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Evaluation of Anaesthetic Efficacy of Xylazine-Ketamine-Guaifenesin Combination for Relieving Dystocia in Buffaloes

A.A. Nirmale[1], R.V. Suryawanshi[1], S.S. Pitlawar[1], A.D. Patil[2], N.Z. Gaikwad[3], B.M. Kondre[4]

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ABSTRACT

Background: Dystocia in dairy animals remains major concern causing huge economical losses of farmers. Over the past years, field veterinarian relieves dystocia via maneuvering, fetotomy, modified Schaffers and Cesarean methods under local or regional anaesthesia which is always stressful and painful procedure leading to excessive tissue damage. Considering the involved stress and further conception during relieving dystocia under local or regional anaesthesia is always questionable. Hence, the present study was aimed to relieve dystocia in buffalo without stress by improving gentle handling of uterus during cesarean or obstetrical method under the anaesthetic combination of Xylazine-Ketamine-Guaifenesin under field condition.

Methods: The present study was undertaken in twelve clinical cases of buffaloes with history of dystocia irrespective of age and breed and they were sedated with xylazine and subjected to obstetrical or cesarean procedure under ketamine and guaifenesin anaesthetic protocol.

Result: Twelve buffaloes with average age between 3-8 years and body weight 389.66±19.56 kg reported to hospital and amongst them eight were primiparous. Among maternal dystocia, uterine torsion was most common followed by incomplete cervical dilation whereas in foetal dystocia, malpositioned foetus and emphysematous foetus was reported. Tachycardia and hypothermia were consistent findings in all animals. The alkaline phosphatase, SGPT and SGOT has been increased significantly due to muscular damage. Mean duration of general anaesthesia required for obstetrical and cesarean procedure was 35.00±0.25 min and 132.00±0.18 min, respectively. The present study was concluded that, use of Ketamine-Guaifenesin combination premedicated with xylazine hydrochloride produced excellent muscle relaxation during obstetrical and cesarean procedure in buffaloes characterized by loss of abdominal muscle tone, stable respiration and minimal cardiopulmonary changes.

Key words: Buffalo, Cesarean, Dystocia, Guaifenesin, Ketamine, Xylazine.

INTRODUCTION

Dystocia is one of the economically important reproductive disorders in dairy animals sometimes it becomes life threatening clinical entities leading to huge economic losses to the farmers. Dystocia is defined as the inability of the dam to deliver its young one through its own efforts (Jackson, 2004). In cattle and buffalo, the incidence of dystocia is alarming as compared to other farm animals (Purohit *et al.,* 2011) due to multifactorial reasons. Buffaloes are known to have greater incidence of maternal dystocia (Nanda *et al.,* 2003). However, a higher incidence of fetal dystocia has been also recorded in both cows (Singla *et al.,* 1990) and buffaloes (Singla *et al.,* 1990; Phogat *et al.,* 1992 and Singla and Sharma, 1992).

Cesarean section in buffaloes is an emergency operative procedure being performed principally for uncorrectable uterine torsions and for delivery of fetal monsters (Khurma *et al.,* 2018). Cesarean section is a widely used emergency operative technique for delivery of calves. The fetotomy/cesarean section dilemma has been based on poor dam survival rates and poor fertility (Singh *et al.,* 2013) however many reports depicted that dam survival is high when the operation is performed early stage without mishandling (Nanda *et al.,* 1991 and Purohit *et al.,* 2011) and thus early decision to perform cesarean greatly improves the dam survival rate. Various central muscle relaxants anaesthetic drugs play an important role for relieving the torsion in cattle and buffaloes which could prevent invasive cesarean procedure. Guaifenesin has

[1]Department of Veterinary Surgery and Radiology, College of Veterinary and Animal Sciences, Maharashtra Animal and Fishery Sciences University, Udgir, Latur-413 517, Maharashtra, India.
[2]Department of ARGO College of Veterinary and Animal Sciences, Maharashtra Animal and Fishery Sciences University, Udgir, Latur-413 517, Maharashtra, India.
[3]Department of Biochemistry,College of Veterinary and Animal Sciences, Maharashtra Animal and Fishery Sciences University, Udgir, Latur-413 517, Maharashtra, India.
[4]Department of Pathology, College of Veterinary and Animal Sciences, Maharashtra Animal and Fishery Sciences University, Udgir, Latur-413 517, Maharashtra, India.

Corresponding Author: R.V. Suryawanshi, Department of Veterinary Surgery and Radiology, College of Veterinary and Animal Sciences, Maharashtra Animal and Fishery Sciences University, Udgir, Latur-413 517, Maharashtra, India. Email: drravi_7@yahoo.co.in

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been considered as muscle relaxant in buffalo calves (Singh *et al.*, 1981) however, the use of Guaifenesin (165 mg/kg IV) alone in water buffalo calves to produce complete immobilization causes significant hypotension. Cardiovascular and respiratory depressant produced by high doses of Guaifenesin are generally undesirable (Agarwal *et al.,* 1983).

Guaifenesin is centrally acting muscle relaxant with mild to moderate sedative activity. Since ancient time, majority of cesarean procedure in dairy animals was performed under local analgesia in which the pre-stressed animals use to struggle lot throughout the surgical procedure without much muscle relaxation leading to intense pain, gross contamination of surgical field and evitable postoperative complications. To overcome these anticipated intraoperative problems during cesarean, the present study was undertaken to evaluate the efficacy of xylazine-ketamine and guaifensin combination and ensure effective pain management and significant muscle relaxation will definitely improve the surgical procedure hassle free and uneventful recovery from general anaesthesia.

MATERIALS AND METHODS

Selection of animals

Total 27 buffaloes were presented with history of long-standing dystocia during buffalo calving season. Out of 27, 12 buffaloes underwent thorough obstetrical examination revealed severe uterine torsion, unable to dilate the cervix and they were evaluated for physiological parameters before (0 min), during (15, 30, 45, 60 and 90 mins) and after complete recovery from general anaesthesia to observe the changes in vital parameters.

Haemato-biochemical parameters

Blood was drawn from each animal in EDTA vial before (0 min), during (30 mins) and after 24 hours for analysis of complete blood count, alkaline phosphate (mg/dL), SGOT (mg/dL), SGPT (mg/dL), total bilirubin (mg/dL), bilirubin (mg/dL), total protein (g/dL), albumin(g/dL), blood urea nitrogen (mg/dL) and creatinine (mg/dL) to evaluate the impact of dystocia as well as said anaesthetic protocol.

Anaesthetic protocol

Animals were randomly subjected for inj. Xylazine Hydrochloride @ 0.01 mg/kg body weight as a pre anaesthetic followed by ketamine Hydrochloride 2 mg/kg body weight and Guaifenesin (25 gm in 500 ml of 5% dextrose solution). The solution comprised of guaifenesin 50 mg/mL and ketamine Hydrochloride 2 mg each mL and it was administered @1.5 ml/kg body weight intravenously for induction as well as maintenance of general anaesthesia till its effect.

Anaesthetic parameters

Quality of sedation was evaluated by observing the behavioral changes and it was graded as no sedation (0); mild (1); moderate (2) and deep sedation (3) on basis of alertness and eye reflexes. The quality of induction was assessed after intravenous injection of ketamine and guaifenesin (double drip) till the animal became calm, quiet and elicit no response to the unpleasant stimuli and graded as excellent, good, moderate and poor. The quality and depth of maintenance of anaesthesia was evaluated on basis of muscle relaxation, analgesia, various reflexes (corneal, palpebral, eyeball position, rectal pinch, *etc*.) and abdominal muscle tone. Muscle relaxation was judged by checking the jaw tone relaxation, flaccidity of tail and limb and it was graded as excellent, good, moderate and poor. The degree of pain was evaluated by observing the animal response at every 15 minutes by deep prick by using 22gauge blunt needle at coronary band. The total duration of anaesthesia and recovery time was recorded.

Statistical analysis

Data obtained in the present clinical study was analyzed by using one sample student t-test for physiological parameters while using complete randomized design one way analysis of variance (ANOVA) for anaesthetic parameter (Snedecor and Cochran 1994).

RESULTS AND DISCUSSION

Incidence

Out of 27, 12 buffaloes (44.44%) with average body weight 389.66±19.56 kg were reported during calving period; amongst them eight were primiparous suffering with dystocia since 11.83±0.85 hrs. Per-vaginal examination revealed, uterine torsion followed by two each case of incomplete uterine dilatation and malpositioned foetus and in one case; the cause of dystocia was oversized foetus. Similar incidence of dystocia was drawn by Purohit and Mehta (2006) in 103 cattle and 53 buffaloes. Srinivas *et al.* (2007) concluded that, 142 graded Murrah buffaloes had dystocia contributing about 59.16% were maternal and 40.84% were foetal causes, respectively.

Uterine torsion was most common findings followed by incomplete cervical dilation; malpositioned foetus and emphysematous foetus. In uterine torsion, four cases showed more than 180 degree whereas remaining three cases, the degree of torsion was 180 degrees. In the same way, many researchers found that, major cause of dystocia in cattle and buffaloes are uterine torsion namely Noakes *et al.* (2001) who reported 90% of uterine torsion in cattle and buffaloes; Srinivas *et al.* (2007) found 83.33% of incidence of uterine torsion leading to dystocia; Satish *et al.* (2018) reported 70.51% incidence of uterine torsion in buffaloes. Thangamani *et al.* (2019b) observed 92.63% uterine torsion in graded Murrah buffaloes.

Clinical findings

Out of 12, eleven cases (91.66%) were presented with history of complete gestation length accompanied with relaxed sacrosciatic ligaments, teat engorgement and

relaxed perineum with presence of foetal limbs outside the vulval lips. In one case (8.33%), the gestation length was incomplete showed signs of blood-tinged vaginal discharge and severe abdominal pain. Similar symptoms reported by Bisla *et al.* (2018) and Kumar and Solanki, (2018) in their study. Tachycardia was predominantly observed in all animals at 0th hrs (71.00±0.63 per minute) and it was fluctuating throughout anaesthetic procedure even after completion of surgical procedure or recovery up to 135th minute (68.17±0.44 per minute) could be due to septicemia. Body temperature in all animals at 0th hrs (102.19±0.310F) and it was decreasing trend upto 135th minute (98.72±0.550F) indicative of effect of anaesthetics. In present study, tachycardia and hypothermia was consistent finding could be due to septicemia or effect of general anaesthetic drugs on thermoregulatory system which coincides with the findings of Frazer *et al.* (1996) and Kumar and Solanki (2018).

Haematobiochemical findings

Non-significant changes were recorded in haematological values except mild neutrophilia was noticed at 0th min (49.55±6.39%) which was increased subsequently after anaesthesia (52.58±4.18%) might be due to mixed infectious. Similarly, Phogat *et al.* (1991) and Verma *et al.* (2018) observed neutrophilia and monocytosis in their study, however in present study non-significant changes were observed in monocytic count.

The average values of blood urea nitrogen and serum creatinine in all animals observed within the normal physiological range. Alkaline phosphatase in all cases were increased before (301.29±55.90 mg/dl), during (279.71±43.00 mg/dl) and after (243.23±25.42 mg/dl) relieving of dystocia or anaesthetic procedure indicative of significant rise its level may be few tissues like spleen, placenta, gastrointestinal mucosa, *etc*. in body they always possess highest concentration of alkaline phosphatase activity. Our findings are homogenously related with Pattabiraman and Pandit (1980); Hussein and Abd Ellah (2008) and Selvaraju *et al.* (2022).

The mean serum glutamic pyruvate transaminase values were 39.63±1.89 mg/dl; 42.89±1.89 mg/dl and 41.74±1.40 mg/dl revealed before; during and after relieving dystocia, respectively. There was increasing trend of SGPT level was noticed in present study indicative of significant changes could be due to cellular hypoxia or hepatocellular necrosis might produce moderate or marked elevation of serum glutamic pyruvate transaminase level (Table 1). The mean of serum glutamic oxaloacetic transaminase values were 151.93±16.96 mg/dl; 160.51±18.05 mg/dl and 156.17±16.03 mg/dl revealed before; during and after relieving dystocia, respectively showed significant alteration. The present findings are in corroboration with Ali *et al.* (2011); Jeengar *et al.* (2015) and Selvaraju *et al.* (2022).

The quality of sedation was ranged between mild to moderate drowsiness characterized by lowering head, dropping of eyelids, shifting of weight and none of animals showed untoward reaction to sedation and allowed for easy induction of general anaesthesia in lateral recumbency. The average sedation time in our study was 3.75±0.25 minute after administration of xylazine intravenously. Similarly, Hall and Clarke (2001) stated that, xylazine has been most effective sedative used in cattle and they found that, xylazine causes moderate drowsiness and lowering of head. Lumb *et al.* (2007) stated that, use of xylazine is more effective than other analgesic and opioid for relieving the visceral

Table 1: Mean average values (S.E.±) of haemato-biochemical parameters recorded during the interval of general anaesthesia in buffaloes suffering with dystocia (n=12).

Haemato-biochemical parameters	Before	During	After
Hemoglobin (g/dL)	10.73±0.75*	10.70±0.71*	10.25±0.62*
WBC (thousand/mm^3)	12.67±1.06*	12.57±0.99*	12.05±0.96*
RBC (/mm^3)	6.54±0.64*	6.86±0.52*	7.15±0.42*
PCV (%)	35.26±3.13*	37.43±2.34*	38.96±2.20*
Platelets (%)	225.93±31.63*	223.05±301.83*	247.58±34.49*
Neutrophils (%)	49.55±6.39**	54.64±4.47**	52.58±4.18**
Lymphocytes (%)	47.08±5.84*	42.11±3.61*	43.89±3.56*
Alkaline phosphate(mg/dl)	301.29±55.90**	279.71±43.00**	243.23±25.42**
SGPT/ALT(mg/dl)	39.63±1.89**	42.89±1.89**	41.74±1.40**
SGOT/AST (mg/dl)	151.93±16.96**	160.51±18.05**	156.17±16.03**
Bilirubin (Total) (mg/dl)	0.75±0.15**	0.70±0.16**	0.68±0.18**
Bilirubin (direct) (mg/dl)	0.28±0.05**	0.36±0.05**	0.39±0.05**
Total protein (g/dl)	5.53±0.27*	5.60±0.23*	5.76±0.30*
Albumin (g/dl)	2.50±0.20*	2.59±0.22*	2.93±0.25*
BUN (mg/dl)	25.89±2.21*	27.58±2.52*	28.23±3.14*
Creatinine (mg/dl)	1.24±0.08*	1.73±0.12*	1.69±0.15*

*- Non-significant; **- Significant.

pain and effectively sedate the animal which prevents the self-mutilated trauma.

Induction in eleven cases (91.66%) was smooth characterized by complete unconsciousness, loss of peripheral reflexes; however, some of them showed sluggish palpebral and corneal reflexes throughout procedure. Similar findings were reported by Schindele *et al.* (1990) in their study. Suryawanshi *et al.* (2023) used intravenous route of Inj. Diazepam @ 0.1 mg/kg and Inj. Ketamine @1 mg/kg to facilitate smooth induction Isoflurane in buffalo underwent for diaphrgmatic hernia and they found that, diazepam and ketamine found to be excellent which facilitate the induction of general anaesthesia. Ratajczak *et al.* (1993) evaluated the combination of xylazine with the muscle relaxants (guaifenesin) and anesthetics (ketamine) and they found no complication or adverse signs.

The quality of induction in all animals was ranged between good to excellent. In cases of cesarean section, continuous infusion of a mixture of Guaiphenesin-ketamine (1000 mg ketamine added to 1 litre of 5% Guaiphenesin) at approximately 2 ml/kg/hr. showed normal breathing pattern and relaxation of abdomen indicative excellent muscle relaxation or complete loss of muscle tone. Similarly, Kerr *et al.* (2007) reported that, the quality of induction with Guaiphenesin-ketamine was excellent premedicated with xylazine in buffaloes. Furthermore Dhawale *et al.* (2019) observed that, overall quality of induction of anaesthesia was good with Xylazine-ketamine-guaifenesin in cattle, sheep and goats.

In present study, Guaiphenesin produced moderate muscle relaxation in six cases (50.00%) in which the dystocia were relieved *via* maneuvering and modified Shafer's techniques whereas in remaining six cases, cesarean was performed under ketamine and Guaiphenesin drip was continued till completion of procedure showed excellent muscle relaxation characterized by shrinking of flank with minimal change in cardiopulmonary function remains stable in correspondence with william *et al.* (2007).

Mean duration of anaesthesia in present study for maneuvering technique and cesarean section was a 35.00±0.25 minute 132.00±0.18 minutes, respectively. The longest duration of anaesthesia *i.e.* 95 minutes were recorded for cesarean section for handling of gravid uterus, maneuvering of fetus, removal of placenta, lavage of uterus, uterine suturing, abdominal suturing, *etc*. Similarly, Thurmon (1986) found that, major surgical procedures like cesarean section and hernia can be performed by using Guaifenesin-ketamine-xylazine in cattle. Tank (2017) reported an average of 82.16 mins duration of anesthesia induced by ketamine, guaifenesin and maintained on isoflurane in butorphanol premedicated bovines.

The mean average score of relaxation jaw, limb and tail muscles in cases of maneuvering and cesarean section were 2.167±0.307 and 1.66±0.218, respectively. The excellent to good muscle relaxation was observed under ketamine and guaifensin anaesthesia featured by abdominal distention and stable respiratory rate. William *et al.* (2007) stated that, muscle hypertonus is a feature of ketamine-based protocol and it should not consider as light level of anaesthesia. Good relaxation was noticed in animals that underwent for maneuvering technique for relieving dystocia whereas excellent muscle relaxation was recorded in the animals in cesarean section could be due to continuous infusion of a mixture of Guaiphenesin-ketamine maintained depth of anaesthesia with non-significant alteration of cardiopulmonary function in accordance with Dhawale *et al.* (2019). Degree of analgesia in all cases was observed to be moderate to excellent quality, characterized by occasional to no response to pin prick at coronary band. Khyum *et al.* (2021) observed that, guaifenesin as an adjunct to xylazine-ketamine was better than the induction rather than addition of Midazolam in cattle.

In our study, initially there was transient yet complete loss of gag reflex soon after induction of ketamine-guaifensin. However, during maintenance of anaesthesia, eight animals showed complete loss of gag reflex, three animals showed sluggish gag whereas in one animal, presence of tongue movement indicative of plane level of surgical anaesthesia. However, in ruminants jaw muscle tone always tonic or may be sluggish and this parameter signs cannot be used to evaluate the depth of anaesthesia as described by William *et al.* (2007). In cases of cesarean section (6 cases) and partial fetotomy (1 case), the position of eyeball remains in the center indicative of deep level of surgical anaesthesia whereas in remaining cases the position of eyeball was located laterally (2 cases), latero-ventral (1 case), latero-medial (1 case) and medially (1 case). Similarly, William *et al.* (2007) reported that eye ball never rotates in ketamine anaesthesia and remains at centre whereas nystagmus may indicate light level of anaesthesia in ruminant and swine.

In our study all animals were anaesthetized by the end of cesarean procedure just to avoid self-trauma. Sometimes there is no obligatory association between level of anaesthesia and physiological responses to anaesthesia; light level does not preclude severe hypotension or hypoxemia. William *et al.* (2007) emphasized that, the anaesthetic level and its requirement is depending upon the magnitude of surgical stimulation, redistribution of drugs and its site and variation in body temperature.

Out of 12, nine animals (75.00%) showed smooth, uneventful and fast recovery and they assumed their water and feed intake after surgical or obstetrical procedure. Two animals (16.66%) showed signs like prolonged but smooth recovery characterized by shallow breath, intermittent tail and limb movement and changing sternal and lateral recumbency frequently. One animal (8.33%) showed little bit struggling and paddling could be arrtibuted to hallucination effect of ketamine. Similar anaesthetic recovery observed by Hall and Clarke (2001) in cattle with xylazine-ketamine-guaifenesin combination followed by Yamashita *et al.* (1996) and William *et al.* (2007) in their studies.

CONCLUSION

It was summarized that, guaiphenesin and ketamine produced excellent to good muscle relaxation during obstetrical and cesarean procedure to relieve dystocia in buffaloes could be due to depression of impulses at the internuncial neurons of the spinal cord, brain stem and subcortical regions of the brain characterized by loss of abdominal muscle tone, stable respiration and minimal cardiopulmonary changes.

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Conflict of interest

This is to certify that, the research article or its data has not been sent/will not be sent elsewhere for publication. It also declares that, all authors of this article do not have conflict of interest.

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