Rumen Cannulation of the Red Sokoto (Maradi) Goats for Nutritional Studies in Nigeria

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SUMMARY

TWO techniques for cannulating the rumen of the Red Sokoto goat of Nigeria are described. Stump type cannulae made of rigidblack, vulcathene¹ material with screwable corks were found to be more suitable than the flexible cannulae made of plastisol². They appeared to be well tolerated and remained *in situ* in spite of the animals' nervous temperament and somewhat flabby abdominal wall.

Experiences with some forty five of such cannulations performed between October 1970 and January 1975 are reported. These showed that although the double abdominal wall incision approach offered a better technique for cannulae implantation into the rumen of goats, strict routine post-operative attention was essential to avoid a range of post cannulation problems, such as pericannulae necrosis and infection, excessive leakage of the rumen liquor and partial or complete rejection of feed by the cannulated animals consequent upon such complications.

INTRODUCTION

THE role of cannulation of the various regions of the digestive tract of ruminants as a research tool in nutritional, biochemical and physiological studies all over the world is too well known to warrant detailed mention. In Nigeria, the past ten to fifteen years have also witnessed considerable interests in the ruminant metabolism studies. (Oyenuga 1966; Olubajo and Oyenuga 1970; Mba 1971; Ademosun 1973; and Mba, Oke and Oyenuga 1974).

All these studies involve quantitative and qualitative measurements of soluble products of digestion in the rumen that are directly absorbed and of the products that pass with the food residue to the abomasum. The technical difficulties presented in attempting such measurements have been partially overcome by cannulating the rumen for direct periodic sampling of the rumen digesta.

Although several reports have appeared from various countries using ruminants fitted with cannulae, very little information is available on the surgery and post operative complications of the operation in the domestic ruminants of West Africa, more especially, in the semi-dwarf Red Sokoto (Maradi) goat and the West African dwarf sheep (Plate 1). This paper presents a comparative report on the techniques of rumen cannulation used for the Red Sokoto goat, as well as some recommendations and remedial measures in routine post operative care.

MATERIALS AND METHODS

The Cannulae

Firm, small sized vulcathene cannulae fittings with screwable cappings, flanged

1 Allied Iron — Founders, Ltd., Mill Hill, London.

2 Plastic and Synthetic Division, Norton Company, Akron, Ohio.

cylindrical bodies with standard pipe threads were used. The cannulae were slightly modified in the departmental workshop as described by McKenzie and Kay (1968). Small 1.25 cm locking screws were prepared from the external flanges to give a permanent grip against these abdominal wall after fixation. The internal flange of the cannulae (usually implanted within the mucosal surface of the rumen) has the same thickness as the external flange. The dimensions of the cannulae type found most suitable for the adult Red Sokoto goat are given in Table 1.

time they were checked for general health pre-operative blood values and blood parasites. They were allowed at this time to acclimatise to the feed and confinement of the recovery pens of the hospital prior to surgery. Health records were kept using routine clinical parameters during this period of admission. They were given 1 vial of triplopen³ and 2 ml. vitamin AD₃E twenty four hours before surgery, using intramuscular routes. Coarse fodders were withdrawn 72 hours before surgery; concentrate ration 24 hours, and water at least 12 hours before operating.

TABLE 1

Standard cannulae specifications for the average sized matured Sokoto red goats

<i>Cannulae Components</i>	<i>Cork (cm)</i>	<i>Barrel (cm)</i>	<i>Int. Flange (cm)</i>	<i>Ext. Flange (cm)</i>
Internal Diameter (I.D.)	4.50	2.75	3.50	3.50
External Diameter (E.D.)	5.00	3.50	8.50	7.50
Height/Thickness	3.00	7.00	0.40	0.60
Int. = Internal				
Ext. = External				

The Animals

About forty five goats consisting of she goats, castrated he-goats (Plate 1), and intact (non castrated) he-goats aged 2-3½ years, weighing 15-38 kg were cannulated. Most of the goats were presented for surgery between October 1970 and January 1975 by the Departments of Animal Science of the Universities of Ibadan and Ife. On admission to the Large Animal Hospital the subjects were kept under clinical observation for at least two weeks before the surgical operation, during which

The Operative Site, Restraint and Anaesthesia

About 20-30 minutes before surgery the animals were sedated with intravenous 'Largactil'⁴ at a dose rate of 2.2 mg/kg bodyweight. Salivation was controlled by subcutaneous administration of atropine sulphate at a dose rate of 0.04 mg/kg bodyweight.

The area around the sub-lumbar fossa were liberally clipped, moistened with soap and water, shaved and washed with 1% Savlon⁵ solution and allowed to

3 Benethamine penicillin G, Procaine penicillin G and Sodium penicillin G — Glaxo Lab. Ltd., Greenford, England.

4 Chlorpromazine injectable — May & Baker Ltd., Dagenham, England.

5 Chlorhexidine Gluconate — I.C.I. Ltd., Macclesfield, Cheshire, Great Britain.

drip dry before dressing with lint soaked in surgical methylated spirit. The subjects were restrained with soft $\frac{1}{4}$ " ropes in right lateral recumbency on an oblong foam cushions with the prepared operation site facing the surgeon. Paravertebral anaesthesia of the area of operation was achieved by nerve-blocks of the thirteenth thoracic, first, second and third lumbar nerves using 2% lignocaine HCl and injecting 5 ml of anaesthetic at each site.

Operative Technique — Double Abdominal Wall Incision Method

The method used here was a modification of the one described for the Zebu cow by Akpokodje and Oladosu (1973). The rumen was approached by sublumber laparotomy through a paracostal incision between the last rib and the *tuber coxae*, at about 8 cm from the latter. The incision, about 10 cm in length, was commenced approximately 5 cm ventral to the transverse process of the third lumbar vertebrae. The skin, the subcutaneous fat and fascia, the abdominal muscles and the peritoneum were incised and the hand introduced into the peritoneal cavity to outpouch the rumen through the laparotomy incision. A continuous purse string suture of about 10 cm in diameter was made round the wall of the outpouched and intact rumen using No. 3 monofilament nylon (Plate 2). Care was taken to avoid the larger blood vessels and nerves of the rumen.

The lips of the laparotomy incision was packed and protected with sterile gauze, and the rumen wall at the point of access into the rumen held upwards to avoid possible spillage and contamination by ingesta. The rumen was then incised sufficiently wide enough to admit the internal flange of the cannula bung. The internal flange was introduced into the rumen and the purse string suture tightened with three surgeon's knots after the lips

of the incision had been completely invaginated around the fitted cannula (Plate 3). The rumen and fitted cannula, plugged with gauze, were then returned into the abdominal cavity. A mixture of 400,000 i.u. procaine penicillin G and 0.25 gm streptomycin sulphate was administered intra-peritoneally through the left flank laparotomy to prevent possible bacterial complications.

The exteriorization of the cannula barrel was through a secondary stab incision on the abdominal wall. The primary incision was sutured routinely using No. 2 chromic catgut for the peritoneum and the muscles; monofilament nylon size 3 was used for the skin. A gauze strip soaked in 2.1 penicillin-streptomycin mixture was wound round the cannula at the point of exteriorization. The external flange of the cannula and the locking screw were fixed, the gauze plug removed and the cannula opening covered with the bung. After surgery, which took about 45 minutes, the goats were released from the operating table and admitted to the recovery pen.

Operative Technique — Single Abdominal Wall Incision Method

This method was a slight modification of the open rumen fistula method described by Dougherty (1955), which was the old method of cannulation of small ruminant stock frequently associated with post-operation complications. The restraint, anaesthesia and pre-operative preparations of the goats were the same as those described above for double abdominal wall incision method. A 6 cm long vertical laparotomy incision was made on the dorso-central part of the left sub-lumber fossa, through which the serosal surface of the rumen was slightly exteriorised.

The skin was sutured all round the exteriorised rumen wall using size 3 interrupted monofilament nylon and taking adequate precaution not to pierce through into the lumen of the rumen. At about 1 cm from the rumeno-cutaneous sutures another purse string suture was placed round the rumen wall. The latter was centrally incised and the external flange of the cannula inserted into the rumen. The lips of the rumen incision were invaginated and the purse string sutures tightened against the cannula. Combined antibiotics were administered intra-peritoneally as in the double abdominal wall incision method. The edges of the skin incision were opposed as much as possible at their dorsal and ventral commissures using size 3 monofilament nylon, and the horizontal mattress suture pattern. The antibiotic medications and the fittings of the cannulae accessories were essentially the same as for the double abdominal wall incision method.

Post-operative management was essentially the same for the two methods. Close physical supervision was given for about 20 minutes after surgery to ensure recovery from anaesthesia and sedation. The subject was then placed in a specially prepared pen with clean, dry, hay or foam rubber bedding. No feed was offered for the first 24 hours after surgery. Thereafter, initially small, but increasing amounts of a good quality feed were given. Water was restricted to about 2 fluid ounces every 8 hours for the first two days, then slowly increased to *ad lib.* Daily intramuscular injections of penicillin/streptomycin were administered for a course of 5 days after surgery. Constant clinical surveillance included daily records of health parameters such as rectal

temperature, pulse, respiration, rumen motility, appetite, abdominal size, pericannulae appearances and general disposition of the fistulated goats. No attempts were made to interfere with healing and adhesions of the rumen to the abdominal wall during the first 5 days after surgery, or for longer periods when there were no exudates around the cannula. Disturbances of the cannulae during this period had been observed to lead to a breakdown in tissue adhesions of the rumen at the point of contact with the abdominal wall and subsequent extensive leakage of the rumen digesta. The appetite of the patient was given special attention. Where indicated, intra-ruminal infusions of 30 gm MgSO₄ in 170 ml. of water were given to improve appetite. Redressing of the pericannula areas and the surgical wound were carried out every other day using 1% savlon solution and topical application of aureomycin* powder. The goats were normally discharged 3-4 weeks after surgery for various experimental work.

The Routine Management of Goats fitted with Rumen Cannulae during the course of Experiments

Special types of small ruminants' metabolism cages used allowed for easy clearing of faecal and urine materials. Feed bins and water containing attachments were made available in the metabolism cages. The wire mesh floor allowed for adequate disposal of urine and faeces into the collecting tray beneath. The cages were cleansed daily and where the fistulated goats were housed in pens rigorous hygiene of the pens were pursued. Fresh clean water was provided to the animals after cleaning and scrubbing water containers,

* Chlortetracycline HCl — American Cyanamid Co., Princeton, N.J.

The feed bins were routinely kept dry and clean.

The pericannula exudates were removed with 1% luke-warm savlon solution using 40 cm x 30 cm lint. Sometimes the exudates were removed by gentle scrub with 8 cm x 5 cm oval shampoo brush after clipping with curved Mayo scissors. The wet pericannula areas were damped dry with absorbent lint washed in the savlon solution. Where there were pericannulae necrosis and minor pressure wounds they were treated with topical application of aureomycin powder. The blood and faeces of the animals were checked routinely for blood or gastro-intestinal parasites.

RESULTS AND DISCUSSION

With the double abdominal wall incision technique successful surgical implantation of permanent rumen cannulae in the Red Sokoto (Maradi) goats were accomplished. A higher degree of survivals were also observed — thirty three survivals out of thirty nine operations, at an approximate cannulation time of 45 minutes compared with lower survival rate — one out of six operations, at an approximate time of 105 minutes using the modified open fistula technique (Table 2). Fewer operations were performed using the single abdominal incision method because most of the animals died of peritonitis. These

findings agreed with the views of Dougherty (1955) and showed why the double abdominal wall incision technique is more commonly used in small ruminants. However, it must be emphasised that the surgically modified ruminant stock must be well cared for, immediately after surgery and during the course of experimental utilization.

In most cases, the cannulated goats were capable of standing on their feet immediately after surgery. This, perhaps, showed the advantage of using chlorpromazine sedation and paravertebral anaesthesia instead of the long acting barbiturate anaesthesia. The intravenous administration of the sedative also contributed to faster clearance of the drug from circulation and hence quick recovery.

Complete healing of the surgical wound (laparotomy and stab) took place within 2 weeks. Skin stitches were removed thereafter and the subjects discharged 3-4 weeks after operation. It is recommended that the cannulated goats be rested for 6-8 weeks after surgery before being used for experimental investigation.

The cannulae used were relatively inexpensive, readily available and firm enough to remain within the rumen unexpelled during the period of sampling and intra-ruminal infusions.

The double abdominal wall incision technique as modified by the authors for the Maradi goats of Nigeria has proved

TABLE 2

Comparative Observations on Techniques of Rumen Cannulation in the Sokoto Red (Maradi) Goats.

<i>Cannulation Technique</i>	<i>Number Cannulated</i>	<i>No. dead from complications</i>	<i>Number survived</i>	<i>% Survival</i>	<i>Approx. Time of cannulation</i>
Single Abdominal wall incision Technique (open fistula method)	6	5	1	16.67	105 mins
Double Abdominal wall incision Technique	39	6	33	84.62	45 mins

Plate 1. An Adult Red Sokoto (Maradi) Goat with Rumen Cannula in position after operation.

Plate 2. The Outpouched intact rumen with purse string suture in progress.

Plate 3. Invagination of the Lips of Rumen incision after Cannula Implantation.

to be simple, safe and efficient for rumen cannulae implantation in this breed of goats. The distress and risk associated with general anaesthesia had been eliminated and we consider the method as a more reliable one if animals are well catered for immediately after surgery and throughout the course of experiment.

ACKNOWLEDGEMENTS

The authors wish to thank the Senate of the University of Ibadan for grants in support of this work. We also wish to thank Professor D. H. Hill, Dean of the Faculty and Head of the Department of Veterinary Medicine & Surgery for his continued advice, encouragement and assistance; Mr. T. K. Biuwovwi and his staff at the Large Animal Hospital for their technical assistance during and after operations.

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