

Radical Mastectomy in 20 Ruminants

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Objective—To describe a surgical technique for radical mastectomy in ruminants and to report experience and outcome in 20 animals.

Study Design—Retrospective study.

Animals—Seventeen goats and 3 cows.

Methods—Medical records of ruminants that had radical mastectomy between June 1, 1987 and June 1, 2003 were reviewed. Follow-up information was obtained by telephone interview of owners.

Results—One animal died within 24 hours from complications of gangrenous mastitis and another died from necrotizing cellulitis. Eighteen animals were discharged and follow-up information was available for 15 animals; 12 animals lived at least 1 year postoperatively.

Conclusions—Ruminants with severe but localized diseases of the udder did well after radical mastectomy. The procedure was well tolerated, made the animals more comfortable, and potentially prolonged their lives as pets.

Clinical Relevance—Radical mastectomy can be a safe and effective procedure for ruminants with udder disease, with few complications.

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THE SURGICAL TREATMENT of chronic mastitis and other disorders of the mammary glands in ruminants has been infrequently reported.^{1–5} Acute gangrenous or chronic mastitis is the most commonly reported indication for mastectomy.^{1–5} To our knowledge, there have been no reports describing long-term outcome after mastectomy in ruminants. Mastectomy is reportedly a high-risk procedure because of the potential for massive blood loss.⁵ Other risk factors include general anesthesia, especially with gangrenous mastitis, where hypoperfusion can be expected from generalized toxemia.⁶

Our purpose was to describe the surgical anatomy relevant to radical mastectomy in ruminants and to report our experience with this procedure in 20 animals, including the histopathologic diagnosis of the affected mammary tissue, and short- and long-term outcome.

MATERIALS AND METHODS

Medical records for 20 ruminants that had radical mastectomy between June 1, 1987 and June 1, 2003 were

reviewed. Signalment, duration of illness, physical examination findings, history of pregnancy, and clinicopathologic findings were retrieved. Further, the type of anesthesia (local or general) and the type of intravenous (IV) fluids administered during surgery were recorded. Histopathologic diagnoses from resected tissue or from necropsy were retrieved. Short-term survival was defined as living until discharge from the hospital and long-term survival was defined as being alive for ≥ 6 months after surgery. Long-term follow-up information was obtained by telephone questionnaire of the owner.

RESULTS

Radical mastectomy was performed on 17 goats and 3 cows. Mean duration of illness before admission was 15.4 weeks (range, 1 week–7 years). The mean age for the goats was 6.3 years (range, 1–10 years) and the 3 cows were aged 11, 15, and 15 years.

Sixteen animals had bilateral mammary enlargement; 4 had unilateral mammary enlargement. Fourteen goats had never been bred and were kept solely as pets. Nine animals had anemia (PCV < 27) that was attributed to

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chronic disease. All animals were administered perioperative anti-microbial drugs (penicillin or ceftiofur, or both) and 17 were administered perioperative non-steroidal anti-inflammatory drugs. Radical mastectomy was performed under general anesthesia; however 6 goats also had epidural catheters that were maintained for administration of morphine (5) or bupivacaine (1) for additional analgesia. All animals were administered lactated Ringers solution IV during surgery and 7 animals were administered fresh whole blood because of anticipated or perceived blood loss.

Surgical Technique

Radical mastectomy was performed by initially making an elliptical skin incision around the affected mammary gland. When possible, the incision was made about one-third of the way up the side of the udder, not around the base (Fig 1A) to preserve sufficient skin for closure. Subcutaneous tissues were separated by using a combination of sharp and blunt dissection. In 2 animals, a carbon dioxide laser (Lumenis, Santa Clara, CA) was used to make the initial skin incision and to start subcutaneous dissection. A dissection plane was started on the lateral aspect of the mammary gland between the lateral laminae and the skin, and was continued cranially and caudally using a combination of blunt and sharp dissection. In most animals, cranial dissection was performed initially because it seemed easier to separate the udder from the abdominal wall at this site. Vessels were isolated as the dissection was continued caudally. It was helpful to have at least one assistant to retract the udder and facilitate observation of the surgical field by

suction and sponging of blood. The assistant retracted the incised skin edge opposite where the surgeon was working to facilitate exposure of fascial planes and vasculature.

The external pudendal artery and vein, smaller mammary branch of the ventral perineal artery, and subcutaneous abdominal vein were the principal vessels that required ligation (Fig 1B). Smaller veins that emerged from the cranial aspect of the gland also required ligation, including branches of the external pudendal vessels adjacent to the suspensory ligament of the udder. If possible, the external pudendal artery was ligated before the vein to reduce blood loss. Finally, the fascial attachments (lateral and medial laminae of the suspensory apparatus) were incised and dissection was continued gradually, freeing the entire mammary gland from the body wall. The records were insufficiently detailed to determine the frequency of removal of the supramammary lymph nodes.

After udder removal, the incision was closed. If necessary, tension-relieving sutures (vertical mattress or near-far-far-near) were placed at intervals to appose the deep subcutaneous tissues. Interrupted subcutaneous sutures were placed between the tension sutures to appose the skin flaps. Penrose drains were positioned to prevent seroma formation in 10 animals. The skin was usually apposed using a continuous Ford interlocking pattern. Drains were removed between 48 and 72 hours.

Histopathology

Histopathologic diagnosis on tissue for 7 animals included fibrocystic mammary tissue (1), mammary

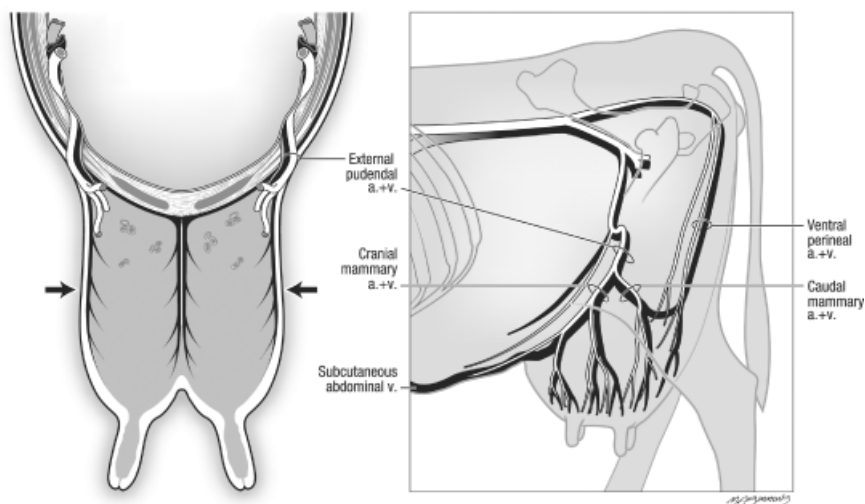


Fig 1. (A) Line diagram of the udder showing the preferred starting point for the skin incision for udder amputation. (B) Diagram of the vascular supply to the ruminant udder.

hyperplasia (2), papillary duct adenoma (1), squamous cell carcinoma (1), and mammary gland adenocarcinoma (2). The remaining animals were believed to have chronic/active mastitis with lobular hyperplasia.

Outcome

Eighteen animals were discharged; 1 goat with gangrenous mastitis died 24 hours after surgery because of multi-system organ failure, presumably caused by generalized toxemia. Another cow died from septicemia resulting from a necrotizing cellulitis at the surgical site. Incisional seroma occurred in 1 goat. All other incisions healed without incident.

Follow-up was obtained for 15 animals. Mean survival was 28.4 months (range, 1 month–6 years). One goat died within 1 month of surgery, after surgery for abomasal impaction; a necropsy was not performed. Another goat died from a metastatic leiomyosarcoma unrelated to the udder, 2 months after surgery. Twelve animals lived for ≥ 1 year; this included 2 goats with adenocarcinoma, 1 goat with ductal adenoma, and 1 goat with squamous cell carcinoma.

DISCUSSION

Most of the radical mastectomies we performed were to make the affected ruminants more comfortable. Sixty-two percent of these animals, including 1 cow, had never been bred. All the nulliparous goats had precocious udder development that resulted in mastitis and marked udder enlargement.

In does, precocious udder development is defined as lactation without a preceding parturition.¹ The cause is not completely understood but a hereditary basis has been suggested. It has also been suggested that precocious udder development may occur because of a persistent corpus luteum (CL). If true, then a luteolytic dose of prostaglandin might cause regression of the CL and by doing so prevent the development of udder enlargement and mastitis.⁷

Primary mammary neoplasia (squamous cell carcinoma, fibromas, fibrosarcomas, and papillary adenomas) in cows and goats is uncommon.^{7–10} Lymphosarcoma (LSA) extending from another primary site is the most common tumor to occur within the mammary gland and associated lymph nodes of cattle.⁷ None of our cows had LSA.

There are few reports of mammary tumors in goats. Unilateral fibroepithelial hyperplasia (benign hyperplasia) of the mammary gland was reported in a Nubian goat and was treated successfully by unilateral mastectomy.¹¹ Two of our goats had mammary adenocarcinoma and 1 had squamous cell carcinoma, which is exceedingly

rare.^{8–10} All 3 goats survived at least 12 months after surgery. Histopathology results for tissue from the other goats included mammary hyperplasia, fibrocystic mammary tissue, and gangrenous mastitis. The other animals were believed to have chronic, active mastitis with mammary hyperplasia although histologic confirmation was not obtained because of economic constraints. Because neoplasia was diagnosed in our study, we recommend submission of mammary tissue for histopathology if at all possible. The removal of the regional lymph nodes in animals where neoplasia is suspected is warranted, to determine if metastasis has occurred.

From a surgical perspective, dissection and ligation of the larger vessels (superficial abdominal veins, external pudendal arteries and veins, and perineal arteries) prevented marked blood loss in these animals. Hemostasis of smaller vessels was controlled by use of electrocautery. The CO₂ laser was used in 2 animals but offered little advantage to sharp dissection and vessel ligation. One notable difference in performing radical mastectomies on goats compared with cows is the large size of the cow udder. In our experience, using 2 teams of surgeons for cows (1 team per side), decreased surgery and anesthesia time.

Another surgical technique for animals with diseased udders was originally described by Brewer.^{4,5,12} With this technique, a skin incision is made over the inguinal area, the external pudendal artery and vein are ligated, and the udder is allowed to gradually slough. Advantages of the Brewer technique include use of local anesthesia and a shorter operative time, which may be less traumatic to an animal with systemic illness. In addition to vessel ligation, amputation of the teat is advocated by some authors¹² to provide drainage of exudate, and allow air to enter the gland cistern and deter anaerobic organisms. The disadvantages of these techniques are the intensive wound care and the unsightly appearance of the udder as it sloughs. This technique may be more appropriate than amputation for animals with severe toxemia and cardiovascular compromise that will not tolerate general anesthesia. In our study, 1 goat died soon after surgery because of sepsis and endotoxemia presumably related to gangrenous mastitis. Another cow died from septic cellulitis.

In our opinion, ruminants with diseased and/or enlarged udders, which have become non-functional and have led to constant discomfort, are candidates for a radical mastectomy. Peri-operative antibiotic choices were influenced by the preference of the surgeon and/or financial constraints of the owner of the animal. Because cattle can enter the human food chain, it is important to remember the meat withholding time for antibiotics and non-steroidal anti-inflammatory drugs. The most common antibiotics used in our study were Procaine

Penicillin G and Ceftiofur sodium. Penicillin has a meat withholding time of 14 days, whereas Ceftiofur sodium has no meat withholding time. Flunixin meglumine, phenylbutazone (goats only), and aspirin were all used in this study for their anti-inflammatory properties.¹

The decision on whether or not to transfuse an animal with whole blood was based on the severity of anemia and the potential or perceived blood loss, during surgery. Many of these animals were already mild to moderately anemic before surgery; therefore, the concern for preventing hypoxia from further blood loss was real. In our experience, blood loss during radical mastectomy in goats was minimal. However, the potential for blood loss in cattle, with their dangerously large external pudendal veins and engorged udders, led us to have a ready source of whole blood easily available, should the need arise.

In ruminants in good physical condition with diseased udders we advocate radical mastectomy. With attention to aseptic technique and hemostasis, the surgery was not difficult and the outcome was favorable.

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