Objective:

To establish a leak-proof, cannulated fistula between the ruminal lumen and the external environment.

This permits the examination of rumen metabolites and microflora/fauna; the performance of in vivo ruminal sacco digestibility trials; the obtaining of inoculant for in vitro digestibility assays; the monitoring of slow release devices; the assessment of rumen motility patterns.

Details of Procedures:

a) Induce and maintain general or local anaesthesia (see under drugs, chemicals or biological agents below)

If a standing procedure is to be followed, administer any necessary sedatives to the animal(s) and restrain them in a standing position, PRIOR TO ADMINISTERING LOCAL ANAESTHETIC, so that the left flank can be approached for surgery.

b) Following the induction of general anaesthesia, lie the animal(s) in right lateral recumbency, on a slight slope, so that the chest is lower than the abdomen and the head lower than the chest (to allow fluids to drain freely from the mouth and nose, and avoid inhalation of ruminal contents).

c) Prepare the surgical site following aseptic procedures – wash to remove any remaining dirt or grease (with a preparation containing a detergent plus povidone iodine or hibitane solution), swab with 70% alcohol (from incision site, working outward in concentric circles) then alcoholic iodine (from incision site, working outward in concentric circles) immediately before beginning surgical procedures.

d) Surgical Procedure (Sheep & Goats):

i. At the site to be cannulated, make a diagonal skin incision (about 5cm long), approx. 3cm caudal to the last rib, 3cm ventral to the transverse process of the first lumbar vertebra.

ii. Blunt dissect the underlying muscles and peritoneum, again in a diagonal direction.

iii. Exteriorise a portion of the rumen, including the site of Cannulation.
iv. Place swabs, drapes, etc so as to prevent contamination of tissues with accidentally lost digesta.

v. Place an elliptical purse-string suture in the wall of the rumen, \(-\frac{1}{2}\) - \(\frac{3}{4}\) thickness of the gut wall and approx. 1-1 \(\frac{1}{2}\) cm at the widest curvature and 2-2 \(\frac{1}{2}\) cm long. Avoid areas traversed by blood vessels.

vi. Cut through ruminal wall inside the purse-string suture, taking care not to cut the suture.

vii. Insert the internal flange of the cannula into the visceral lumen. This is facilitated, and the spillage of digesta minimized, if the assistant holds up the ruminal wall with one or two pairs of Allis forceps. Following insertion of the cannula, ensure the internal flange is fully unfolded/everted. Then place a sterile bung or swabs in the lumen of the barrel of the cannula, to prevent the escape of digesta.

viii. Tighten and tie the purse-string suture. Place a second purse-string suture if the first does not completely close the incision.

ix. Irrigate the site with sterile saline (ensuring first that the exposed rumen is well packed off the swabs), ensuring any contamination (e.g. digesta) is removed. Follow with an irrigation of penicillin solution.

x. The peritoneal flange (if used) is inserted.

xi. Omentum is located, an incision is made through it and the omentum draped over the barrel of the cannula.

xii. The barrel is exteriorized through the laparotomy incision and the muscles then skin closed around it. Continuous sutures may be used in the muscle layers, single horizontal mattress or single interrupted sutures in the skin.

xiii. The external retaining flange is added, firmly enough to hold the cannula against the abdominal wall to allow adhesion to form rapidly, but avoiding excess pressure (which delays healing) on the tissues between the flanges.

xiv. Antibiotic spray may be applied to the underside of the exterior flange and the skin surface immediately before this last ring is placed in position.

Note: for cattle, the surgical procedure is the same but measurements are slightly greater to allow for between-species differences in anatomical size. In addition, more robust surgical instrumentation and prosthetic materials need to be used.

Drug, Chemicals or Biological Agents:

a) General anaesthetic (Sheep)
Sodium pentobarbitone (60mg/ml) is used intravenously, at approx. 0.33 ml/kg body weight, to induce anaesthesia. Half is given rapidly as a single injection and the remainder administered slowly after 2-3 minutes, until the desired depth of anaesthesia is reach. An appropriately sized endotracheal tube is placed with the aid of a laryngoscope.
Provided surgery takes no longer than 20 minutes to complete this anaesthetic dose should suffice. If insufficient a small top-up does may be given or the animal put on to inhalation anaesthesia (halothane + oxygen).

b) **Local anaesthetic (Sheep, Goats & Cattle)**
For standing surgery, animals may require sedation (e.g. with Acepromazine or Rompun) prior to the administration of a paravertebral nerve block. An animal ready for surgery, is placed in a metabolism crate (left panel removed) or crush and restrained using a head bale, and with or without a diagonal side-bar on the left. Using 2% Xylocaine/Lignocaine the left spinal nerves T1, L1, L2, L3 are blocked in the intervertebral spaces T13/L1, L1/L2, L2/L3 above and below the transverse processes of the vertebrae. About 1-2ml (small ruminants) or 2-3ml (cattle) of local anaesthetic is needed for each of the dorsal and ventral sites for each spinal nerve.

Local infiltration of 2% plain Xylocaine/lignocaine, using an inverted-L block, dorso-cranial to the incision site can be used as an alternative to the paravertebral block.

This surgery should not be performed under local anaesthetic unless the surgeon has performed the procedure at least once under general anaesthesia.

c) **Antibiotics**
Appropriate doses of long-acting antibiotics (e.g. tetracyclines or a penicillin/streptomycin combination) should be administered from 12-24 hours prior to surgery and continued for 7-10 days following surgery.

d) **Analgesics (Sheep & Goats)**
Buprenorphin should be administered intramuscularly, at a rate of 12ug/kg body weight, 6 hours before surgery and then continued 12 hourly for 4 days following surgery.

Post operative drug regime consists of IM Buprenorphin (12ug/kg) and IM Tolfedine (4mg/kg).

**Care of Animals before & after the Procedure:**

a) **Before surgery**
Prior to surgery all animals must be older than 3 months, health but not fat, wormed and vaccinated and have had at least 2 weeks in which to adjust to animal house conditions.

All animals should be eating normally for several days (preferably a good quality roughage ration such as Luceme chaff) and then fasted overnight prior to the surgery.

All animals should be started on a course of systemic antibiotics 12-24 hours prior to surgery. These antibiotics should be continued for 7-10 days following surgery (see below).

Buprenorphin (analgesic agent) should be administered 6 hours before surgery and then continued 12 hourly for 4 days following surgery (see below).
A large square (approx. 30 x 30cm) should be shaved, as close to the skin as possible, around the site of the proposed Cannulation. This skin area should then be thoroughly washed, to remove all dirt and grease.

Animals should be kept warm and quiet for the 12 hours preceding surgery.

b) After Surgery
Each animal which has received a general anaesthetic should be recovered initially in right lateral recumbency, head and chest lower than abdomen, in a warm quiet pen with a solid floor (e.g. rubber mat) to prevent trauma to the surgical site as the animal regains its ability to stand. It is essential that there are no projections on which the animal may injure itself and nothing in which the animal’s limbs or head may get caught during recover. The endotracheal tube should be left in place until swallowing reflex has returned, then the animal propped in sternal recumbency. Animals should be observed every 10-15 minutes until they are standing.

Animals should be provided with food immediately after surgery. It is important to get normal rumen function as soon as possible after surgery. Animals should receive half their usual volume of feed for the first 24-48 hours post-surgery, three quarters of the usual volume for the following 48 hours, then be returned to normal feeding regimes.

Antibiotic treatment should be continued and vital signs (respiration and heart rate, rectal temperature and general disposition) of all animals should be monitored twice daily for the ensuing 3-4 days.

Animals should be allowed a minimum of 3 weeks during which to recover, prior to the commencement of experimental procedures.

Cannulae and their associated fistulae should be kept clean and free of excessive wool. Care should be taken to avoid fly strike and infection of the site.

Qualifications, Experience, Skills or Training Necessary to Perform this Procedure:

Surgeons must:

a) Hold a veterinary qualification, registerable in NSW, as well as have suitable surgical experience. OR

b) Have completed at least the PSIO 410 Introduction to Experimental Surgical Techniques course, or equivalent, conducted in the Department of Physiology at UNE and have had extensive and suitable experience assisting and performing relevant surgical techniques. OR

c) Have had extensive practical experience in relevant surgical techniques and are judged by the Animal Ethics Committee, or it executive officers, to have sufficient skill and background knowledge.
In addition:
A person familiar and competent with all anaesthetic techniques to be used should be present to perform or closely supervise all such techniques for the duration of the undertaking (induction to recovery).

**Effects of Procedure on Wellbeing of Animals:**

Should be minimal.

**Pain Relief Measures:**

- General or local anaesthesia
- Analgesics (see above)

**References:**

Nil

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