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COMPARISON OF PHYSIOLOGIC AND ANALGESIC EFFECTS OFXYLAZINE/KETAMINE, XYLAZINE/LIGNOCAINE, AND LIGNOCAINE ANAESTHESIA IN WEST-AFRICAN DWARF GOAT

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SUMMARY

The physiologic and analgesic effects following injections of xylazine/ketamine (0.05/10mg/kg) intramuscularly (IM), xylazine/lignocaine (0.05/10mg/kg) IM /subcutaneously (SC) and Lignocaine (10mg/kg) SC were evaluated in mature, non-fasted West- African Dwarf (WAD) goats for a period of 80 minutes during rumenotomy. The duration of analgesia obtained were 28±5.4 minutes for xylazine/ketamine (XK), 24±1.2 minutes for xylazine/lignocaine and 29.25±9.6 for Lignocaine (L). The mean heart rate (HR) in XK and L group were significantly ($P < 0.05$) higher between 10–30 minutes post treatment compared to the XL group. The mean respiratory rate (RR) in XL group was significantly($P < 0.05$) low whereas the mean rectal temperature (RT) was significantly ($P < 0.05$) low in XK group. Notable side effects were salivation (100%) in all experimental animals. Urination was observed to be 25% and 50% in XK and XL groups respectively. Grunting was observed in 50% of the animals in both XK and L groups while breath-holding was observed in all the groups. However no animal regurgitated or aspirated during the procedure. It was concluded that whereas the three treatments produced short duration of analgesia compared to what is required for the intended procedure, XK and XL treatments offered better operating condition. None of the treatments adversely affected the physiological parameters under consideration.

KEYWORDS: Physiologic, anaesthesia, xylazine, ketamine, Dwarf goats

INTRODUCTION

The current upsurge of interest in the goat as a source of meat in most parts of West Africa there is an increased demand for veterinary services in the field or operating theatre. Goats are tractable and may tolerate physical restraint provided the associated discomfort is minimal. The use of general or local anaesthetics plus sedative helps to minimize excessive movement and vocalization (Adetunji and Ogunyemi, 1998). Commonly used anaesthetics in ruminant anaesthesia include ketamine, saffan and lignocaine (Hall and Clarke, 1991).

Bowen (1977), Green *et al* (1981) and Gray and McDonell (1986) have demonstrated notable undesirable properties of the sole use of ketamine as injectable anaesthesia in ruminants. In spite of its undesirable side-effects, like increased muscle tone, tendency to cause excitement at induction and during recovery, ketamine possesses a wide therapeutic index and permits retention of coughing and swallowing reflexes which are desirable properties in the small ruminant (Hall and Clarke, 1991). Thus to counteract ketamine side effects, the drug has been combined with sedatives, including xylazine (Green *et al*, 1981, Muir, 1985). Successful use of xylazine/ketamine

combination in sheep (Nowrouzian *et al*, 1981) and goats (Gray and McDonell, 1986; Taylor, 1991, Adetunji and Ogunyemi, 1998) has been reported. This combination has been reported to produce satisfactory muscle relaxation than does ketamine alone. Also Kumar *et al* (1976), Keller and Bauman (1978), Mohammed and Yelwa (1993) and Adetunji and Ogunyemi (1998) reported that the combination produces good, safe and dependable anaesthesia.

Sheep and goat are ideally suited to local anaesthetic techniques under sedation or manual restraint (Taylor, 1991). Lignocaine is the most widely used and well tolerated local anaesthetic in these specie (Taylor, 1991). Toxic effects of lignocaine however occur at high doses and includes drowsiness, respiratory depression and convulsion (Taylor, 1991). Local infiltration of lignocaine is commonly used in sheep and goats, and the most commonly useful regional blocks in these specie are the paravertebral block, cornual block and the "L" block (Taylor, 1991). However although "L" block is easy to perform, large volumes of the anaesthetic is usually required. Its use is characterized by lack of muscle relaxation and no analgesia of visceral peritoneum, thus necessitating use of a sedative prior to local infiltration of lignocaine. Xylazine is commonly administered by practicing veterinarians as a form of chemical restraint and to provide good muscle relaxation and visceral analgesia prior to lignocaine infiltration. Although the sole use of lignocaine infiltration, or in combination with xylazine is widely practiced, proper assessment of the physiologic effects should be important to any practicing veterinarian.

This study was therefore undertaken to compare the physiologic and analgesic effects of the used doses of xylazine/ketamine, xylazine/lignocaine and lignocaine anaesthesia in WAD goats. The side -effects of these combinations results were also compared .

MATERIALS AND METHODS

Experimental animals

Twelve mature West African Dwarf (WAD) goats with mean body weight 4.5kg and age 3.5 months were used for the study. The goats were housed in a loose pen inside the animal house of the Faculty of Veterinary Medicine, University of Nigeria, Nsukka, Nigeria. They were fed fresh pasture and water *ad-libitum*.

During the acclimatization period which, lasted for 2 weeks, the goats were dewormed with Ivermec super® (Merial) and also vaccinated with PPR vaccine (NVRI, Vom, Nigeria) immediately they were bought. Procaine penicillin® (Helm Pharmaceuticals) 10,000 I.U/ kg and Streptomycin® (Antibiotics S.A) 10mg/kg were given for 5 days to obviate any possible bacterial infection. During this period and throughout the experiment, the clinical parameters were taken daily.

Animal grouping

The experimental animals were randomly distributed into three groups of four goats each. Group I (control treatment) animals were anaesthesized with Xylazine/ketamine. Xylazine,® (Indian Immunological Ltd) was administered at 0.05mg/kg intramuscularly (IM) . This was followed 5 minutes later with ketamine,® (Rotexmedica) at 10mg/kg IM. Group II animals were anaesthesized using lignocaine® (Hans-E-Lembcke, Germany) at the dose rate of 10mg/kg SC, using inverted "L" block. Group III animals were

anaesthesized using xylazine/lignocaine. Xylazine was given IM at a dose rate of 0.05mg/kg. This again was followed 5 minutes later by SC infiltration of lignocaine hydrochloride at the flank using inverted "L" block.

Clinical parameters and anaesthetic monitoring

Prior to surgery the animals were restrained and clinical parameters were taken, namely; the heart and respiratory rate and rectal temperature. The values obtained at time 0 served as baseline values. These physiological variables were monitored every 10 minutes thereafter till the end of the surgery (rumenotomy).

The heart rate (beats/minute) and the respiratory rate (breaths/minutes) were obtained with the aid of pre-cordial stethoscope and visual observation of thoraco-abdominal movement. The rectal temperature was monitored using a clinical thermometer.

Following induction, onset of analgesia was assessed in all treatment groups by the goats response to forcipressure on the left flank using a haemostatic forceps. The duration of analgesia was calculated from time of loss of pain at the flank to return of pain. Pain was deemed present when the animals bleated or moved in reaction to surgical manipulation at the operating site. Additional drugs were administered at one-third the initial dose following onset of pain on surgical manipulation. Side effects such as ruminal tympany, regurgitation, aspiration, breath holding, salivation, grunting, phonation, urination and defecation were noted throughout the period of surgery.

Surgical procedure

The routine, sterile pre-surgical preparation of the subject's flank (restraint, scrubbing, shaving, disinfection and draping) were performed as described by Knecht *et al* (1987). The head was lowered at the poll during surgery to achieve postural drainage since the animals were not intubated. Rumenotomy was carried out as described by Oeheme (1988). This involved a laparatomy incision which, was made on the left flank. The rumen was exteriorized and packed off with gauze to avoid seepage of its content into the abdominal cavity. This was followed by incision into the rumen. The rumen was then closed using inverting lembert suture with 2/0 chromic catgut. The peritoneum and muscles were sutured using simple continous pattern and size 2/0 chromic catgut. The skin was sutured with silk size 2/0 using horizontal mattress suture pattern.

Post-surgical care

After surgery, the flank was cleaned and the wound dressed with oxytetracycline spray, while the animals were placed on streptopen® (Dantex Holland, B.V) for 5 days.

Data analysis

The data were presented as mean ± SD. The physiological variables were compared using analysis of variance for repeated measures (ANOVA). P values less than ($P < 0.05$) were considered significant. The side-effects were expressed in percentage.

RESULTS

Duration of analgesia

Whereas rumenotomy lasted for about 80 minutes, the duration of analgesia obtained in the three animal groups were; 28.25 ±5.4

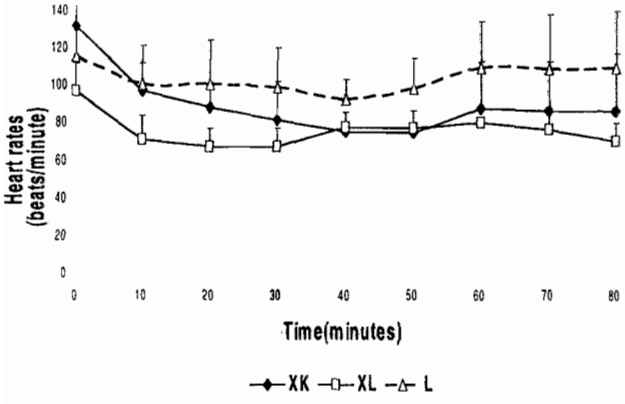
minutes (XK), 24.0 ±1.2 minutes (XL) and 29.25 ±9.6 (L) groups respectively.

Physiological variables

Heart rate (HR)

The three treatments equally displayed a general reduction in the HR per time period of the procedure which varied amongst the groups, (from 10 – 50 minutes in XL, 10–20 minutes in XL and 10–40 minutes in L treatment group). The mean HR for XK and L groups were significantly ($P < 0.05$) higher between 10–30 minutes of anaesthesia than the XL group. (Fig 1)

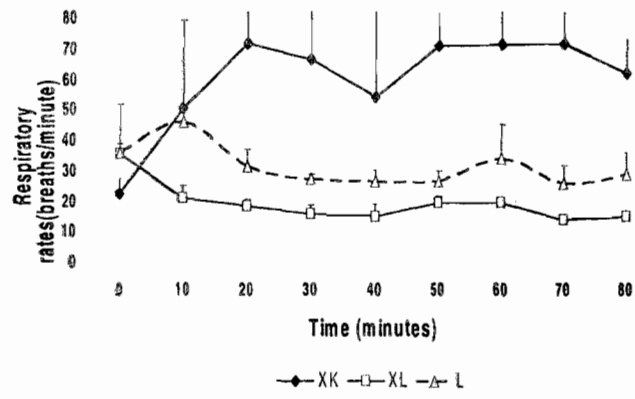
FIG 1:Changes in heart rate



Respiratory rate (RR)

The respiratory rate was observed to increase following induction with XK drug combination but declined in XL and L groups. The mean RR in XL group were significantly ($P < 0.05$) low in XL group compared to the other two groups studied (Fig 2)

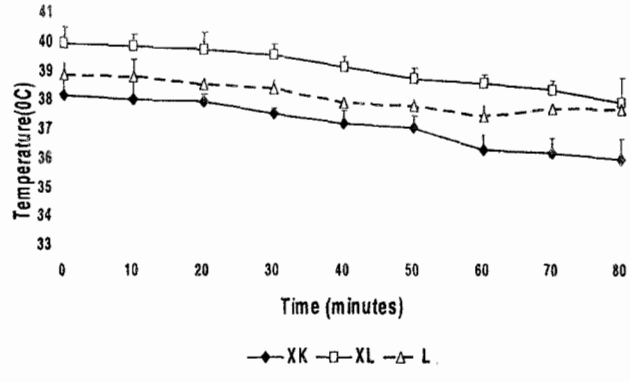
FIG 2: Changes in respiratory rates



Rectal temperature (RT)

The three treatments groups showed a general decline in rectal temperature throughout the duration of the procedure. The decrease was observed to be significant ($P < 0.05$) at 20–70 minutes of the procedure in the XK group compared to the XL and L groups (Fig 3).

FIG 3: Changes in temperature



Side effects

Bloat was observed only in one animal (25%) in XL treatment group whereas salivation was observed in all (100%) of the animals in the three treatment groups. It is worthy to note that though salivation was common in all the animals, it was more profuse in XK and XL groups. Defecation,

regurgitation and aspiration were absent in all the groups. Urination was recorded in 25% and 50% animal in XK and XL groups respectively (Table 1). Again, grunting and phonation were recorded in 50% of the animals in both XK and L groups while breath-holding was common in all the groups - XK (75%), XL (75%) and L (50%).

DISCUSSION

The result of this study shows that analgesia lasted for 28 ± 5.4 minutes in XK, 24 ± 1.2 minutes in XL and 29.3 ± 9.6 in L treatment groups. The use of 0.03–0.05 mg/kg intravenous (iv) xylazine followed by 3–5 mg/kg IV ketamine in small ruminants has been reported to produce 15–30 minutes period of anaesthesia (Green and Thurmon, 1988; Taylor, 1991, Caroll and Hartsfield, 1996). Adetunji and Ogunyemi (1998) evaluated the anaesthetic qualities of single IM injection of 0.15mg/kg xylazine, followed 10 minutes later by 7.5 mg/kg IV ketamine in mature non- fasted WAD goats. The authors reported an anaesthetic time of 46.8 ± 17.2 minutes .The different dosage and routes of administration used in this work probably accounts for the duration of anaesthesia obtained in XK group. Search through the literature did not reveal any duration of analgesia following local infiltration of lignocaine in goats. However, use of 0.5–1% lignocaine for local infiltration in man has been reported to give 30–60 minutes duration of action (Brunner and Eckenhoff, 1981). These periods of analgesia obtained in the 3 groups were too short for the 80 minutes duration of surgery thus necessitating injection of additional anaesthetics.

The cause of the initial decline in heart rate in all groups is unknown. The heart rate (HR) obtained for XK and L treatment groups were however observed to be significantly ($p<0.05$) higher between 10–30 minutes of anaesthesia compared to XL treatment group. The higher HR observed in XK group may probably be due to the cardio-stimulatory effect of ketamine. Ketamine is known to cause cardiac stimulation by sympathomimetic effects mediated within the central nervous system, (CNS) (Altura *et al*, 1980, Ivankovitch *et al*, 1974). This cardio- stimulatory effect of ketamine may have obtunded xylazine bradycardic effect, which was evident in XL treatment group; thus the lower HR observed. The mean HR of L group was observed to have the highest values throughout the anaesthetic period. Lignocaine has been reported to have a stabilizing action during cardiac irregularities and is also known to maintain cardiac output and myocardiac contractility (Hall and Clarke, 1991)

TABLE 1: Side-effects

Side-effects.	Xylazine-ketamine(XK)	Xylazine-lignocaine(XL)	Lignocaine(L)
Regurgitation	0%	0%	0%
Aspiration	0%	0%	0%
Bloat	25%	0%	0%
Grunting	50%	0%	50%
Defecation	0%	0%	0%
Phonation	50%	0%	50%
Breath-holding	75%	75%	50%
Urination	25%	50%	0%
Salivation	100%	100%	100%

Whereas the mean respiratory rate (RR) was observed to be significantly low in XL treatment group, it was higher in XK group .This low RR in XL group could be attributed to the effect of both xylazine and lignocaine. Kumar and Thurmon (1979) reported significant reduction in rate of breathing following IM administration of Xylazine. Bronchial smooth muscle relaxation and some respiratory depression are also notable systemic effects of local anaesthetics like lignocaine (Hall and Clarke, 1991). However the observed higher RR in XK group could be attributed partly to the over-riding respiratory effect of ketamine. Ketamine is said to differ from other anaesthetics in that it does not depress ventilatory response to hypoxia (Branson *et al* , 2001). Skeletal muscle tone is maintained or even increased, thus arterial oxygenation and functional residual capacity are usually maintained during ketamine anaesthesia (Domino *et al.*, 1986, Mankikan *et al.*, 1986).

The mean rectal temperature (RT) in all treatment groups showed a general decline throughout the duration of surgery. This could be attributed to the effect of surgery on this parameter. Body temperature has been shown to decline following surgical preparation (like wetting, shaving, swabbing with alcohol etc), and during surgery involving exteriorization of large amount of viscera as these leads to evaporation and increased heat loss (Watermann, 1975). However, the RT for XK treatment was significantly ($p<0.05$) low compared to the other treatment groups. This fall in RT observed in XK group may be due to the combined effect of general anaesthesia (Watermann, 1975; Holdcroft, 1980) and surgery. The RT in the three groups was however maintained within the physiological limit at the end of surgery. However, considering the drop in RT observed during surgery in the 3 groups, proper thermoregulation is thus important in surgeries in which these combinations are used for anaesthesia in goats.

Salivation was a notable side-effect and was observed in all experimental groups (Table 1). Ruminants are known to salivate continuously, even during anaesthesia (Taylor, 1991). In this study, it was however more pronounced in XK and XL groups. Both xylazine and ketamine have been reported to cause increased salivary secretion in ruminants (Trim, 1981). Although salivation is an obvious indication for concurrent use of atropine during premedication, the use of atropine as a drying agent in ruminants is presently under controversy (Gray and McDonell, 1986; Hall and Clarke, 1991). Thus to ensure drainage of saliva and avoid possible aspiration, postural drainage was employed during the procedure (Gray and McDonell, 1986, Adetunji and Ogunyemi, 1998)

Grunting and phonation were observed in XK and L groups (Table 1) .Use of XK combination is associated with retention of oropharyngeal reflexes due to the "dissociative" effect of ketamine (Hall and Clarke 1991, Adetunji and Ogunyemi, 1998). Grunting was also seen in L group probably due to its route of administration, though lignocaine has not been reported to abolish oropharyngeal reflex. However the abolition of oropharyngeal reflex in XL group may be ascribed to xylazine effect on the reflex.

Urination observed in XK and XL groups would have been induced by the xylazine component of the mixture. Passage of urine during surgery will wet drapes and cause

break of asepsis. Omamegbe and Sundaravadanan (1985) in a study of the effect of 0.03 mg/kg xylazine on some serum enzymes, protein and glucose levels in WAD goats, reported hyperglycemia which might cause osmotic diuresis especially in well hydrated animals.

Regurgitation with consequent aspiration was not observed in the study subjects probably due to retention of oropharyngeal reflexes in XK and L groups. It was however surprising to note the absence of regurgitation in XL group where oro-pharyngeal reflex was observed to be absent. The absence of regurgitation may be attributed to the absence of increased intra-ruminal pressure (resulting from bloat, which did not occur) in these animals. It is also important to note that surgical manipulation of the rumen and the visceral organs did not precipitate regurgitation in all the animals. The absence of regurgitation in all the animals contradicts the earlier fear of Trim (1981) who suggested that surgical procedures involving handling of the rumen and viscera may precipitate regurgitation.

Breath-holding was observed in the experimental groups though more pronounced in XK and XL groups. Apnoea is a noted effect of xylazine and ketamine (Hall and Clarke, 1991). From this study, the various drug mixtures had no untoward physiological effect on the experimental goats, since the observed clinical parameters were within the acceptable physiological base values. Though XK was observed to cause more pronounced increase in RR while lignocaine maintained the mean HR at higher value. The mean RT was significantly ($p<0.05$) low in the XK group by the end of surgery. More fascinating was the absence of regurgitation in the cause of surgical manipulation of the rumen and the associated viscera. Again, XK and XL groups were more quiet following induction.

It was concluded that though the three drug combinations used did not produce enough analgesic time for the procedure. XK and XL drug combinations offered a better operating condition. None of the treatments adversely affected the physiological parameters under consideration.

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