

Table 1

Quality of anaesthesia in buffaloes undergoing diaphragmatic herniorrhaphy (Mean ± S.E.) (n=6)

Parameters	Premedication (1-4)	Induction (1-4)	Maintenance (1-4)	Recovery (1-4)	Sedation (1-3)	Muscle relaxation (1-3)	Analgesia (1-3)
Score	3.67 ± 0.21	3.67 ± 0.21	3.8 ± 0.17	3.8 ± 0.17	2.67 ± 0.21	2.8 ± 0.17	2.3 ± 0.17

Table 2

Means and standard errors (±) in time format of minutes fordifferent behavioural characteristics by administration of atropine-midazolam–butorphanol-propofol- isoflurane combination in buffaloes undergoing diaphragmatic herniorrhaphy

Parameters	Mean ± SE (Minutes)	Parameters	Mean ±SE (Minutes)
Weak Time[1]	0.83 ± 0.1	Intubation[2]	3.3 ± 0.17
Down time[1]	1.91 ± 0.2	Extubation[3]	10.0 ± 0.6
Loss of palpebral reflex[2]	2.25 ± 0.1	Return to sternal recumbency[3]	15.2 ± 0.6
Relaxation of Jaw muscle[2]	2.16 ± 0.1	Standing with ataxia[3]	24.7 ± 1.2
Loss of tongue reflex[2]	2.33 ± 0.17	Complete recovery[3]	33.8 ± 1.4
Loss of swallowing reflex[2]	2.5 ± 0.13		

[1]After administration of midazolam, [2]After administration of propofol, [3]After discontinuation of isoflurane

Table 3

Effects of atropine-midazolam-butorphanol-propofol-isoflurane on rectal temperature, heart rate and respiratory rate in buffaloes undergoing diaphragmatic herniorrhaphy (Mean ± S.E.) (n=6)

Parameters	Before rumenotomy	Before DH	After 15 minutes of induction	After 30 minutes of isoflurane maintenance	Complete recovery	24 hours after complete recovery
Rectal temperature (ºF)	98.4 ± 0.9	98.2 ± 1.1	98.9 ± 0.9	98.5 ± 0.8	98.9 ± 0.6	99.1 ± 0.5
Heart rate (beats/ minute)	55.8 ± 2.2	62.8 ± 6.2	81.7 ± 11.2	66.0 ± 7.1	62.0 ± 2.1	61.3 ± 2.9
Respiration rate (breaths/ minute)	13.0 ± 1.6	15.33 ± 1.8	14.2 ± 2.3	14.4 ± 2.2	16.8 ± 1.6	15.5 ± 1.6

Table 4

Effects of atropine-midazolam-butorphanol-propofol-isoflurane on haematological parameters in buffaloes undergoing diaphragmatic herniorrhaphy (Mean ± S.E.) (n=6)

Parameters	Before rumenotomy	Before DH	After 15 minutes of induction	After 30 minutes of isoflurane maintenance	Complete recovery	24 hours after complete recovery
Haemoglobin (g/dl)	10.87 ± 0.56	11.28 ± 0.42	10.17 ± 1.25	8.28 ± 0.85	9.12 ± 0.80	9.50 ± 0.80
Packed cell volume (%)	36.7 ± 3.56	34.6 ± 2.32	32.0 ± 2.16	29.8 ± 2.78	25.8 ± 2.96	28.4 ± 2.74
Total erythrocyte count ($\times 10^6$/mm^3)	10.87 ± 0.56	11.28 ± 0.42	10.17 ± 1.25	8.28 ± 0.85	9.12 ± 0.80	9.50 ± 0.80
Total leukocytes count ($\times 10^3$/mm^3)	11.78 ± 1.74	7.94 ± 1.21	7.94 ± 1.22	6.40 ± 0.79	6.50 ± 0.84	10.6 ± 3.48
Neutrophils %	66.33 ± 3.24	74.33 ± 2.30	72.50 ± 1.95	69.67 ± 2.94	71.67 ± 2.95	75.17 ± 2.76
Lymphocytes %	32.2 ± 3.26	24.3 ± 2.3	26.0 ± 2.06	27.5 ± 2.58	27.17 ± 2.99	23.67 ± 2.84
Monocytes %	1.67 ± 0.33	1.50 ± 0.34	1.50 ± 0.34	1.50 ± 0.42	1.33 ± 0.43	1.17 ± 0.48
Total platelets count ($\times 10^3$/mm^3)	220.7 ± 14.6	313.5 ± 68.4	242.8 ± 36.8	226.8 ± 38.67	226.4 ± 48.7	232.17 ± 30.1

Table 5

Effects of atropine-midazolam-butorphanol-propofol-isoflurane on biochemical parameters in buffaloes undergoing diaphragmatic herniorrhaphy (Mean ± S.E.) (n=6)

Parameters	Before rumenotomy	Before DH	After 15 minutes of induction	After 30 minutes of isoflurane maintenance	Complete recovery	24 hours after complete recovery
Total protein (g/dl)	7.26 ± 0.63	6.92 ± 0.52	6.43 ± 0.69	5.71 ± 0.54	5.42 ± 0.32	5.84 ± 0.41
Albumin (g/dl)	1.78 ± 0.17	1.62 ± 0.10	1.43 ± 0.13	1.36 ± 0.10	1.27 ± 0.07	1.63 ± 0.16
Blood glucose (mg/dl)	100.5 ± 10.1	79.5 ± 7.5	87.1 ± 8.5	120.0 ± 19.7	121.5 ± 17.9	88.5 ± 9.6
Blood urea nitrogen (mg/dl)	33.5 ± 5.8	36.3 ± 7.6	32.1 ± 6.9	34.8 ± 6.7	37.0 ± 8.2	36.5 ± 5.5
Serum creatinine(mg/dl)	1.87 ± 0.24	2.2 ± 0.35	1.77 ± 0.2	1.9 ± 0.24	2.14 ± 0.39	2.07 ± 0.27
SGOT (IU/L)	461.7 ± 154.2	567.8 ± 181.8	496.3 ± 193.7	482.3 ± 151.1	498.7 ± 146.7	397.3 ± 103.4
SGPT (IU/L)	37.2 ± 3.2	37.9 ± 3.5	35.1 ± 5.8	33.2 ± 3.7	36.8 ± 4.7	36.2 ± 3.3
Calcium (mmol/L)	7.63 ± 0.54	6.58 ± 0.63	5.70 ± 0.68	6.62 ± 0.77	6.37 ± 0.97	6.90 ± 0.54
Phosphorus (mmol/L)	3.75 ± 0.30	2.77 ± 0.29	3.20 ± 0.40	2.60 ± 0.27	3.01 ± 0.26	2.83 ± 0.17

leucocytes, and red cells. It is less sensitive and specific for the liver. On the other hand, SGPT is a cytosolic enzyme which is more specific to the liver due to the high concentration in liver tissue (Gwaltney-Brant, 2016). Increase in BUN and creatinine values were seen before diaphragmatic herniorrhaphy as the animals were chronically ill and were kept off-feed and off-water after rumenotomy.Similar observations were observed by Kishore *et al.* (2019) and Jamdagni *et al.* (2020). On the basis of above observations, it is concluded that anaesthetic combination of atropine-midazolam-butorphanol-propofol-isoflurane is effective as well as safe for buffaloes undergoing diaphragmatic herniorrhaphy.

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