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Research Article

CLINICOPHYSIOLOGICAL EVALUATION OF GLYCOPYRROLATE-XYLAZINE-PENTAZOCINE-PROPOFOL–SEVOFLURANE ANAESTHESIA IN BUFFALOES UNDERGOING DIAPHRAGMATIC HERNIORRHAPHY

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ABSTRACT

The objective of the study was to evaluate the efficacy of glycopyrrolate-xylazine-pentazocine-propofol-sevoflurane in buffaloes undergoing diaphragmatic herniorrhaphy. No significant variation was observed in any haematobiochemical, haemodynamic parameters at any interval of study. Sedation, muscle relaxation, analgesia, induction and maintenance were excellent in all animals. On the basis of findings of our study, it can be concluded that this combination is safe and effective in buffaloes undergoing diaphragmatic herniorrhaphy.

Keywords: Buffaloes, Diaphragmatic herniorrhaphy, Sedation, Xylazine

Diaphragmatic hernia is a serious digestive disorder in buffaloes involving rupture of diaphragm at the musculo-tendinous junction resulting in herniation of abdominal viscera into thorax. Ruminants are poor subject for general anaesthesia because during dorsal recumbency under general anaesthesia for transabdominal approach to diaphragmatic herniorrhaphy leads to marked ventilation-perfusion mismatch due to pressure of the abdominal organs on the diaphragm, posterior vena cava and aorta along with danger of regurgitation and aspiration of ingesta. However, these can be minimized by proper anaesthetic management and more particularly when maintenance of general anaesthesia is carried out with inhalant anaesthetic. So, there is always a need for an anaesthetic regimen which provide eternal safety and posses fewer side effects (Mirakhur *et al.*, 1984). The use of inhalant anaethesia helps in minimizing patient morbidity or mortality as it facilitates lung ventilation and provides improved arterial oxygenation along with rapid adjustment of inhalation anaesthetic concentration, thereby enhancing the safety of anesthetic management beyond the extent commonly not possible with injectable anaesthetic agents (Steffey and Mama, 2007). Hence, this study was planned to combine the drugs for a balanced anaesthetic combination with smooth induction, fast recovery and with minimum complications in buffalo patients undergoing diaphragmatic herniorrhaphy.

MATERIALS AND METHODS

The study was conducted on five buffaloes suffering from diaphragmatic hernia reported to the Veterinary Clinical Complex, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar. Animals were weighed before laparo-rumentomy to calculate the weight of ruminal content and then kept off feed and water after laparo-rumenotomy, weighed again before doing diaphragmatic herniorrhaphy for calculating the dose of drugs used for balanced anaesthesia. After fifteen minutes of pre-anaesthetic medication with glycopyrrolate (0.01mg/kg i/m), the buffaloes were administered with xylazine hydrochloride (0.05mg/kg i/m) and restrained in lateral recumbency after sedation. Then, pentazocine (0.75 mg/kg i/v) was given after 30 minutes of xylazine administration. Thereafter, induction was done with propofol (1.3 mg/kg i/v) and maintained with sevoflurane (0-6%). Concentration of inhalation anaesthetic agents was regulated to maintain adequate depth of anaesthesia after monitoring body reflexes, animal's response to surgical stimulation and physiological parameters like blood pressure, heart rate, respiration rate, peripheral capillary oxygen saturation etc.

Various behavioural parameters were investigated after administration of preanaesthetics and after discontinuation of sevoflurane as shown in Table 2. Physiological parameters and haemato-biochemical parameters were investigated before doing rumenotomy and on next day before drug administration, at 5 min. of induction of anaesthesia, and then at 15 and 30 minutes of sevoflurane administration, at recovery and at 24 hr of recovery. A fixed criterion was followed for evaluation of quality of anaesthesia. Scoring was done to assign numerical values; starting from 1 to 4 (1-poor, 2-fair, 3-good, 4-excellent) for premedication quality, induction quality, maintenance quality and recovery quality. Qualitative and subjective effects (sedation, analgesia and muscle relaxation) of drugs were judged by observing physical response of the medicated animals to surgical stimulation during diaphragmatic herniorrhaphy. Numerical values starting from 0 to 3 (0-no effect, 1-mild

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Table 1

Mean ± S.E. of scores depicting quality of anaesthesia during glycopyrrolate-xylazine-pentazocine-propofol–sevoflurane anaesthesia in buffaloes undergoing diaphragmatic herniorrhaphy

Parameter	Premedication (1-4)	Induction (1-4)	Maintenance (1-4)	Recovery (1-4)	Sedation (0-3)	Analgesia (0-3)	Muscle relaxation (0-3)
Score	3.34±0.21	3.48±0.22	3.61±0.31	3.36±0.32	2.50±0.22	2.26±0.23	2.60±0.21

effect, 2-moderate effect, 3-deep effect) was used for sedation, analgesia and muscle relaxation during maintenance of anesthesia. Blind fold study was performed to overcome the individual variations.

The statistical analysis of data was done by one-way-ANOVA using Duncan's multiple range test and paired t-test.

RESULTS AND DISCUSSION

The most common affected age group was between five to eight years and 3rd lactation. Based on clinical observations, mean scores for quality of anaesthesia are shown in Table 1. Overall score for premedication was good and induction was good to excellent. The sedative and muscle relaxant effect of xylazine has been reported to be outstanding in buffaloes, camel, sheep, and cattle (Peshin and Kumar, 1979). The mean score for maintenance was excellent but sedation score was moderate to good, analgesia was proper and muscle relaxation was adequate for surgical procedure to be carried out easily. Recovery score was excellent in all the animals. Similar results were noted by Chaudhary (2016) and Kishore (2018) both, by using the glycopyrrolate-xylazine-butorphanol-propofol-sevoflurane.

The effects of administration of glycopyrrolate-xylazine-pentazocine-propofol–sevoflurane combination on behavioral parameters are shown in Table 2. Muzzle became dry after an average interval of 15.48 ±0.22 min of glycopyrrolate administration. A decrease in spontaneous activity with ataxia was seen in animals at 16.38 ± 0.32min of xylazine administration. Then buffaloes were restrained in lateral recumbency at the mean time of 16.7 ±0.53 min of xylazine administration. Chaudhary (2016) observed that muzzle became dry at 13.52±1.01 min of glycopyrrolate administration with decrease in spontaneous activity at 15.17±1.96 and down time of 21.33±1.99 min. of xylazine in combination glycopyrrolate-butorphanol-xylazine-propofol-sevoflurane in buffaloes undergoing diaphragmatic herniorrhaphy.

There was drooping of eyelids with loss of palpebral reflex at 1.00±0.12 min of propofol administration. Mouth gag was applied after relaxation of jaw and intubation was performed after loss of tongue and swallowing reflexes after 1.74±0.21min of propofol administration. Kishore (2018) has also reported loss of palpebral reflex at 2.50±0.34 min. of propofol with loss of tongue reflex, swallowing reflex and relaxation of jaw in buffaloes. Sevoflurane was administered by semi-closed re-breathing circuit system with vaporizer setting starting at 5.0% and maintained on 2.0 to 4% during surgery. Mean time for surgery was 41.0± 1.78 min and sevoflurane was administered for 50.0±1.38 min. and complete recovery was observed after 38.00±1.14 minutes of sevoflurane withdrawal. Potliya (2015) found that induction with propofol and maintainence with isoflurane had earlier recovery than propofol halothane combination in buffaloes. Quiet and excitement free recovery has reported with propofol alone in different species like calves, goat, sheep, horses and dogs (Sharma and Bhargava, 2007). Kishore (2018) has also reported smooth early recovery min. after induction with propofol and maintenance with sevoflurane i.e. 29.33±2.28 minutes in buffaloes.

No significant variation was observed in various physiological and hemodynamic parameters i.e heart rate, respiratory rate, rectal temperature, systolic blood pressure, diastolic blood pressure and mean blood pressure at any time interval of the entire study (Table 3). Similar

Table 2

Different behavioural characteristics of CNS depression in buffaloes (n=5) of onset of CNS depression induced by administration of glycopyrrolate-xylazine-pentazocine-propofol-sevoflurane combination from onset of anaesthesia to complete recovery

Parameters	Mean ±SE (Minute)
Muzzle dryness°	15.48 ± 0.22
Weak time°°	16.38 ± 0.32
Down time°°	16.70 ± 0.53
Loss of palpebral reflex*	1.00 ± 0.12
Relaxation of jaw muscle*	1.28 ± 0.17
Loss of tongue reflex*	1.38 ± 0.18
Loss of swallowing reflex*	1.74 ± 0.21
Intubation*	3.00 ± 0.16
Regain of alar reflex†	3.72 ± 0.23
Extubation†	9.78 ± 1.21
Regaining of muscle tone†	10.44 ± 0.69
Regaining of head righting reflex†	12.80± 0.73
Return to sternal recumbency†	17.80 ± 0.66
Standing with ataxia†	33.50 ± 0.92
Complete recovery†	38.00 ± 1.14

°after administration of glucopyrrholate; °°after administration of xylazine; *after administration of propofol; †after discontinuation of sevoflurane

Table 3

Effects of glycopyrrolate-xylazine-pentazocine-propofol-sevofluraneanaesthetic combinations on various physiological and hemodynamic in buffaloes undergoing diaphragmatic herniorraphy (Mean± S.E.)

Parameters	Before rumenotomy	Before drug admn.	At 5 minutes propofol	At 15 minutes of sevoflurane	At 30 min. of sevoflurane	At recovery	After 24 hr of recovery
Heart rate (beats/minute)	58.2 ± 7.8	54.6 ± 7.8	53.6 ± 7.5	51.6 ± 7.2	58.4 ± 7.6	55.2 ± 7.3	53.8 ± 7.3
Respiratory rate (breath/minute)	17.6 ± 2.6	16.8 ± 2.3	15.8 ± 2.7	17.2 ± 2.6	17.4 ± 2.8	16.7 ± 2.5	15.4±3.8
Rectal temperature (ºC)	36.4 ± 1.1	36.3 ± 1.1	36.2 ± 1.1	36.1 ± 1.1	36.2 ± 1.0	36.1 ± 1.0	36.1 ± 1.0
Systolic BP (mm Hg)	134.4 ± 23.7	152.6 ± 22.5	127 ± 22.1	132.4 ± 22.6	142.2 ± 23.3	152.2 ± 22.0	152.4 ± 27.6
Diastolic BP (mm Hg)	93.4 ± 18.5	108.4 ± 20.5	83.4 ± 19.4	84.4 ± 20.1	92.0 ± 20.2	104.8 ± 15.8	105.0 ± 19.5
Mean BP (mm Hg)	101.0 ± 20.6	114.2 ± 21.0	99.6 ± 18.4	98.8 ± 20.1	104.0 ± 19.5	118.8 ± 16.8	122.6 ± 20.4
SpO_2 (%)	96 .0± 1.8	95.4± 0.9	97.4±1.12	96.4±1.0	94.4±1.3	89.4±3.2	90.6±2.0

Mean±SE values don't differ significantly in same row

results were recorded by Kishore (2018) in buffaloes undergoing diaphragmatic herniorrhaphy anesthestized with glycopyrrolate-acepromazine-butorphanol-propofol -sevoflurane and glycopyrrolate-xylazine-butorphanol-propofol-sevoflurane at any time interval of study.

Seller *et al.* (2013) observed steady heart rate throughout surgery in calves operated for placement of jugular and portal vein canulas under xylazine-ketamine anaesthesia maintained with either isoflurane or sevoflurane without any significant difference.

The effects of glycopyrrolate-xylazine-pentazocine -propofol-sevoflurane combination on haematological parameters in buffaloes undergoing diaphragmatic herniorrhaphy are shown in Table 4. There was no significant ($P<0.05$) change in any of the haematological parameters during the entire observation period and values fluctuated near the base value. Similar results were observed during atropine-xylazine-propofol anaesthesia (Potliya, 2012). Similar observation were made by Pandey *et al.* (2017) that no significant variation were observed in haematological parameters i.e. Hb, TLC, TEC and PCV at various time interval after anesthesia with dexmedetomidine (2.5µg/kg.b.wt) and Propofol (0.25 mg/kg b.wt) in buffalo calves. Kishore (2018) observed no significant difference in any hematological parameters except total lymphocyte count in combination of glycopyrrolate - xylazine-butorphanol-propofol-sevoflurane in buffaloes.

The effects of glycopyrrolate-xylazine-pentazocine -propofol-sevoflurane combination on biochemical parameters in buffaloes undergoing diaphragmatic herniorrhaphy are shown in Table 5. There was no significant ($P<0.05$) change in any of the biochemical parameters during the entire observation period. Similar observation was observed by Pandey *et al.* (2017) after

Table 4

Effects of glycopyrrolate-xylazine-pentazocine-propofol-sevoflurane on haematological parameters in buffaloes (n=5) undergoing diaphragmatic herniorrhaphy (Mean ± S.E.)

Parameters (Units)	Before Rumenotomy	Diaphragmatic Herniorrhaphy					
		Before Drug admn.	At 5 min of propofol	At 15 min of sevoflurane	At 30 min of sevoflurane	At recovery	At 24 hrs of recovery
TLC ($x10^3/mm^3$)	6.76 ± 0.92	8.07 ± 0.95	7.16 ± 1.03	6.59 ± 0.88	4.98 ± 0.58	7.19 ± 1.24	6.91 ± 0.68
TEC ($x10^6/mm^3$)	7.36 ± 1.29	6.89 ± 0.45	5.97 ± 0.53	4.42 ± 1.02	4.44 ± 0.91	6.34 ± 0.43	7.20 ± 0.58
Packed cell volume (%)	46.86 ± 10.18	41.94 ± 3.08	36.10 ± 3.41	35.00 ± 4.18	30.48 ± 6.54	39.16 ± 3.55	43.86 ± 2.55
MCV (fl)	62.76 ± 3.17	60.82 ± 2.49	60.22 ± 2.32	60.26 ± 2.49	59.84 ± 2.45	61.60 ± 2.28	61.06 ± 3.04
Haemoglobin (g/dl)	9.62 ± 1.51	9.34 ± 0.45	7.78 ± 0.77	7.58 ± 0.84	6.36 ± 1.27	8.72 ± 0.71	9.06 ± 0.41
Total thrombocyte count ($x10^3/mm^3$)	396.00±130.68	246.60 ± 49.62	325.60 ± 30.00	221.20 ± 55.47	231.00 ± 96.32	262.20 ± 54.68	320.40 ± 57.75
MPV (fl)	7.46 ± 0.46	7.92 ± 0.29	8.34 ± 0.15	8.00 ± 0.30	8.04 ± 0.30	8.20 ± 0.13	7.84 ± 0.30
Pct (%)	0.69 ± 0.17	0.33 ± 0.10	0.26 ± 0.08	0.22 ± 0.05	0.31 ± 0.08	0.35 ± 0.18	0.36 ± 0.08
PDW (%)	7.74 ± 0.52	8.76 ± 0.47	8.42 ± 0.53	7.58 ± 0.50	7.98 ± 0.52	8.34 ± 0.48	7.58 ± 0.16
MCH (pg)	13.14 ± 0.39	13.56 ± 0.40	12.88 ± 0.62	13.34 ± 0.54	12.4 ± 0.63	13.68 ± 0.95	12.78 ± 0.85
MCHC (%)	21.14 ± 0.92	22.38 ± 0.66	21.48 ± 0.75	21.96 ± 0.69	20.46 ± 0.61	22.32 ± 1.39	20.22 ± 0.90
RDW (%)	14.14 ± 0.57	13.32 ± 0.66	13.70 ± 0.41	13.62 ± 0.34	13.6 ± 0.35	14.28 ± 0.83	17.68 ± 3.73
L (%)	47.50 ± 3.65	36.12 ± 6.39	31.36 ± 5.90	30.82 ± 3.43	35.72 ± 4.31	36.54 ± 4.71	37.22 ± 3.26
M (%)	1.62 ± 0.22	1.10 ± 0.47	1.46 ± 0.83	1.02 ± 0.27	1.86 ± 0.89	1.06 ± 0.36	1.02 ± 0.14
N (%)	50.64 ± 3.59	62.18 ± 6.60	66.82 ± 6.55	66.92 ± 3.59	62.88 ± 4.53	61.78 ± 4.93	61.78 ± 3.22

Mean ±SE values don't differ significantly in same row ($P<0.05$)

Table 5

Effects of glycopyrrolate-xylazine-pentazocine-propofol–sevoflurane on blood biochemical parameters (Mean ± S.E.) in buffaloes (n=5) undergoing diaphragmatic herniorrhaphy

Parameters (Units)	Before Rumenotomy	Diaphragmatic Herniorrhaphy					
		Before Drug admn.	At 5 min of propofol	At 15 min of sevoflurane	At 30 min of sevoflurane	At recovery	At 24 hrs of recovery
LDH (IU/L)	3542.33±219.11	3847.00±156.19	3945.33±255.70	3845.00±140.59	3659.83±198.89	3524.67±61.19	3549.17±79.82
ALT/SGPT (IU/L)	98.64±3.45	100.20±5.24	104.34±6.25	115.46±8.54	119.36±9.35	124.27±10.45	120.64±11.24
AST/SGOT (IU/L)	670.20±113.20	608.30±115.20	615.40±120.30	594.30±125.40	583.20±103.20	596.40±104.60	615.40±117.40
ALP (IU/L)	45.00 ± 8.40	50.40 ± 7.91	46.20 ± 7.30	51.80 ± 7.30	47.60 ± 9.22	48.00 ± 11.06	51.40 ± 8.76
GGT (IU/L)	58.50 ± 0.00	57.70 ± 20.42	57.58 ± 21.73	55.04 ± 22.04	59.64 ± 24.05	62.54 ± 21.25	55.78 ± 18.87
Glucose (mg/dL)	130.14 ± 62.63	95.42 ± 40.60	94.16 ± 36.75	158.26 ± 61.67	149.04 ± 56.21	97.28 ± 55.94	96.86 ± 47.36
Bilirubin total (mg/dL)	1.07 ± 0.20	1.55 ± 0.17	1.32 ± 0.23	0.90 ± 0.19	0.84 ± 0.10	1.21 ± 0.13	1.14 ± 0.17
Triglycerides (mg/dL)	13.38 ± 5.10	14.50 ± 5.37	17.50 ± 8.56	13.44 ± 3.31	14.82 ± 4.96	15.38 ± 4.27	19.12 ± 7.36
Cholesterol (mg/dl)	27.60 ± 6.79	29.20 ± 7.86	30.80 ± 7.81	22.80 ± 3.15	25.20 ± 5.56	27.40 ± 5.48	25.60 ± 5.98
Total proteins (g/dL)	7.15 ± 0.32	7.75 ± 0.34	7.41 ± 0.42	6.98 ± 0.40	7.10 ± 0.16	7.40 ± 0.37	7.19 ± 0.13
Albumin (g/dL)	2.45 ± 0.17	2.57 ± 0.22	2.67 ± 0.25	2.40 ± 0.15	2.36 ± 0.17	2.49 ± 0.19	2.80 ± 0.21
Globulin (g/dL)	4.71 ± 1.19	5.17 ± 1.26	4.74 ± 1.18	4.58 ± 1.29	4.74 ± 1.18	4.91 ± 1.29	4.39 ± 1.19
A:G ratio	0.52 ± 0.03	0.50 ± 0.05	0.56 ± 0.04	0.53 ± 0.03	0.51 ± 0.05	0.51 ± 0.05	0.65 ± 0.08
Urea (mg/dL)	44.44 ± 8.49	56.26 ± 8.69	55.40 ± 9.34	46.30 ± 7.50	54.48 ± 7.85	59.70 ± 6.70	63.90 ± 9.53
Creatinine (mg/dL)	1.99 ± 0.20	2.35 ± 0.22	2.29 ± 0.22	2.09 ± 0.30	2.22 ± 0.19	2.58 ± 0.04	2.53 ± 0.20
Sodium (mmol/L)	125.18 ± 2.87	130.68 ± 3.53	130.14 ± 3.18	133.02 ± 3.22	131.74 ± 2.67	132.66 ± 3.75	134.80 ± 3.62
Potassium (mmol/L)	12.08 ± 2.63	12.83 ± 3.47	12.13 ± 3.48	11.14 ± 2.69	10.42 ± 2.26	11.95 ± 2.77	11.41 ± 2.64
Chloride (mmol/L)	101.82 ± 3.29	106.40 ± 1.75	105.78 ± 3.52	109.56 ± 2.57	108.46 ± 2.82	110.50 ± 2.02	111.24 ± 0.94
Calcium (mg/dl)	7.30 ± 0.28	7.74 ± 0.16	7.62 ± 0.29	6.44 ± 0.71	7.26 ± 0.12	7.96 ± 0.23	7.71 ± 0.34
Phosphorus (mg/dl)	4.14 ± 0.84	3.52 ± 0.50	3.51 ± 0.42	2.35 ± 0.41	2.83 ± 0.32	4.12 ± 0.43	4.77 ± 1.32
Cortisol (µg/dl)	0.56 ± 0.10	0.57 ± 0.09	0.72 ± 0.06	0.79 ± 0.08	0.51 ± 0.04	0.73 ± 0.29	0.84 ± 0.24

Mean ±SE values don't differ significantly in same row ($P<0.05$)

anesthesia with dexmedetomidine (2.5µg/kg b.wt.) and propofol (0.25 mg/kg b.wt.) in buffalo calves. Similar observations were reported by Sharma (2011) in buffaloes undergoing diaphragmatic herniorraphy anesthetized with glycopyrrolate-xylazine-pentazocine-ketamine.

The sedation was good along with complete analgesia in the study. Induction was smooth along with excellent maintenance with isoflurane and fast recovery with no cardiopulmonary depression. So, on the basis of results observed it can be concluded that glycopyrrolate-xylazine-pentazocine-propofol sevoflurane anaesthesia is safe and effective for buffaloes undergoing diaphragmatic herniorrhaphy.

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