

ALCOHOL BLOCK OF THE DISTAL VENTRAL) SACRAL NERVES OF THE BOVINE
SPECIES AS) A METHOD OF CONTROLLING RECTAL TENESMUS

by

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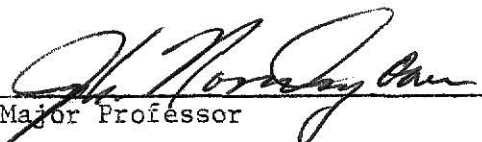
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PART I: ALCOHOL BLOCK OF THE DISTAL VENTRAL SACRAL NERVES OF CATTLE
AS A METHOD OF CONTROLLING RECTAL TENESMUS

INTRODUCTION

Rectal tenesmus is painful, prolonged, ineffectual rectal straining.

Rectal tenesmus in cattle can result from chronic specific diarrhea as caused by coccidia, bacteria, viruses, ingestion of low grade enterotoxic material, or non-specific diarrhea (Anon., 1966; Blood and Henderson, 1968). Obstinate constipation may also cause irritation of rectal mucous membrane resulting in tenesmus.

In adult animals, rectal tenesmus can result as a complication of vaginal prolapse induced by protracted dystocia, injury to the rectal mucous membrane from faulty manipulation or false copulation (Roberts, 1971). There appears to be an increased incidence of rectal tenesmus in feed-lot cattle since stilbesterol feeding became widespread (Blood and Henderson, 1968).

Rectal tenesmus frequently results in rectal prolapse or tenesmus may be induced after the rectum had already prolapsed. The presence of tenesmus brings about a more extensive prolapse, and if not controlled or eliminated, it is difficult to prevent recurrence of rectal prolapse after correction (Marsh, 1965). Such an animal requires medical attention with prolapse recurrence; as such, the animal is usually sold for slaughter. Discomfort caused by rectal tenesmus may be a factor causing poor appetite and poor weight gain in affected animals. It is economically important to the livestock industry.

If the nerves innervating the distal segment of rectum and perineum are selectively blocked with alcohol, it is possible to control tenesmus on a long-term basis, and possibly prevent recurrence of rectal prolapse post-reduction.

The purpose of this study was to develop a simple method for identifying and blocking the middle and caudal hemorrhoidal nerves in cattle to control rectal tenesmus on a long-term basis, and thus possibly prevent rectal prolapse recurrence after the underlying cause has been removed.

Certain methods have been described in controlling rectal tenesmus in cattle.

Low epidural injection of 3-8 ml of isopropyl, ethyl or benzyl alcohol have been used as a salvage procedure to control rectal tenesmus which frequently accompanied rectal prolapse (Roberts, 1971). This has been effective in long-term control of rectal tenesmus, but leaves the tail paralyzed. There is also the risk of introducing pathogenic organisms into the spinal canal with resultant septic myelitis. Hence, this method has limitations--especially in dairy cattle.

Tracheotomy has been used in preventing tenesmus in cattle with prolapsed rectum (Roberts, 1971). The danger of secondary bacterial pulmonary infection and the free access of dust into the trachea coupled with constant attention of cleaning the tracheal tube gave this method little support.

Artificial pneumoperitoneum has been claimed to have 70-80% success in controlling rectal tenesmus in cattle and sheep due to inflammatory or traumatic lesions of the rectum, vulva, vagina or uterus, or straining due to unknown causes (Esperson, 1962; Oehme and Prier, 1974). This method is reported to control tenesmus for a week or more. Subcutaneous emphysema and abortion in pregnant cows and ewes were some of the complications encountered (Roberts, 1971).

Subcutaneous resection of the inflamed mucosa has been used indirectly to control tenesmus during surgical reduction of rectal prolapse

(Arthur, 1964; Johnson, 1943; Gibbons, Catcott and Smithcors, 1970).

Intermittent low caudal epidural anesthesia has been used to control rectal tenesmus (Roberts, 1971).

Mild tenesmus has been controlled by ointments containing local anesthetic agents such as Benzocaine¹ and Nupercaine;² tranquilizers have also been used. Mild laxatives have been used to control constipation where such was the underlying cause of rectal tenesmus (Giessen, 1968; Roberts, 1971; Anon., 1973).

This study was designed to develop a method for controlling rectal tenesmus by blocking the distal ventral sacral nerves.

MATERIALS AND METHOD

Each cow was stanchioned and ropes were used on the side to prevent side to side and forward and backward movements; hock hobbles were used to prevent kicking.

The skin was shaved for 8 cm on either side of the third sacral vertebra through the first coccygeal vertebra. The area was washed with soap and dried, and swabbed with Surgical alcohol.³

A pre-injection pin-prick sensitivity test of the perineum was performed on each cow with a sterile 4 cm-22 gauge hypodermic needle.⁴

¹Benzocaine, Beutlich, 7006 N. Western Ave., Chicago, Ill. 60645.

²Nupercaine, CIBA; Division of CIBA, Geigy Corporation, Summit, N.J. 07901.

³Surgical alcohol, prepared in Dykstra Veterinary Hospital, K.S.U., Manhattan, Ks. 66506.

⁴ECO Hypodermic needles, Eisele & Co., Inc., Nashville, Tenn.

The external anal sphincter tone of each animal was determined by assessing the degree of resistance to rectal insertion of fingers. The anal opening was observed for closure on withdrawal of the fingers.

The left hand was gloved and sleeved. The gloved hand was lubricated with a non-irritating soap. The hand was shaped like a cone and gently introduced into the anus. The rectum was dilated with a slow, rotating wrist motion. Defecation was usually induced. The arm was then re-introduced and the rectum cleared of remaining feces. With the introduction of the arm, straining may be induced and peristaltic waves were usually strong enough to prevent further unforceful introduction of the arm. If force was used, there was a tendency for the rectal mucosa to be damaged. This was prevented by cautious manipulation.

With the rectum cleared of feces, the hand was re-introduced after which the palm was turned upward; the concave surface of the sacrum with small prominencies at intervals (indicating the fused bodies of sacral vertebrae) and a median groove carrying the middle sacral vessels were palpated. With the middle finger on the median groove, the index and fourth fingers were laterally placed, and the first ventral sacral foramina were identified (one on either side of the median groove) as depressions lateral to the fused bodies of the sacral vertebrae. With the middle finger placed against the median groove and the fourth and index fingers laterally placed, the hand was gradually brought backwards (feeling for the succeeding lateral depressions on the body of fused sacral vertebrae at the same time) until the fourth ventral sacral foramina were located. Each ventral branch of the nerve felt like a cord as it emerged from its corresponding foramen. Each nerve was followed laterally for a short

distance. These nerves were confirmed to be middle hemorrhoidals by sudden contraction of the anal sphincter muscles upon digit pressure.

With fingers identifying the fourth ventral sacral foramina, the hand was further brought backwards, and the succeeding depression felt between the body of the last sacral vertebra and the transverse processes of the first coccygeal vertebra was the fifth ventral sacral foramen. These nerves, caudal hemorrhoidals, were much smaller in diameter than the middle hemorrhoidals.

Having located the fourth ventral sacral foramina per rectum, the index finger of the left hand was used in applying slight pressure at the left side and overlying skin was raised slightly.

With the right hand, a sterile 20 gauge 10 cm hypodermic needle¹ was inserted at the point of skin elevation and directed forwards and downwards at about 45° angle, passing through the skin, croup muscles, lateral sacral ligament and the left fourth dorsal sacral foramen. To be certain the needle went in the right direction and the tip at the ventral sacral foramen, the point of the needle was allowed to touch the nerve slightly. As the needle touched the nerve, the anal sphincter muscles contracted and the cow kicked. Sometimes, the tip of the needle deviated and struck the anterior border of the dorsal sacral foramen or the transverse process of the sacral vertebra; the needle was retracted slightly and redirected at an increased angle to enter the dorsal sacral foramen.

Caution was taken not to penetrate the rectal lumen to avoid contamination of the nerve and perineural tissues.

¹Hypodermic needle, Eco Stainless Hypodermic needles, Eisele & Co., Inc., Nashville, Tenn.

With the needle in position, a 2-ml plastic syringe containing 1.0 ml of the agent to be injected was fixed to the needle using the free hand. The position of the needle was checked and then the agent was slowly injected to obtain maximum contact with the nerve as it emerged from the foramen.

The fourth right ventral sacral and the fifth ventral sacral foramina were similarly located and the corresponding nerves identified--using the fourth finger in locating the foramen on right side and the index finger for the left side. The above procedure for needle insertion and injection of agent were previously described.

Seven clinically healthy Jersey cows were used, each weighing between 420 and 450 kgm, and were divided into three groups. Group A cows (ear-tag numbers 01, 02 and 03) were injected with 1 ml 95% isopropyl alcohol¹ at each site of fourth and fifth ventral sacral foramina. (Isopropyl was preferred to ethyl alcohol because of easy availability and low cost.) Group B cows (ear-tag numbers 04, 05 and 06) had 1 ml 2% Lidocaine² infused at each site of fourth and fifth ventral sacral foramina. Group C (ear-tag number 07) was injected with 1 ml sterile physiological saline at each site of fourth and fifth ventral sacral foramina. Groups B and C served as control groups.

At ten minutes post injection of each agent, clinical observations were made. These included superficial and deep response perineal pin pricks,

¹95% Isopropyl alcohol, Union Carbide Corp., 6901 West 63rd St., Shawnee Mission, Ks. 66201.

²2% Lidocaine HCl injection U.S.P., McGaw Laboratories, Division of American Hospital Supply Corporation, Glendale, California 91201.

reflex defecation on anal irritation, urination and defecation pattern, anal sphincter tone, and tail use.

Weekly observations were made for five weeks.

RESULTS

Before injecting the various agents, all cows responded to superficial and deep pin-pricks over perineum as evidenced by spasms of the perineal skin, kicking and struggling each time an area was pricked.

All cows had tone in the anal sphincter muscles as evidenced by resistance to finger insertion. Reflex defecation was present in all cows because of anal irritation by fingers. There was adequate closure of the anal opening post withdrawal of fingers from the rectum. Tail use was normal in each cow. No injury or defect was observed in the perineal region of any cow. Defecation and urination were observed to be normal in all cows used.

Group clinical observations after drugs were administered are tabulated (Tables 1-3). Detailed clinical observations on individual cows are given in Appendix I.

DISCUSSION

Isopropyl alcohol is neurotoxic while physiological saline is not. Cows in group A had isopropyl alcohol treatment while the cow in group C had physiological saline. Cows in group A had long term desensitization of the perineum as reflected by lack of pain response to perineal pin pricks for five weeks. Cows in group C responded to perineal pin pricks throughout the period of observation. Cows in group A had loss of tone in the external anal sphincter muscles. There was resistance to rectal insertion

of fingers in group C cow throughout the period of observation. Peristaltic waves in the distal segment of rectum in cows in group A were weak, but strong in group C cow. Reflex defecation was observed in group C cow but not in group A cows. Cows in both groups retained normal tail use.

Differences in both groups was due to the neurotoxicity of alcohol, and since peripheral nerve regeneration takes months, perineal desensitivity persists. This controls tenesmus and would permit an accompanying rectal prolapse to remain corrected.

The cows in group B had 2% Lidocaine treatment. Lidocaine gave short-lived perineal desensitivity to group B cows--for an average time of 30 minutes. Group B cows remained sensitive to perineal pin pricks thereafter and throughout the observation period.

Single treatment with 95% isopropyl alcohol resulted in prolonged perineal desensitization without interference with appearance of the perineum or tail use. Comparable results with 2% Lidocaine would require injections being repeated every 30 minutes. This would not be practical or economical in terms of time, labor and Lidocaine used. Risk of infection at the injection site would be greatly increased.

Results from this study indicate that a single injection of isopropyl alcohol is a practical method for controlling rectal tenesmus in cattle. Since middle and distal hemorrhoidal nerves in cow also innervate the external genitalia, isopropyl alcohol treatment could be used in controlling tenesmus resulting from prolapsed genitalia.

SUMMARY

In this study, a simple technique of selectively blocking the middle and caudal hemorrhoidal nerves in cow was undertaken to control rectal tenesmus. Nerves were located and identified via the rectum.

Group A cows had 1 ml 95% isopropyl alcohol injected around each nerve as it emerged from its ventral sacral foramen by going through the corresponding dorsal sacral foramen. Group B cows received 1 ml 2% Lidocaine, and group C cow 1 ml sterile physiological saline. Clinical observations were continued for five weeks.

Cows receiving isopropyl alcohol (group A) had perineal desensitization throughout the observation period and normal tail use. There was loss of external anal sphincter muscle tone. Desensitization lasted about 30 minutes in group B cows, while the perineum was sensitive to pin pricks throughout the observation period in group C cow.

It was concluded from the study that rectal tenesmus in cattle can be effectively controlled by a single injection of 1 ml 95% isopropyl alcohol.

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Table 1. Response of cow (group C) after receiving 1 ml physiological saline injection around middle and caudal hemorrhoidal nerves^a

External anal sphincter tone	Peri-anal sensitivity	Peri-vulval sensitivity	Defecation	Urination	Tail-sensory and motor response
No relaxation of external anal sphincter muscles throughout the period of observation. Resistance to the rectal insertion of hand and tight closure of the anal opening post withdrawal of hand from rectum.	Continual response to superficial and deep pin pricks.	Pain response to pin pricks to the vulval lips, dorsal and ventral commissure of the vulva at all times.	Voluntary and reflex defecation were observed. Fecal consistency was normal.	Stream-lined voluntary urination was observed. The reflex urination was also present.	Tail skin responded to superficial and deep pin pricks. There was no loss of tail tone.

^a Around 4th and 5th ventral sacral foramina.

Table 2. Response of cows (group B) after receiving 1 ml 2% Lidocaine injection around middle and caudal hemorrhoidal nerves^a

External anal sphincter tone	Peri-anal sensitivity	Peri-vulval sensitivity	Defecation	Urination	Tail-sensory and motor response
Relaxation of the external anal sphincter muscles in each cow about 10 minutes post injection. No resistance to rectal insertion of hand, and anal opening remained patent after withdrawal. Diameter of the anal opening was 0.8 to 2 cm. Complete tone returned to external anal sphincter muscles about 30 minutes after injection, and resistance was again experienced to hand insertion.	No pain response to superficial and deep pin pricks about 10 minutes after injection. Normal sensitivity returned about 30 minutes later.	No pain responses to superficial and deep pin pricks about 10 minutes after injection. Lasted about 30 minutes, and then sensitivity returned to normal.	Voluntary defecation was not observed about 10 minutes after the injection. Reflex defecation was not observed in any cow. Distal segment of rectum was empty in each cow, but peristalsis was present. Approximately 30 minutes after injection, reflex defecation was observed in cow--#04. Reflex defecation was consistent in all cows thereafter, but not voluntary defecation.	Neither voluntary nor reflex urination was observed about 10 minutes after injection. Returned to normal approximately 30 minutes later.	There was a pain response to superficial and deep pin prick tests at the tail. Tail maintained its normal tone and sensitivity in all cows throughout the test period.

^a Around 4th and 5th ventral sacral foramina.

Table 3. Response of cows (group A) after receiving 1 ml 95% isopropyl alcohol injection around middle and caudal hemorrhoidal nerves^a

External anal sphincter tone	Peri-anal sensitivity	Peri-vulval sensitivity	Defecation	Urination	Tail-sensory and motor response
Relaxation of the external anal sphincter muscles about 10 minutes after the injection. No resistance to rectal insertion of hand. Anal opening in each cow was patent after withdrawal of hand from rectum. Diameter of anal opening ranged from 0.8 to 2.0 cm.	No pain response to superficial and deep pin pricks about 10 minutes after injection, except in cow #01 that gave response to superficial and deep pin pricks on the left anal side. There was no pain response to the pin pricks in all cows during 2nd-3rd week post-injection	No pain response to superficial and deep pin pricks about 10 minutes after injection, excluding cow #01 which responded to pin pricks around the left lip of vulva. During 2nd week the vulva lips of the cows were swollen. The vulval lips became wrinkled, and then returned to normal by 4th week. There was no pain response to superficial and deep pin pricks at this time and throughout the period of observation.	No reflex defecation in any cow throughout the observation period. Voluntary defecation was observed in all cows. Fecal soiling of perineum was observed in cow #03, but disappeared by 4th week. Peristalsis in the posterior rectal segment was present in each cow throughout the observation period.	Voluntary urination was observed in all cows. No clinical manifestation of urinary incontinence observed in any cow.	Each cow had pain response to superficial and deep pin pricks throughout the observation period. Tail use remained normal.

^a Around the 4th and 5th ventral sacral foramina.

PART II: GROSS AND MICROSCOPIC CHANGES IN THE MIDDLE HEMORRHOIDAL
NERVES INJECTED WITH ISOPROPYL ALCOHOL, LIDOCAINE, AND
PHYSIOLOGICAL SALINE

INTRODUCTION

Protracted diarrhea in calves often results in rectal prolapse and tenesmus (Blood and Henderson, 1968; Marsh, 1965). Size of the anal opening in calves limits locating and identifying the middle and caudal hemorrhoidal nerves by hand. Since the anal opening of calves and ewes is similar in size and permits rectal insertion of both index and middle fingers, ewes were used to establish a method for rectally locating and identifying the nerves.

Normal skin has a population of opportunist bacteria and aseptic preparation of injection sites only reduces the population to a minimum (Williams and Wynne, 1962). It is conceivable that some resident bacteria could gain entry into the ventral sacral foramina during injection and result in an abscess.

This part of the study was done to determine whether the isopropyl alcohol technique was applicable in controlling rectal tenesmus in calves and the danger of infection and abscess formation.

MATERIALS AND METHODS

Restraint procedure included a short head tie and a rope on the side to prevent sideways movements by the ewe. The skin was clipped about 6 cm from either side of the third sacral vertebra through the first coccygeal vertebra and then shaved. This area was washed with soap, and cleaned with surgical alcohol.¹ A pre-injection pin-prick sensitivity test was done on the perineal area using sterile 4 cm-22 gauge needles. External anal

¹Surgical alcohol, prepared in Dykstra Veterinary Hospital, K.S.U., Manhattan, Ks. 66506.

sphincter tone was assessed on each ewe by determining the degree of resistance to rectal insertion of middle and index fingers. Tail use and response to pin pricks were also observed. Voluntary and reflex defecation and urination were recorded for each ewe.

The left hand was gloved and fingers lubricated with non-irritating soap. The index and middle fingers were brought together and carefully inserted into the rectum, holding the fingers straight. Any remaining feces was removed from the rectum.

Turning the palm up, the index and middle fingers were brought together and re-inserted into the rectum. The fingers were separated, and each finger placed on the ventral border of the transverse process of the cranial coccygeal vertebrae. The sacro-coccygeal space was pre-determined by moving the tail up and down with the free hand. The fingers were slowly pushed forward until each finger rested against the ventral border of the transverse process of the first coccygeal vertebra. The depression felt between these transverse processes of first coccygeal vertebra and the posterior body of the last sacrum represented the last ventral sacral foramina. Caudal hemorrhoidal nerves were palpated (one on each side) digitally, and a slight upward digital pressure resulted in a reflex contraction of the anal sphincter.

The index and middle fingers were maintained on the last ventral sacral foramina, and the fingers pushed in a cranial direction. The next depression felt between the transverse process of the last (fourth) sacral vertebra and the third sacral vertebra, and lateral to the body of these vertebrae represented the third ventral sacral foramen (one on each side). The middle hemorrhoidal nerves were palpated and an upward digital pressure resulted in a marked reflex contraction of the external anal sphincter

muscles was experienced. With the index finger of gloved left hand, a slight upward pressure was exerted at the left ventral sacral foramen, and the corresponding site of the bulged skin noted. With the free hand, a 4 cm-22 gauge sterile hypodermic needle was inserted through the skin at this site in a downward and cranial direction at an angle of about 60°, passing through the croup muscles, lateral sacral ligament, third left dorsal sacral foramen to third left ventral sacral foramen. The tip of the needle was allowed to touch the nerve as it emerged from the foramen so as to bring about a reflex contraction of the external anal sphincter muscles. (Precautions taken in Part I of the experiment were followed to avoid rectal bacterial contamination of the injection sites.)

With the needle in position, a 2-ml plastic syringe containing 1.0 ml of the agent to be injected was fixed to the needle with the free hand. Before injecting the solution around the nerve, the position of the needle was assessed to be correct. The agent was then slowly deposited on the nerve around the ventral sacral foramen.

The above procedure for positioning the needle and injection of the solution was repeated for the right side using the left middle finger. Occasional vasopuncture occurred during the insertion of the needle as evidenced by minute quantity of blood in the syringe. The needle was withdrawn and repositioned at a different site at the ventral sacral foramen before injecting the agent on the nerve.

Eight ewes weighing 34 to 45 kgm were used. They were randomly divided into three groups. Group A ewes (ear-tag numbers 06, 07, 08 and 09) were injected with 1 ml of 95% isopropyl alcohol¹ at each site of third

¹95% Isopropyl alcohol, Union Carbide Corp., 6901 West 6erd St., Shawnee Mission, Ks.

ventral sacral foramina. Group B ewes (ear-tag numbers 10 and 11) were injected with 1 ml 2% Lidocaine¹ at the third ventral sacral foramina. Group C served as the control group (ear-tag numbers 12 and 13), and the two ewes were injected with 1 ml sterile physiological saline² at the third ventral sacral foramina.

Clinical observations in Part I of the experiment were made on the ewes at 10 minutes post injection and weekly for five weeks.

Ewes were euthanized at the end of five-week observation with Euthanol.³ The middle hemorrhoidal nerves were dissected out and examined grossly. Each nerve was fixed in 10% buffered neutralized formalin⁴ and sections were taken at the injection site and posterior and anterior to the injection site. Sections were paraffin blocked, cut at 5 μ and stained with hematoxylin and eosin.⁵

All slides were examined under light microscope and microphotographs of representative changes were taken.

RESULTS

On pre-injection sensitivity tests, all ewes gave pain response to superficial and pin-pricks to the perineum, as evidenced by struggling each

¹2% Lidocaine HCl injection U.S.P., McGaw Laboratories, Division of American Hospital Supply Corporation, Glendale, California 91201.

²Physiological saline, Dykstra Veterinary Hospital, K.S.U., Manhattan, Ks. 66506.

³Euthanol, Barb-Euthol, Haver-Lockhart Laboratories, Box 390, Shawnee Mission, Ks. 66201.

⁴Formaldehyde solution, J. T. Baker Chemical Co., Phillipsburg, N.J.

⁵Hematoxylin and eosin stain, The Coleman & Bell Co., Norwood, O.

time an area was pricked. There was tone in external anal sphincter muscles evidenced by resistance to rectal insertion of middle and index fingers, and an adequate closure of anal opening post withdrawal of fingers.

Voluntary and reflex defecation and urination were exhibited by each ewe.

The tail was sensitive to superficial and deep pin pricks; there was tone in each tail and positioning was normal.

Results of post-injection clinical observations at 10 minutes and weekly observations were comparable to those in cows (Part I of this experiment). An overall summary of the clinical observations at 10 minutes post injection and five-week period are presented below.

CLINICAL OBSERVATIONS 10 MINUTES POST INJECTION

GROUP A (1.0 ml 95% isopropyl alcohol): External anal sphincter of ewes 07, 08 and 09 was completely relaxed as evidenced by lack of resistance to rectal insertion of index and middle fingers. Some resistance was experienced in ewe 06. The anal opening was patent upon rectal withdrawal of fingers, and the diameter of opening ranged from 0.5 to 1.0 cm.

There was no pain response to superficial and deep pin pricks peri-anally in ewes 07, 08 and 09; ewe 06 had pain response on the right side of the anus. Vulval pain response was similar.

Voluntary defecation was observed in all ewes, but only ewe 06 had reflex defecation. Peristalsis was present in the distal rectal segment.

No voluntary urination was observed, but all ewes had reflex urination.

The tail of each ewe was sensitive to both superficial and deep pin pricks and tone was present.

GROUP B (1.0 ml 2% Lidocaine): There was a marked and prompt relaxation of external anal sphincter muscles, and no resistance to rectal insertion of index and middle fingers. The anal opening was patent post withdrawal of fingers and the diameter of opening was 1.3 and 1.4 cm for ewe 10 and 11, respectively. There was no pain response to the superficial and deep pin pricks of the perineum. Spasm of the vulva lips was observed.

Neither voluntary nor reflex defecation was observed in the two ewes, but the distal segment of the rectum had peristalsis. Each rectum was empty.

Voluntary and reflex urination was observed in ewe 11, but ewe 10 had only reflex urination.

Tail in each ewe was sensitive to both superficial and deep pin pricks. There was tone in each tail.

GROUP C (1.0 ml physiological saline): No relaxation of the external anal sphincter muscles was observed in these two control ewes. Anal opening closed readily upon withdrawal of the fingers from the rectum.

The perineum was sensitive to both superficial and deep pin pricks.

Both reflex and voluntary defecation and urination were observed in both ewes.

The tail was sensitive to superficial and deep pin pricks, and there was tone in each tail.

FIVE WEEK CLINICAL OBSERVATIONS POST INJECTION

GROUP A (1.0 ml 95% isopropyl alcohol): Relaxation in the external anal sphincter muscles was present in the four ewes and the anal opening remained patent post withdrawal of fingers from the rectum. The diameter of anal orifice from 0.7 to 1.8 cm.

Slight swelling of the peri-anal skin occurred but subsided by the fourth week post injection. There was no pain response to either superficial or deep pin pricks. The ano-vulva space remained sensitive to superficial pin-pricks in ewe 06, until the fourth week.

Vulval lips were swollen for the first two weeks, then became wrinkled, and were normal by fifth week. There was no pain response to superficial and deep pin pricks.

Voluntary defecation was not consistent but there was no reflex defecation at any time. Slight peristalsis was present in the distal segment of the rectum in each ewe. Feces was present in distal segment of the rectum during each observation.

Perineal fecal soiling was observed during the second week in ewe 07, but disappeared by fourth week.

Reflex urination was observed in all the ewes, but voluntary urination was not consistent. When voluntary urination was observed in any ewe, there was no dribbling of urine.

There was tone and normal sensitivity in each tail and positioning was normal throughout the observation period.

GROUP B (1.0 ml 2% Lidocaine) and GROUP C (1.0 ml sterile physiological saline): Had identical five-week clinical observations. Normal tone in the external anal sphincter muscles and closure of the anal opening post withdrawal of fingers from rectum in both groups. Each ewe had pain response to superficial and deep pin pricks at perineum and tail.

Reflex and voluntary defecation were observed in all ewes and peristalsis was present in the distal rectal segment.

Reflex urination was consistent in all ewes, but voluntary urination was not.

Each tail had tone.

GROSS CHANGES IN MIDDLE HEMORRHOIDAL NERVES

Gross changes were restricted to the injection site around the third ventral sacral foramina. There were no abscesses at the injection sites or around nerves.

GROUP A (1.0 ml 95% isopropyl alcohol): There was fibrous adhesions to the perineural tissues at the ventral sacral foramen and for about 1.0 cm posterior along the nerve.

Nerve posterior to the injection site was pale compared to ventral sacral nerves 1 and 2. The left middle hemorrhoidal nerve of ewe number 09 was slightly hemorrhagic.

Each nerve at the injection site was almost half the size of the posterior section of the nerve.

GROUP B (1.0 ml 2% Lidocaine) and GROUP C (1.0 ml physiological saline): No gross changes were observed in the middle hemorrhoidal nerves--except the right nerve of ewe #10 was hemorrhagic around the injection site.

MICROSCOPIC CHANGES IN THE MIDDLE HEMORRHOIDAL NERVES (MHN)

Microscopic changes in the middle hemorrhoidal nerves are illustrated in Plates I-V.

Isopropyl alcohol resulted in a chronic inflammatory and foreign body reaction in the hemorrhoidal nerves. With Lidocaine, there was mild focal vesiculation in the myelin sheath and some axonal swelling. There were no changes with sterile saline.

DISCUSSION

The perineum in each ewe injected with isopropyl alcohol was desensitized throughout the period of observation. Although the tone in external anal sphincter muscles was lost, voluntary defecation was normal and feces were normal in consistency. Tail use remained normal.

Difference in the clinical observations between isopropyl alcohol and physiological saline is that the former is neurotoxic. The middle hemorrhoidal nerves give major sensory and motor innervations to distal segment of rectum, external anal sphincter muscles, vagina and perineum in ewes. With use of isopropyl alcohol on these nerves, the innervated structures lost sensation and tone.

Lidocaine and isopropyl alcohol gave comparable results, but the former lasted about 30 minutes; the latter gave long-term desensitization.

Long-term desensitization of perineum with 2% Lidocaine would require repeated injections every 30 minutes. This is not practical or economical. Isopropyl alcohol is cheap and is easily available. It gave a long-term desensitization of perineum and no systemic toxicity at the dosage used in this study. Hence, it could be used in controlling rectal tenesmus in ewes and calves.

Grossly, adhesions of the nerves to the perineural tissues were found in ewes following alcohol injection. Microscopically, there was a chronic inflammatory response and foreign body reaction in the hemorrhoidal nerves. With Lidocaine, the changes were minor; no changes were observed in the nerves with physiological saline.

As the middle hemorrhoidal nerves were located and identified in ewes, it is concluded that this technique could be used in controlling rectal

tenesmus in both sheep and calves. Since the middle hemorrhoidal nerves also supply sensory and motor innervation to the vagina, this technique could be used in controlling tenesmus accompanying prolapse of genitalia in ewes.

SUMMARY

A technique was developed for rectally locating and identifying the middle hemorrhoidal nerves in ewes.

Eight ewes were divided into three groups and the middle hemorrhoidal nerves were injected at the third ventral sacral foramina by going through the corresponding third dorsal foramina. The first group received 1 ml isopropyl alcohol, the second 1 ml of 2% Lidocaine and the third 1 ml of sterile physiological saline. The ewes were observed for five weeks and then euthanized. The middle hemorrhoidal nerves were dissected out and examined grossly and microscopically.

Isopropyl alcohol gave long term desensitization of perineum with normal tail use. There was a loss in tone of external anal sphincter muscles. Aesthetic appearance was acceptable. Lidocaine gave perineal desensitization and loss of external anal sphincter tone for about 30 minutes. There was no loss of sensitivity in the perineum and no loss in tone of the external anal sphincter muscles with physiological saline.

Isopropyl alcohol resulted in a fibrous tissue adhesion of the middle hemorrhoidal nerves to the perineural tissues, but no abscess formation. Microscopically, there was a chronic inflammatory response and foreign body reaction in the neural tissue.

It was concluded that blockage of the middle hemorrhoidal nerves by isopropyl alcohol in sheep and calves offers a satisfactory method for controlling rectal tenesmus.

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Marsh, H. 1965. Newsom's Sheep Diseases. The Williams and Wilkins Company, Baltimore, Md. pp. 308-10, 319-20.

Williams, L. F., Jr. and Wynne, G. F., Jr. 1962. Fundamental Approach to Surgical Problems. Charles C. Thomas Publishers, Springfield, Ill. pp. 144-46.

PLATE I

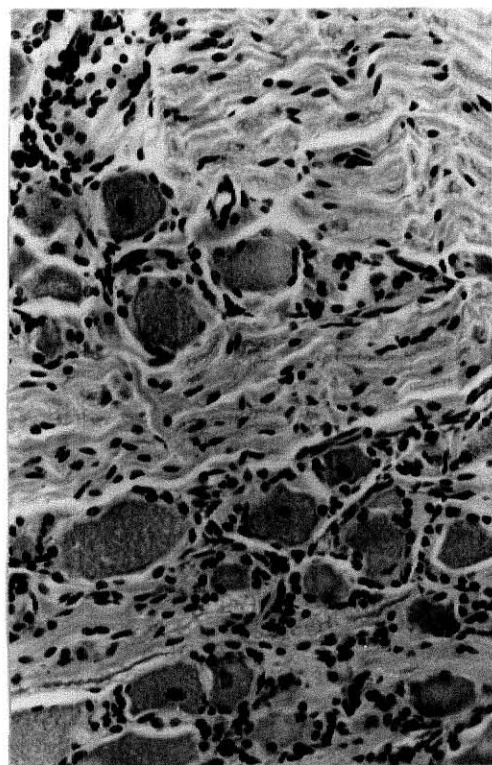
Fig. 1. This cross-section was taken from right middle hemorrhoidal nerve (MHN) of ewe #12 injected with physiological saline. There was a normal relationship between the nerve and supporting tissue.

Fig. 2. A cross-section of right MHN of ewe #13 (physiological saline) was taken anterior to the injection site. There is shrinkage of the perineurium and central chromatolysis in some neurons of dorsal root ganglion. Otherwise, the nerve bears a normal relationship to the supportive tissues.

Fig. 3. A longitudinal section of right MHN of ewe #13 with shrinkage of perineurium; otherwise, the relationship between the nerve and supporting tissue was normal.

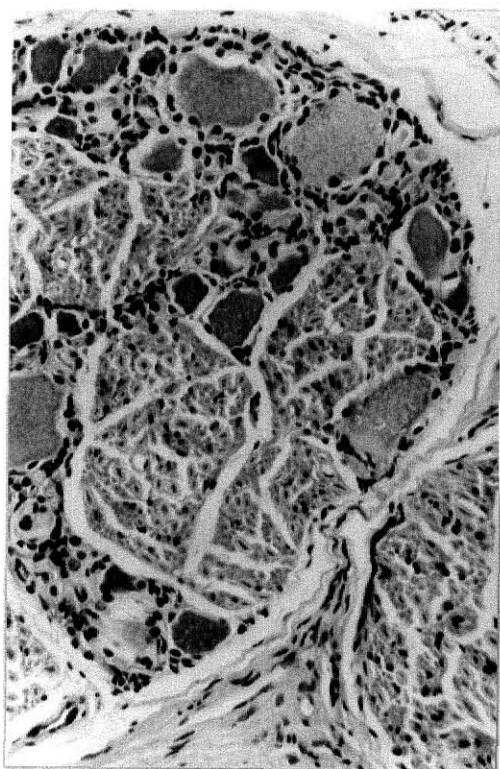
Fig. 4. This slide contained longitudinal, cross and oblique sections of right MHN of ewe #11 (Lidocaine). There were some vesicle formation in the myelin sheath. The axons have a normal relationship to the supporting tissues.

PLATE I, FIGS. 1-4



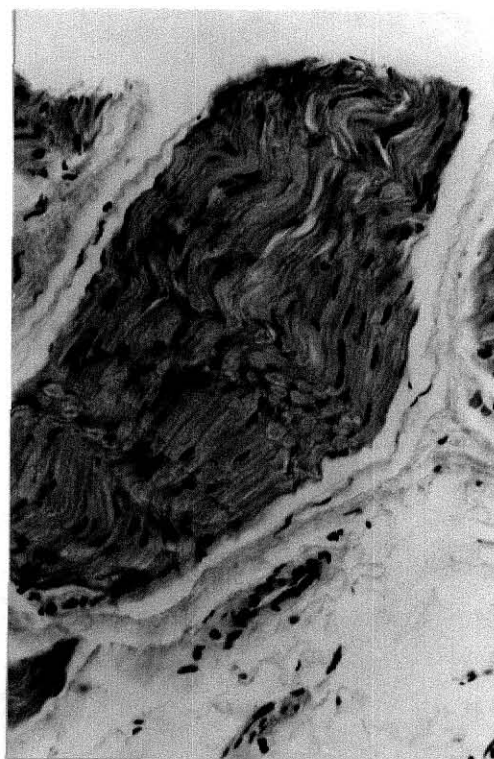
1

X 250



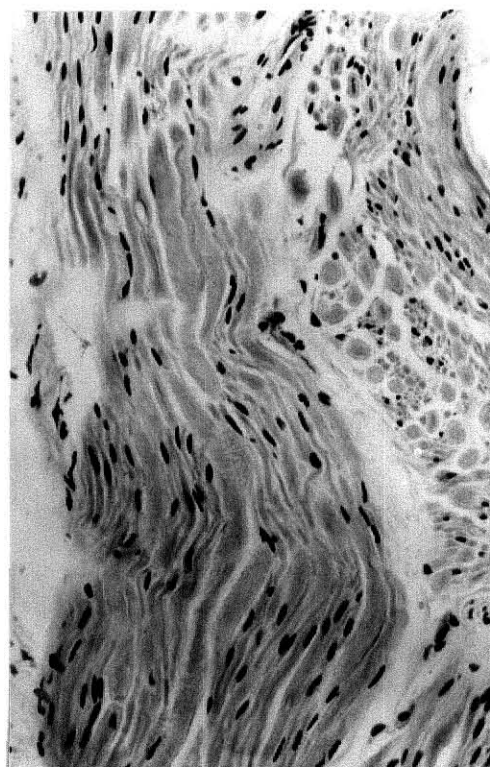
2

X 250



3

X 250



4

X 250

PLATE II

Fig. 1. This slide came from a section taken from the left MHN of ewe #09 injected with 95% isopropyl alcohol.

There was a shrinkage of perineurium, coupled with vacuolation and replacement of nerve fibers by proliferating endoneurium (Schwann cells). There was granulation of perineural supportive tissue and vascularization of the same region. Some macrophages and giant cells were present. Hemosiderosis was present around the vessel on top left hand corner.

Fig. 2. This cross-section came from the left MHN of ewe #09.

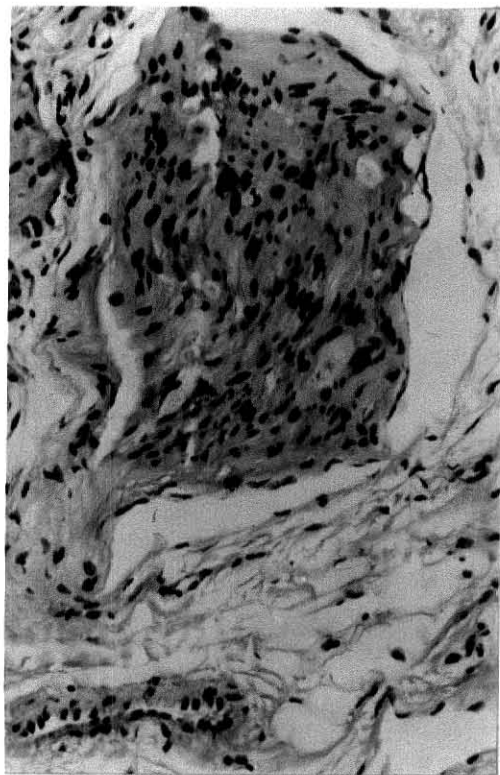
Vacuolation was marked, coupled with fibroplasia of supporting tissue. Vesiculations were present in some myelin sheaths. Macrophages were present, and there was a marked increase in number of Schwann cells. Most axons were degenerating or absent.

Fig. 3. This cross-section came from the right MHN of ewe #07 injected with 95% isopropyl alcohol.

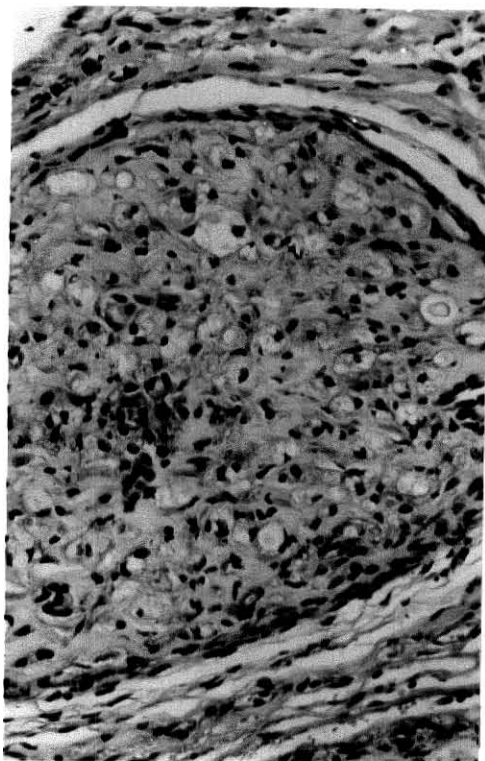
There was an extensive proliferation of epineural tissue and most of the neurofibrils were replaced by Schwann cells. Hemosiderosis was extensive. There were macrophages all around the tissue. Vascularization of the epineural tissue was increased.

Fig. 4. Another section of above nerve (fig. 3). Vacuolation and increased vascularization of the proliferating perineural tissue were marked.

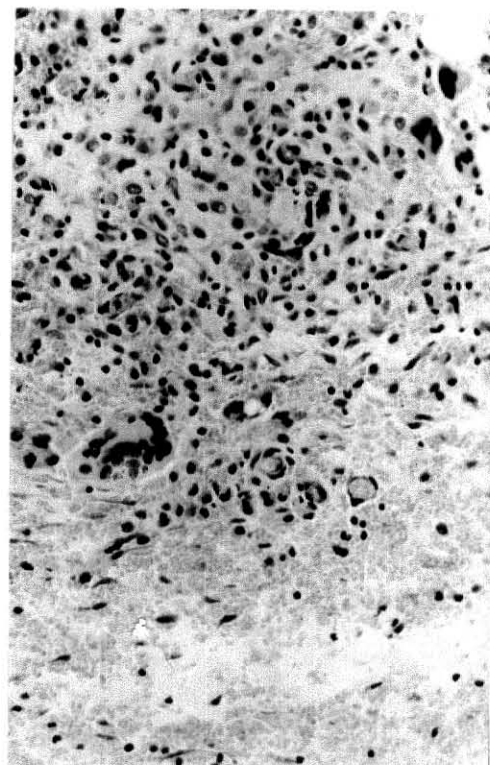
PLATE II, FIGS. 1-4



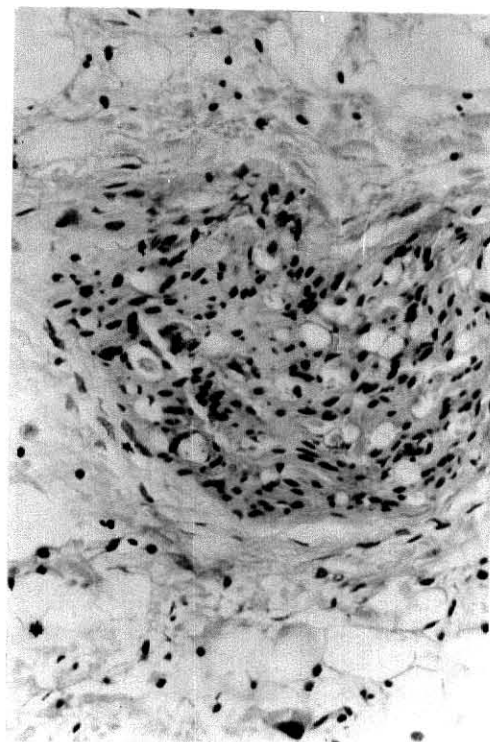
1 X 250



2 X 250



3 X 250



4 X 250

PLATE III

Slides represented in figures 1-3 came from the right MHN of ewe #07, while the slide represented in figure 4 of the same plate came from the left MHN of the same ewe. Ewe #07 had 95% isopropyl alcohol treatment.

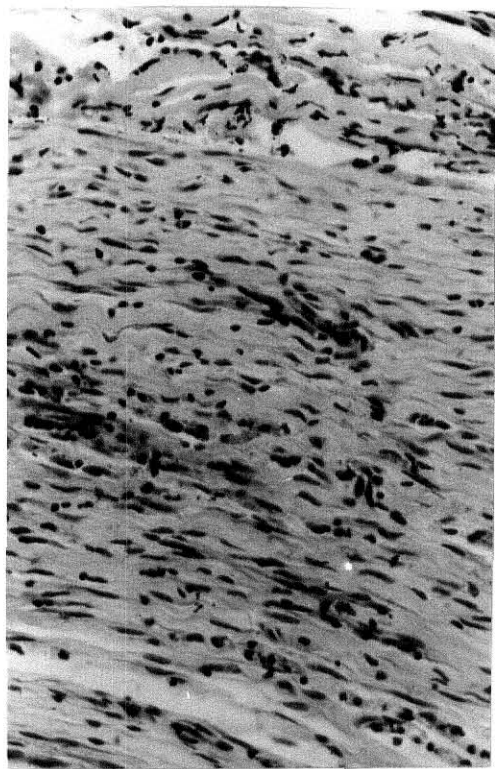
Fig. 1. A longitudinal-section of the nerve with proliferation of the Schwann cells, coupled with macrophages and giant cell infiltration. Most of the axons were degenerated.

Fig. 2. A cross-section of the same nerve with extensive vacuolation, proliferation of Schwann cells, macrophage infiltration and foreign body reaction with the presence of giant cells.

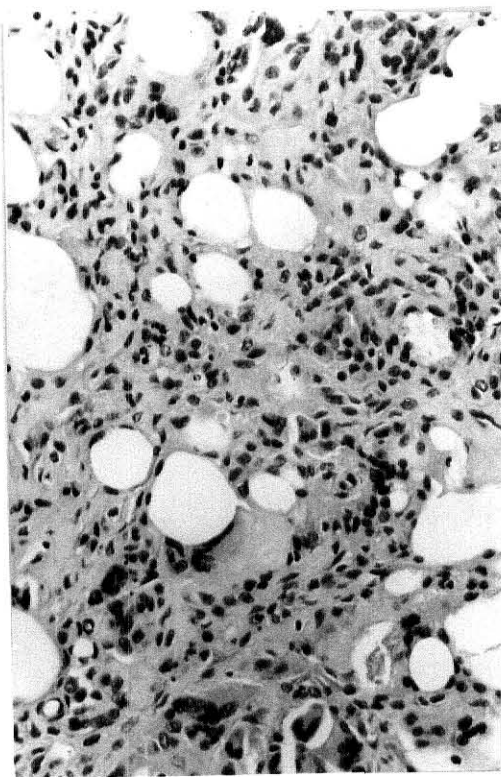
Fig. 3. This slide essentially showed the chronic inflammatory response and foreign body reaction present in fig. 2.

Fig. 4. A longitudinal section of the left MHN of ewe #07 with epineurium proliferation. Axons were either vacuolated or degenerating. There was proliferation of the Schwann cells. Macrophages were abundant and some giant cells were present.

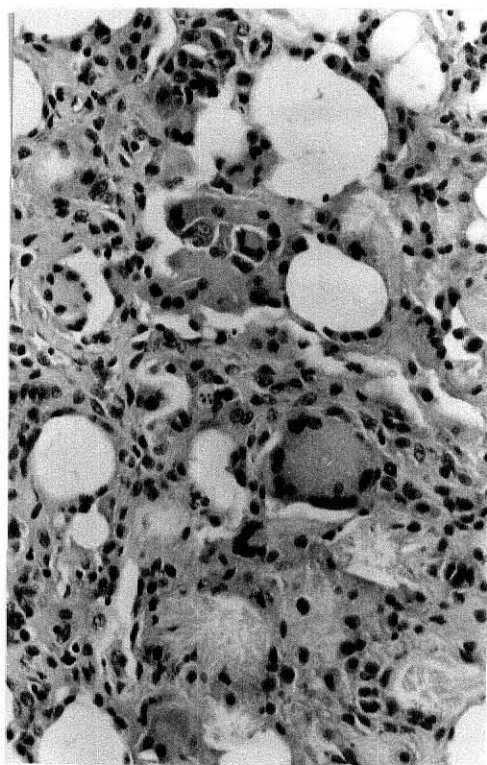
PLATE III, FIGS. 1-4



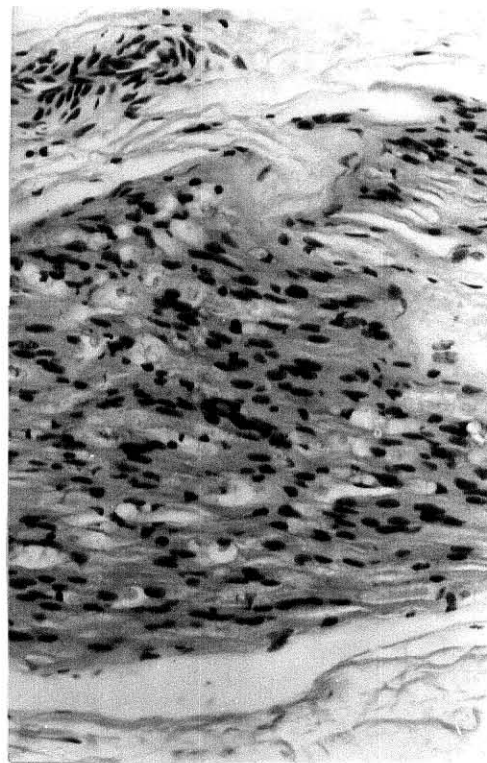
1 X 250



2 X 250



3 X 250



4 X 250

PLATE IV

Slides represented in figures 1-4 came from the right and left MHNs of ewe #06. Ewe #06 had 95% isopropyl alcohol treatment.

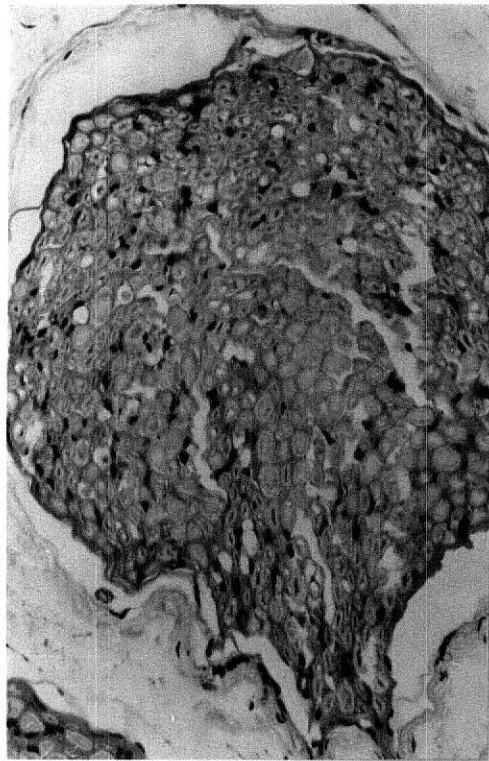
Fig. 1. This slide came from tissue taken from the right MHN of ewe #06. There was a shrinkage of the perineurium and proliferation of epineurium. There was a marked swelling of the degenerating axons in relation to the size of myelin sheaths. Vacuolation was slight, but vesiculation of the fibers having relatively normal sized axon was marked. Few macrophages were present.

Fig. 2. This slide came from the same nerve as above (fig. 1). Vacuolation was marked, with macrophages and giant cells in and around degenerated neurofibrils. Neurillema showed proliferation.

Fig. 3. This longitudinal section came from tissue taken from the left MHN of ewe #06. There was a marked vesiculation of the swollen myelin sheaths. The axons were represented by basophilic streaks in the middle of the myelin sheaths. Macrophage infiltration was minimal.

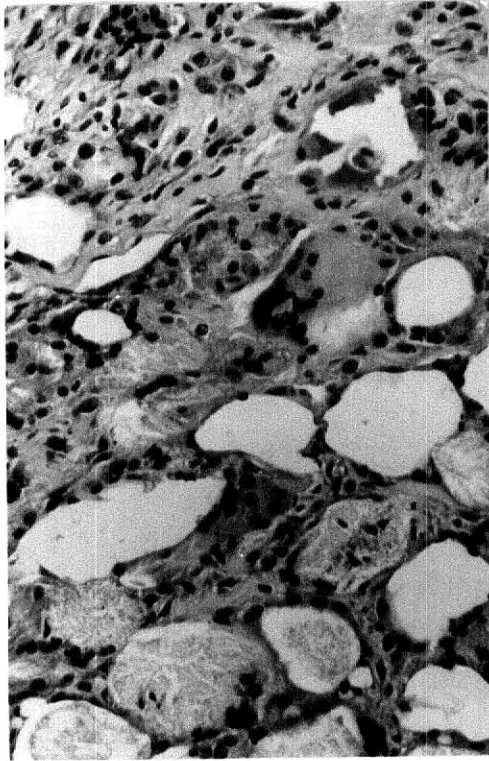
Fig. 4. This represented another section of left MHN of ewe #06. There was shrinkage of perineurium and proliferation of epineurium. This slide showed various stages of degeneration of the nerve fiber--ranging from axonal swelling with vesiculation of myelin sheath, complete absence of axons to vacuolation of nerve fibers.

PLATE IV, FIGS. 1-4



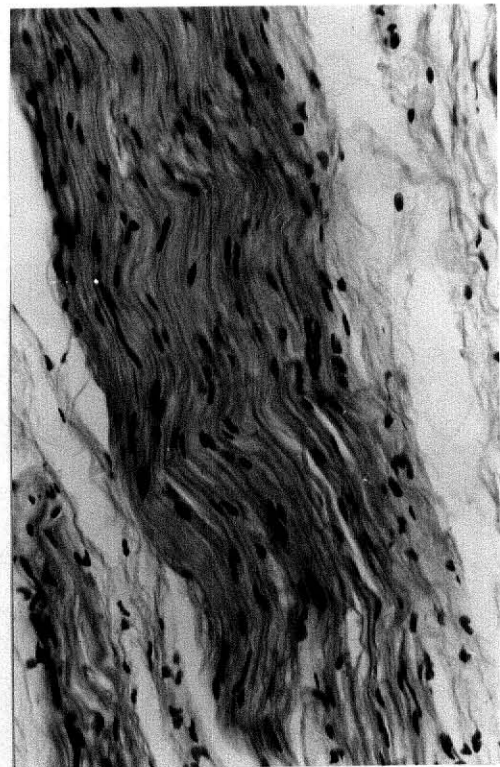
1

X 250



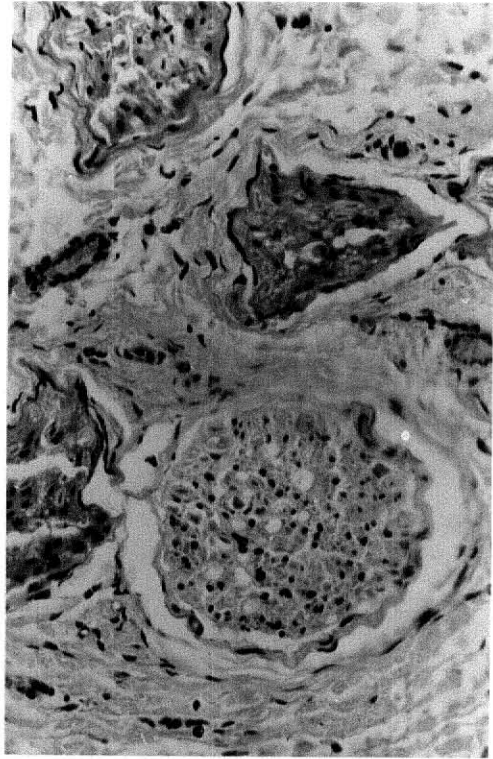
2

X 250



3

X 250



4

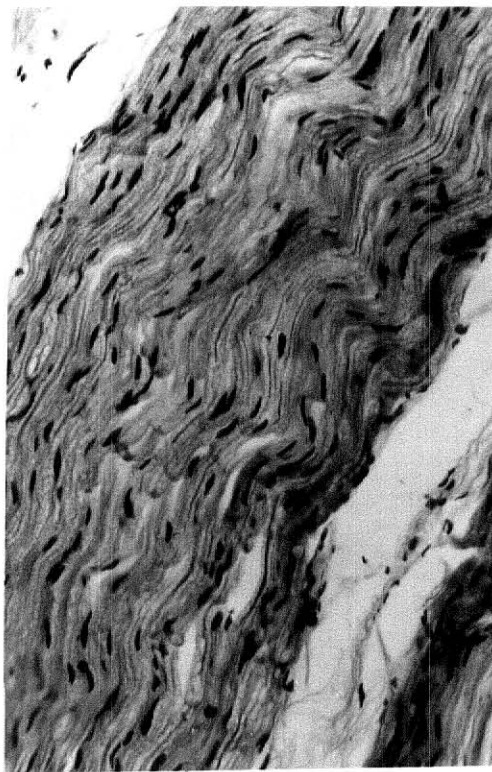
X 250

PLATE V

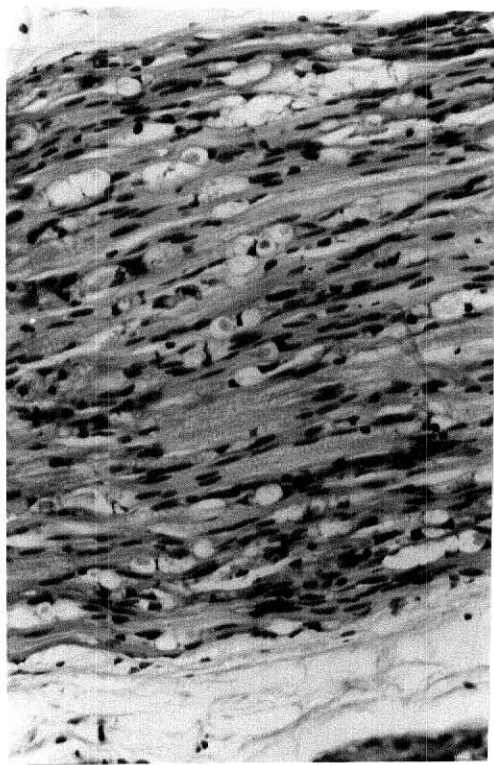
The slides represented in figures 1-4 came from right and left MHNs of ewe #08. Ewe #08 had 95% isopropyl alcohol treatment.

- Fig. 1. This slide came from the right MHN of ewe #08. Vesiculation of myelin sheath was marked. Proliferation of epineurium was slight. Focal vacuolation of nerve fibers were present.
- Fig. 2. Another longitudinal section of above nerve with extensive focal vacuolation of nerve fibers. Vesiculations of myelin sheaths were present coupled with proliferation of Schwann cells and epineurium. Few macrophages were present.
- Fig. 3. This slide came from the left MHN of ewe #08. There was an extensive foreign body reaction with giant cells mostly around the degenerated nerve fibers. Macrophages were all around the tissues. Endoneurium and perineurium showed proliferation--so were the Schwann cells. Some fibers were vacuolated.
- Fig. 4. This represented another section of the above nerve. A more severe foreign body reaction was present as the giant cells were numerous. Macrophage infiltration was also present. Vacuolation of the nerve fibers was extensive. Along with proliferation of endoneurium, perineurium and epineurium, there was hemorrhage at the bottom left side of the slide. Hemosiderosis was not marked.

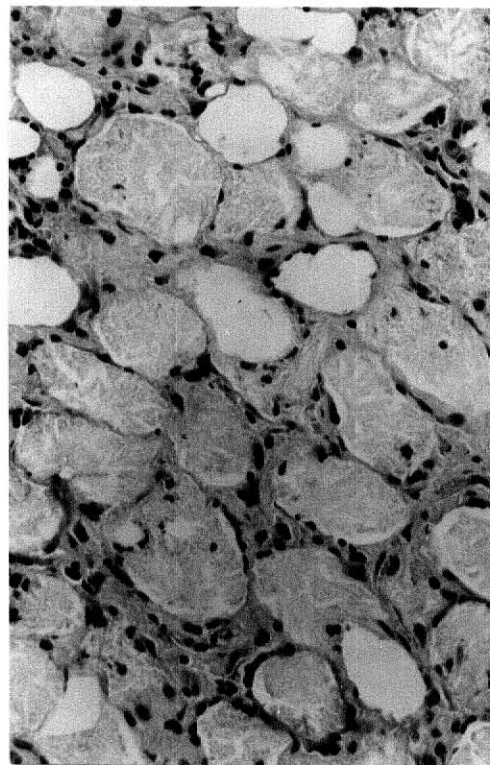
PLATE V, FIGS. 1-4



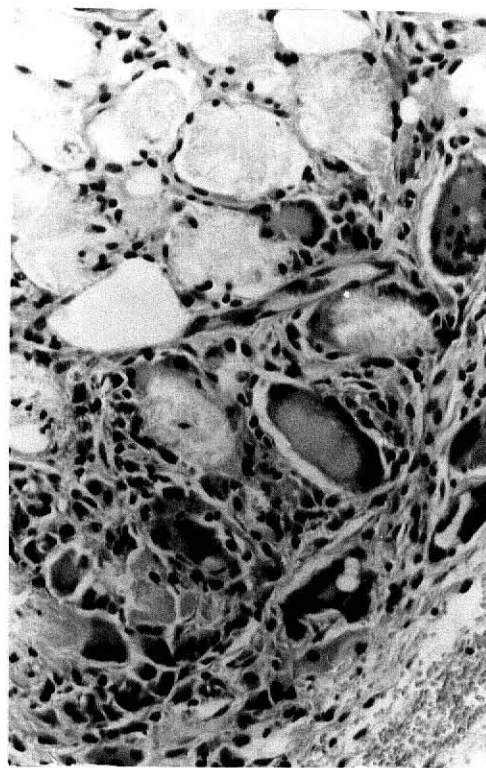
1 X 250



2 X 250



3 X 250



4 X 250

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The author dedicates this thesis to his deceased mother, Alice Okedoja Adeyanju.

APPENDIX I. OBSERVATIONS OF COWS FOLLOWING INJECTION AROUND THE
DISTAL VENTRAL SACRAL NERVES WITH ISOPROPYL ALCOHOL,
LIDOCAINE, AND PHYSIOLOGICAL SALINE (TABLES 1-8)

Table 1. Response of the cows (group A) at 10 minutes after receiving 95% isopropyl alcohol^a

Ear tag number	External anal sphincter tone	Peri-anal sensitivity	Peri-vulval sensitivity	Defecation	Urination	Tail-motor and sensory response
#02	External anal sphincter muscles relaxed. Anal opening patent--about 1.5 cm in diameter. No resistance to insertion of fingers rectally.	Spasm of peri-anal skin. No pain response to superficial and deep pin pricks.	Vulval lips had no pain response to superficial and deep pin pricks. Ventral commissure was sensitive to superficial pin pricks.	No voluntary defecation observed. Distal segment of rectum empty. Slow peristalsis present in rectal wall.	No urination. Rubbing the posterior mid-line (below vulva) induced some urination.	Tail skin sensitive to superficial and deep pin pricks. Tail movements were unimpaired. Anus well covered by tail head.
#03	External anal sphincter tone lost. Anal opening patent--2.0 cm in diameter. No resistance to rectal insertion of fingers	Spasm of peri-anal skin. No pain response to superficial and deep pin pricks. Anovulval space was sensitive to deep pin pricks.	Vulval lips had no pain response to superficial and deep pin pricks. Dorsal and ventral commissures sensitive to superficial pin pricks.	No voluntary defecation observed. Distal segment of rectum empty. Weak peristaltic waves in distal segment of rectum.	Voluntary urination. There was no dribbling of urine.	Tail skin sensitive to superficial and deep pin pricks. Normal tail movement. Anal opening well covered by tail head.

^a1.0 ml 95% isopropyl alcohol was bilaterally injected at 4th and 5th ventral sacral foramina.

Table 1 (continued).

Ear tag number	External anal sphincter tone	Peri-anal sensitivity	Peri-vulval sensitivity	Defecation	Urination	Tail-motor and sensory response
#01	Tone not completely lost as there was some resistance to rectal insertion of fingers. Anal opening remained patent--0.8 cm in diameter.	Spasm restricted to the right side of anal opening. No pain response to superficial and deep pin pricks. Left side sensitive to deep pin pricks.	Right vulva lip had no pain response to superficial and deep pin pricks. Left vulva lip was sensitive to both superficial and deep pin pricks.	Reflex defecation on anal irritation. Strong peristaltic waves in the distal segment of rectum.	No voluntary urination, but reflex urination occurred on stroking the posterior mid line (just below vulva).	Tail skin was sensitive to superficial and deep pin pricks. Normal tail movements. Anal opening well covered by the tail head.

Table 2. Response of cows (group B) at 10 minutes after receiving 2% Lidocaine^a

Ear tag number	External anal sphincter tone	Peri-anal sensitivity	Peri-vulval sensitivity	Defecation	Urination	Tail-motor and sensory response
#06	Tone lost. No resistance to rectal insertion of fingers. Anal opening was patent--2.0 cm in diameter.	There was no pain response to superficial and deep pin pricks. Ano-vulval space was not sensitive to pin prick.	Vulval lips, dorsal and ventral commissures were not sensitive to superficial and deep pin pricks.	Neither voluntary nor reflex defecation. The distal segment of rectum was empty. Peristalsis was still present.	No voluntary urination. Reflex urination occurred on rubbing the posterior midline ventral to the vulva.	Tail was sensitive to both superficial and deep pin pricks. Tail movement was normal, and the head of the tail covered the anal opening.
#05	Same as above. Anal opening was 1.8 cm in diameter.	No pain response to superficial and deep pin pricks. Ano-vulval space was not sensitive to superficial and deep pin pricks.	Same as above.	Same as above.	Some voluntary urination observed.	Same as above.

^a1.0 ml 2% Lidocaine was bilaterally injected at 4th and 5th ventral sacral foramina.

Table 2 (continued).

Ear tag number	External anal sphincter tone	Peri-anal sensitivity	Peri-vulval sensitivity	Defecation	Urination	Tail-motor and sensory response
#04	Same tone retained in the external anal sphincter muscles. Anal opening was 0.8 cm in diameter.	No pain response to superficial pin pricks, but a slight reaction to deep pin pricks.	Vulval lips were not sensitive to superficial and deep pin pricks. The dorsal and ventral commissures were sensitive to deep pin pricks.	Reflex defecation on anal irritation. Peristalsis was present in the distal rectal segment.	No urination--voluntary or reflex.	Same as above.

Table 3. Response of cow (group C) at 10 minutes after receiving physiological saline^a

Ear tag number	External anal sphincter tone	Peri-anal sensitivity	Peri-vulval sensitivity	Defecation	Urination	Tail-motor and sensory response
#07	Tone was intact as reflected by resistance to rectal insertion of fingers. The anal opening closed post withdrawal of fingers from rectum.	Sensitive to both superficial and deep pin pricks.	Vulval lips, dorsal and ventral commissures of vulva were sensitive to both superficial and deep pin pricks.	No voluntary defecation, but reflex defecation occurred when anus was irritated with fingers. There was peristalsis in the posterior segment of the rectum.	Reflex urination on rubbing the posterior mid-line ventral to vulva.	Tail was sensitive to both superficial and deep pin pricks. Movement of tail was unimpaired. The head of the tail covered the anal opening adequately.

^a1.0 ml physiological saline was bilaterally injected at 4th and 5th ventral sacral foramina.

Table 4. Five-week clinical observations of cow #01 (group A) after receiving 95% isopropyl alcohol^a

External anal sphincter tone	Peri-anal sensitivity	Peri-vulval sensitivity	Defecation	Urination	Tail-sensory and motor response
1st Week External anal sphincter tone not completely lost as there was some resistance to rectal insertion of fingers. Anal opening remained patent--but more of a semi-circle--about 0.8 cm in diameter.	Right side of anal opening was flaccid and had no response to superficial and deep pin pricks. Spasm of right side of anal opening. Response to pin pricks.	Right vulval lip was wrinkled and had no pain response to both superficial and deep pin pricks. Left side of vulval lip was sensitive to both superficial and deep pin pricks.	Voluntary defecation of normal consistency. There was reflex defecation on anal irritation. Peristalsis present in the distal segment of rectum.	Urination normal. There was a reflex urination. No sign of urine burn.	Sensitive to both superficial and deep pin pricks. Tone in the tail. The anus was covered by the tail head.
2nd Week Less tone in external anal sphincter muscles; less resistance to rectal insertion of fingers. Anal opening remained patent--about 1.0 cm in diameter.	No pain response to pin pricks. Left side had some pain response to superficial pin pricks--especially at the ventral portion.	Pain response to pin pricks from middle portion of left vulval commissure on the same side. Other areas had no response to superficial and deep pin pricks.	No voluntary or reflex defecation observed. Distal segment had some feces, but the perineum was not soiled. Peristalsis present in distal segment of rectum.	Reflex urination. There was no sign of urine burn.	Same as above.

^a1.0 ml 95% isopropyl alcohol was bilaterally injected at 4th and 5th ventral sacral foramina.

Table 4 (continued).

External anal sphincter tone	Peri-anal sensitivity	Peri-vulval sensitivity	Defecation	Urination	Tail-sensory and motor response
3rd and 4th Weeks Loss of tone. No resistance to rectal insertion of fingers. Anal opening remained patent--about 1.3 cm.	No pain response to both superficial and deep pin pricks.	Marked wrinkling of vulva and no pain response to both superficial and deep pin pricks.	Fecal retention in distal segment of rectum. Voluntary but no reflex defecation. The perineum was not soiled with feces.	Normal urination. No sign of urine burn. No dribbling of urine observed.	Same as above.
5th Week Loss in tone. No resistance to rectal insertion of fingers. Anal opening remained patent--about 1.5 cm.	No pain response to both superficial and deep pin pricks.	Wrinkles of vulva decreased. No pain response to both superficial and deep pin pricks.	Defecation was voluntary. No fecal retention in the distal segment of the rectum. Peristalsis present in the distal segment of the rectum. The perineum was not soiled with feces.	Normal urination. There was no dribbling of urine. There was no sign of urine burn.	Same as above.

Table 5. Five-week clinical observations of cow #02 (group A) after receiving 1 ml 95% isopropyl alcohol^a

External anal sphincter tone	Peri-anal sensitivity	Peri-vulval sensitivity	Defecation	Urination	Tail-sensory and motor response
<p>1st Week</p> <p>There was no tone in external anal sphincter muscle as there was no resistance to rectal insertion of fingers. Anal opening was patent--about 1.5 cm in diameter.</p>	<p>There was no pain response to superficial and deep pin prick tests. Ano-vulval space was sensitive to superficial pin pricks.</p>	<p>Vulval lips were uniformly swollen and there was no pain response to both superficial and deep pin pricks. Dorsal commissure of vulva was sensitive to pin prick.</p>	<p>No defecation observed--reflex or voluntary. Distal segment of rectum contained feces of normal consistency. Peristalsis present in the distal segment of the rectum. The perineum was not soiled with feces.</p>	<p>Voluntary urination was normal--no dribbling of urine. There was reflex urination.</p>	<p>Tail skin was sensitive to both superficial and deep pin pricks. There was tone in tail and aligned in the normal fashion. There was normal use of the tail.</p>

^aAt 4th and 5th ventral sacral foramina.

Table 5 (continued).

External anal sphincter tone	Peri-anal sensitivity	Peri-vulval sensitivity	Defecation	Urination	Tail-sensory and motor response
<p>2nd-4th Weeks</p> <p>The external anal sphincter muscles still had no tone. There was no resistance to rectal insertion of fingers. The anal opening was patent and remained at 1.6 cm in diameter.</p>	<p>Both ano-vulval space and peri-anal region had no pain response to both superficial and deep pin pricks.</p>	<p>Vulval lips were wrinkled and no pain response to superficial and deep pin pricks.</p>	<p>Voluntary defecation of normal consistency. Slight fecal soiling of perineum. Weak peristaltic waves in the distal segment of rectum. No reflex defecation on anal irritation.</p>	<p>Stream-lined voluntary urination observed. No reflex urination. No dribbling of urine observed.</p>	<p>Same as above.</p>
<p>5th Week</p> <p>No return of tone to external anal sphincter muscles. There was no resistance to rectal insertion of fingers. The anal opening decreased in diameter to 1.2 cm.</p>	<p>There was no pain response to superficial and deep pin pricks.</p>	<p>Vulval lips appeared normal. There was no pain response to superficial and deep pin pricks.</p>	<p>Voluntary defecation was observed. There was no reflex defecation. The perineum appeared clean of feces. Peristalsis present in the distal segment of the rectum.</p>	<p>No voluntary urination but reflex urination was observed. No dribbling of urine.</p>	<p>Same as above.</p>

Table 6. Five-week clinical observations of cow #03 (group A) after receiving 1 ml 95% isopropyl alcohol^a

External anal sphincter tone	Peri-anal sensitivity	Peri-vulval sensitivity	Defecation	Urination	Tail-sensory and motor response
1st Week No tone and resistance to rectal insertion of fingers. Anal opening remained patent---about 2.0 cm in diameter.	There was no pain response to superficial and deep pin pricks.	Vulva lips slightly swollen. No pain response to both superficial and deep pin pricks.	No voluntary defecation observed. Distal segment of rectum contained some feces. Weak peristalsis present in distal segment of rectum. No reflex defecation on irritation of the anus.	Voluntary urination which was stream-lined. There was reflex urination. No dribbling of urine.	Tail showed pain response to both superficial and deep pin pricks. There was tone in the tail. The head of the tail was in normal contact with the perineum.
2nd Week Still no tone and resistance to insertion of fingers rectally. Anal opening remained patent---about 2.0 cm.	There was still no pain response to both superficial and deep pin pricks.	Decrease in swelling of vulva lips, but slight wrinkling observed. No pain response to both superficial and deep pin pricks.	Slight fecal soiling of the perineum. Distal segment empty of feces. Weak peristalsis present in distal segment of rectum. No reflex defecation on anal irritation.	No voluntary urination observed, but there was a reflex urination of small quantity. No dribbling of urine.	Same as above.

^a At 4th and 5th ventral sacral foramina.

Table 6 (continued).

External anal sphincter tone	Peri-anal sensitivity	Peri-vulval sensitivity	Defecation	Urination	Tail-sensory and motor response
<p>3rd-5th Weeks</p> <p>Although there was no tone, there was a decrease in the diameter of anal opening which remained at 1.5 cm. There was no resistance to rectal insertion of fingers.</p>	<p>Ano-vulval space slightly sensitive to superficial pin pricks. Other areas remained insensitive to superficial and deep pin pricks.</p>	<p>No swelling nor wrinkling observed. No pain response to superficial and deep pin pricks, but dorsal commissure of the vulva was sensitive to superficial pin pricks.</p>	<p>Voluntary defecation of normal consistency. No fecal soiling of perineum. The distal segment of the rectum was empty. No reflex defecation on anal irritation.</p>	<p>Both voluntary and reflex urination were observed. No dribbling of urine.</p>	<p>Same as above.</p>

Table 7. Five-week clinical observations of cows (group B) after receiving 2% Lidocaine^a

Ear tag number	External anal sphincter tone	Peri-anal sensitivity	Peri-vulval sensitivity	Defecation	Urination	Tail-sensory and motor response
#02 1st to 5th wk.	Present as reflected by resistance to rectal insertion of fingers. The anal opening was not patent post withdrawal of fingers from rectum.	Pain response to both superficial and deep pin pricks.	Pain response to superficial and deep pin pricks.	Voluntary and reflex defecation. Feces was of normal consistency. Peristalsis was present in the distal segment of the rectum.	Voluntary and reflex urination. There was no dribbling of urine.	Tail was sensitive to both superficial and deep pin pricks. Normal tail use.
#04 #05 1st to 5th wk.	Same as above.	Same as above.	Same as above.	Same as above.	Same as above.	Same as above.

^a 1 ml 2% Lidocaine was bilaterally injected at 4th and 5th ventral sacral foramina.

Table 8. Five week clinical observations of cow (group C) after receiving physiological saline^a

Ear tag number	External anal sphincter tone	Peri-anal sensitivity	Peri-vulval sensitivity	Defecation	Urination	Tail-sensory and motor response
#07 1st to 5th wk.	No relaxation of external anal sphincter muscles. Resistance to rectal insertion of fingers. The anal opening was not patent after withdrawal of hand from the rectum.	Sensitive to superficial and deep pin pricks.	Vulval lips, the dorsal and ventral commissures of vulva were sensitive to superficial and deep pin pricks.	Reflex defecation was observed throughout the period of observation. Voluntary defecation was not consistent. Strong peristaltic waves in the distal segment of the rectum.	Voluntary and reflex urinations observed throughout the period of observation.	Pain response to both superficial and deep pin pricks throughout the observation period. Also normal tail use.

^a1 ml physiological saline was bilaterally injected at 4th and 5th ventral sacral foramina.

APPENDIX II. MICROSCOPIC CHANGES IN MIDDLE HEMORRHOIDAL
NERVES IN EWES INJECTED WITH ISOPROPYL
ALCOHOL, LIDOCAINE AND PHYSIOLOGICAL SALINE

Slides 1B to 8B originated from ewes in group C injected bilaterally with 1 ml physiological saline solution.

Slide 1B contained tissue taken from the left middle hemorrhoidal nerve of ewe number 12. There was some shrinkage of perineurium, however, the relationship between the nerve and supporting tissue was normal.

Slide 2B taken from the same nerve had the following changes--there was shrinkage of the perineurium and some axons were swollen in relation to the size of the myelin sheath. Otherwise, the relationship between nerve and supporting tissue was normal.

Slide 3B taken from the right middle hemorrhoidal nerve of ewe #12 was normal.

Another histological section 4B of the same nerve was also normal.

Slide 5B originated from the right middle hemorrhoidal nerve of ewe #13--section taken dorsal to the injection site. There was central chromatolysis in some neurons of the dorsal root ganglion. The nerve and the supporting tissue was otherwise normal; as was the tissue represented on slide 6B of the same nerve.

Slide 7B represented tissue taken from left middle hemorrhoidal of ewe #13. There was vesicle formation in the myelin sheath; however, axons and supporting tissue were normal.

Slide 8B, taken from the same nerve as above had normal histological findings.

Slides 9B to 16B originated from ewes in group B injected bilaterally with 1 ml 2% Lidocaine.

Slides 9B and 10B were taken from the right middle hemorrhoidal nerve of ewe #11. Both had some vesicle formation in the myelin sheath. The

axons were normal in relation to the supportive tissue. There was a slight hemorrhage in epineural layer of slide 10B.

Slides 11B and 12B originated from the left middle hemorrhoidal nerve of ewe #11. There was shrinkage of perineurium, and slight swelling of axons in relation to the size of the myelin sheath. Supportive tissues and structures were normal.

Slides 13B and 14B originated from the right middle hemorrhoidal nerve of ewe #10. There was slight shrinkage of the perineurium. Other structures and supporting tissues appeared normal.

Slides 15B and 16B originated from the left hemorrhoidal nerve of ewe #10. There was focalized axonal swelling and vesicle formation in the myelin sheath. The supportive tissues appeared normal.

Slides 1A to 16A originated from the middle hemorrhoidal nerves of ewes in group A injected bilaterally with 1 ml 95% isopropyl alcohol at each nerve site.

Slides 1A and 2A came from the right middle hemorrhoidal nerve of ewe #09.

Slide 1A showed marked vacuolation (space occupied by axon and myelin sheath replaced by clear vacuoles), axonal swelling and vesicle formation. The axons stained light-blue on hematoxylin and eosin stain. There was an increased number of Schwann cells and granulation of supportive tissue. Macrophages and giant cells were scattered all around the tissue.

Slide 2A had marked fragmentation of myelin sheath and axons; there was a slight proliferation of the connective tissue. Few macrophages were scattered around the tissue.

Slides 3A and 4A came from the left middle hemorrhoidal nerve of ewe #09.

Slide 3A showed marked vacuolation and replacement of nerve fibers by proliferating endoneurium. There was a marked granulation of perineural supportive tissue. There were macrophages and giant cells, coupled with hemosiderosis in the perineural region. Perineural tissue had increased vascularity.

Slide 4A showed very marked vacuolation and fibroplasia of the supportive tissue. Some fibers had vesiculation and axons were in fragments. Macrophages were scattered all around the tissue. There was a focal hemosiderosis and an increase in number of Schwann cells.

Slides 5A and 6A came from the right middle hemorrhoidal nerve of ewe #07.

Slide 5A showed an extensive proliferation of the epineural tissue; most of the neurofibrils being replaced by Schwann cells. There was a marked vacuolation of fibers and macrophages were scattered around the tissue. Neurillema showed proliferation, and there were focal spots of hemorrhage with hemosiderosis. There was an increased vascularization in the epineural area. In most area within the tissue, there was no intact axon or myelin sheath.

Slide 6A showed generalized vacuolation, few fragmenting axons with vesiculation of myelin sheaths. There was an infiltration of the degenerated nerve tissue by Schwann cells. Around the perineurium were macrophages, giant cells; there was also a granulation of the perineurium. There was an increased vascularization of the perineural tissue.

Slides 7A and 8A came from the left middle hemorrhoidal nerve of ewe #07.

Slide 7A showed similar microscopic findings to 6A.

Slide 8A had the following findings--an extensive proliferation of epineurium, hemorrhage and hemosiderosis in the same area. There was a proliferation of neurillema and an increase in endoneural space. Few fibers showed an increased size of myelin sheath with either degenerated or fragmented axon. There were vacuolated fibers (only neurillema present), and some proliferating Schwann cells. Macrophages and giant cells were abundant. Epineurium showed an increased vascularization.

Slides 9A and 10A came from the right middle hemorrhoidal nerve of ewe #06.

Slide 9A showed shrinkage of perineurium. There was a proliferation and increased vascularization of epineurium. There was a marked swelling of axons in relation to the size of the myelin sheath. Some fragmenting axons were present with a relative increased size of myelin sheath. Vacuolation was not marked, and few macrophages were present.

Slide 10A showed extensive vacuolation with macrophages and giant cells in and around degenerated neurofibrils. There was a proliferation of neurillema.

Slides 11A and 12A came from left middle hemorrhoidal nerve of ewe #06.

Slide 11A showed marked vesiculation of myelin sheath; the degenerating axons were represented by tiny basophilic specks. There was a minimal macrophage infiltration and a mild proliferation of the epineurium.

Slide 12A showed various stages of degeneration of the nerve--ranging from axonal swelling with vesiculation of myelin sheath, complete absence of axons, to vacuolation of nerve fibers. There was a shrinkage of perineurium, proliferation of epineurium, coupled with increased vascularization of epineurium. Macrophage infiltration was minimal.

Slides 13A and 14A came from the right middle hemorrhoidal nerve of ewe #08.

Slide 13A showed focal vacuolation, but very extensive vesiculation of myelin sheath. There was a slight proliferation of epineurium.

Slide 14A showed an extensive vacuolation, slight vesiculation of myelin sheath, and proliferation of Schwann cells. Macrophages were scattered around the degenerated nerve fibers. Proliferation of the epineurium was accompanied with an increased vascularization of the same area.

Slides 15A and 16A came from the left middle hemorrhoidal nerve of ewe #08.

Slide 15A showed an extensive foreign body reaction with a lot of giant cells around the degenerated nerve fibers. There was a marked proliferation of endoneurium, perineurium and epineurium. Vacuolation was evident. There was a slight proliferation of Schwann cells.

Slide 16A showed essentially similar microscopic changes but more severe than those in slide 15A. There was hemorrhage and hemosiderosis along with above changes.

ALCOHOL BLOCK OF THE DISTAL VENTRAL SACRAL NERVES OF THE BOVINE
SPECIES AS A METHOD OF CONTROLLING RECTAL TENESMUS

by

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D.V.M., Ahmadu Bello University, Zaria, 1972

AN ABSTRACT OF A THESIS

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A simple technique was devised whereby middle and distal hemorrhoidal nerves (cow) and middle hemorrhoidal nerves (ewes) were selectively blocked at their emergence at the respective ventral sacral foramen as a method for controlling rectal tenesmus. A pre-injection clinical observation was made on each animal.

The individual nerves were located via rectal palpation at their emergence from the respective ventral sacral foramen.

Part I

Seven Jersey cows were used and were randomly divided into three groups A, B and C. Group A cows had 1.0 ml 95% isopropyl alcohol¹ injected around the nerves at the corresponding ventral sacral foramina. Group B cows had 1.0 ml 2% Lidocaine² and Group C cow had 1.0 ml physiological saline³ injected as for cows in group A.

The perineum throughout the period of observation in group A cows was desensitized, together with loss in external anal sphincter muscle tone. Desensitization of perineum lasted about 30 minutes in group B cows and loss in tone of the external anal sphincter muscles. The control cow (group C) had perineal sensitivity and no loss in the tone of the external anal sphincter muscles throughout the period of observation. Tail activity was retained in all cows (groups A, B and C).

¹95% Isopropyl alcohol, Union Carbide Corp., 6901 West 63rd St., Shawnee Mission, Ks.

²2% Lidocaine HCl injection U.S.P., McGaw Laboratories, Division of American Hospital Supply Corporation, Glendale, California 91201; Milledgeville, Georgia 31061.

³Physiological saline, prepared by Dykstra Veterinary Hospital, K.S.U., Manhattan, Ks. 66506.

Part II

The middle hemorrhoidal nerves were involved in the ewes. The individual nerves were located and identified via rectal palpation at their emergence from the respective ventral sacral foramen.

Eight ewes were divided into groups A, B and C. Group A ewes had 1.0 ml 95% isopropyl alcohol bilaterally injected around the middle hemorrhoidal nerves at the corresponding ventral sacral foramen. Group B ewes had 1.0 ml 95% Lidocaine, and ewes in group C had 1.0 ml physiological saline bilaterally injected around the nerves at the sites as in group A ewes. Clinical observations were made for five weeks post-injection after which the ewes were euthanized and the middle hemorrhoidal nerves dissected for gross and microscopic examination.

Ewes in group A had loss of external anal sphincter muscle tone, and the perineum was desensitized throughout the period of observation. Voluntary defecation was observed, and there was no urinary incontinence. Clinical observations in the group B ewes were identical as for group A ewes, but these lasted about 30 minutes after which perineal sensitivity returned. Ewes in group C had perineal sensitivity and tone in the external anal sphincter muscles throughout the period of observation. Tail activity was unimpaired in all ewes in groups A, B and C.

There was a fibrous adhesion of the middle hemorrhoidal nerves to the surrounding tissues in group A ewes. Microscopic examination revealed a chronic foreign body reaction. The middle hemorrhoidal nerves of ewes in groups B and C had normal relationship to the supportive tissues.