

Urogenital Surgery, Including Mastectomy

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Abstract

Veterinarians are often called upon to manage urogenital emergencies in small ruminants and camelids. Mastectomy, c-section and urethral obstruction are among the most common of these procedures and will be discussed.

Anatomy

The mammary system of sheep and goats includes two glands, each of which has one teat. Principal support for the udder is the medial and lateral suspensory ligaments. The medial suspensory ligament is elastic in nature and, although each half of the udder has a medial suspensory ligament, they are tightly adhered to each other. The medial laminae are composed of elastic sheets of tissue arising from the ventral abdominal wall and dividing the udder into two halves. The lateral suspensory arises from the pelvic symphysis, subpelvic tendon, and prepubic tendon. Secondary laminae arise from the medial and lateral laminae to support lobes of the udder. The indentation formed between the two halves of the udder is associated with the medial laminae and is referred to as the intermammary groove.

The two halves of the udder are distinctly separate from each other and are supplied by separate arteries, veins and nerves. Main arterial blood supply to the udder is via the external pudendal artery, which courses through the inguinal ring after having originated from the pudendoepigastric trunk, which originates from the deep femoral artery, which originates from the external iliac artery, which originates from the abdominal aorta. Venous blood from the udder is drained by the external pudendal veins, the caudal superficial epigastric veins and the perineal veins. The iliohypogastric and ilioinguinal nerves provide nerve supply to the cranial udder. The genitofemoral nerve provides nerve supply to the caudal udder.

The teat wall is composed of five layers. The innermost layer is a very thin mucosal layer, followed by the submucosa. The next layer is the connective tissue layer, which is rich in blood supply. External to the connective tissue layer is the muscular layer, which is composed of both circular and longitudinal muscle fibers. Externally, the teat is covered by stratified squamous

epithelium. The teat mucosa surrounds a teat cistern (teat sinus, lactiferous sinus) which, during lactation, is filled with milk. The teat cistern is continuous proximally with the gland cistern. There is a distinct annular ring, which demarcates the teat cistern from the gland cistern. This annular ring contains a large vein that encircles the base of the teat and is occasionally referred to as Furstenburg's venous ring. Located at the distal end of the teat and connecting the teat cistern to the outside is the streak canal (teat canal, papillary duct). The streak canal is lined by stratified squamous epithelium and has longitudinal folds. At the junction of the teat cistern and the streak canal is the Rosette of Furstenberg. This rosette is created when the mucosa of the teat cistern meets the stratified squamous epithelium of the streak canal. The circular teat sphincter muscle lies directly beneath the Rosette of Furstenberg at the proximal end of the streak canal. The streak canal varies from 0.5 to 1.0 cm in length. The streak canal ends externally at the teat orifice.

Supernumerary Teats

Accessory teats or supernumerary teats may be separate and not connected to the primary mammary gland, may be connected to the primary teat or gland, or may be separate and have a functionally separate mammary gland. Small supernumerary teats, which are completely separate from the main teats, are rarely observed in goats. When seen, supernumerary teats are usually located caudal to the main teats and are much smaller. When supernumerary teats are found in rams and bucks, they are usually located cranial to the scrotum. The distinction must be made between supernumerary teats and bifid teats (see below). Supernumerary teats are usually removed with serrated scissors when the kid or lamb is young. Teats should always be removed so the resultant cut is craniocaudal in direction, so the resultant scar blends with the normal folds of the udder. If supernumerary teats are not removed until the animal is older, they should be dissected and sutured after tranquilization and local anesthesia.

After tranquilization and a local anesthesia, the supernumerary teat should be dissected with an elliptical incision in cranial-to-caudal orientation. This dissection will provide visualization of the glandular

mucosa from which the supernumerary teat arose. This mucosa is closed with a simple continuous suture of fine (No. 3-0 or 4-0) absorbable monofilament suture material (e.g. PDS, polyglecaprone). The adjacent connective tissue should also be closed with a continuous suture of fine absorbable suture. The skin should then be closed with interrupted sutures of non-absorbable material (e.g. polymerized caprolactam, polypropylene).

Bifid Teats

Bifid teats (fused teats, forked teat) may be fused for a variable distance, but always have two teat sphincters and two teat orifices. Bifid teats are considered to be an inherited defect, and surgical correction of them is considered to be unethical. Therefore, unless an extra teat is clearly a separate and distinct teat, the kid or lamb should not be used as a dairy or meat replacement animal. These abnormalities may be more common among Pygmy goats and other non-dairy goat breeds.

Udder Amputation

Udder amputation is perhaps the most common teat and udder surgery in small ruminants. Udder amputation is performed when an owner wishes to keep the animal (either for genetic potential or as a pet) after the udder has become beyond repair. In sheep of exceptional value, the udder might be amputated after a long-term chronic mastitis which has left a non-secretory fibrotic mass for an udder. In these cases the animal is often a "poor doer" because of the chronic infection. In goats, udders may be amputated because of chronic fibrotic udders (as with sheep) or may be amputated because of excessive size secondary to precocious milking. Goats are more prone to precocious milking than any other domestic species. Although many medical therapies to cause this milking to cease have been tried, they are seldom successful. Often these are pet animals that the owner does not wish to milk. In other cases, the owner gets tired of milking this animal on a continual basis. Regardless, without milking the udder increases in size over time until it becomes large enough to become uncomfortable for the animal and unsightly for the owner. At this point, in a goat maintained as a pet, the owner will often elect udder amputation.

Udder amputation is not a procedure to be undertaken lightly, as the animals are often in poor physical condition due to chronic infection. The animals may also be anemic due to the chronic nature of the infectious process. Additionally, one must consider the sheer mass of the udder to be removed and the potential for serious hemorrhage. The owner must, therefore, be made aware of these potentially serious consequences. General an-

esthesia, although not an absolute necessity, is certainly preferable.

It is also recommended that a blood donor be available, or even that blood be drawn and banked for a blood transfusion in case it is needed. This recommendation is probably more applicable to the bovine than it is to the ovine and caprine. If possible, the animal should be positioned in dorsal recumbency. This facilitates working on both sides of the udder. If dorsal recumbency is not possible, the animal will need to be rolled from one side to the other during surgery and the appropriate preparations should be made.

With udder amputation, the external pudendal artery should be ligated before any of the venous system is ligated. This gives the blood in the udder some chance to drain back into the circulation before the udder is removed. A skin incision is made parallel to the base of the udder and about 3-5 cm ventral to the dorsal edge of the mammary tissue. Eventually this incision will extend completely around the udder in an elliptical manner. Hemorrhage should be controlled by cautery or ligation. Once through the skin, the incision is carefully extended through the lateral suspensory ligament of the udder. Care should be taken, as the external pudendal artery and vein lie directly beneath the lateral suspensory. The external pudendal artery and vein can be found coursing from the inguinal ring in a tortuous manner. As they exit the inguinal ring they should be ligated. It has been recommended that the artery and vein be separated from each other and ligated separately. If this is attempted, extreme care must be taken during this procedure. In practice, the artery and vein are often ligated together. This certainly leaves the possibility of an arterio-venous shunt, although in reality this rarely occurs. Once the artery and vein have been ligated on one side, the procedure should be repeated on the opposite side unless a hemi-mastectomy is being performed.

At this point the incisions (each side) are extended cranial and the subcutaneous abdominal veins are ligated. It should be noted that, although textbooks and articles report that there is one subcutaneous abdominal vein for each half of the udder, in reality these veins have multiple branches as they approach the udder. Each branch must be individually double ligated. Once the subcutaneous abdominal veins have been ligated, the skin incisions are extended caudal and the perineal veins are ligated. There should be one perineal vein on each side although this is somewhat variable.

After ligating all major vessels, the median suspensory ligament is cut near the body wall. Ideally, about 1-2 cm of medial suspensory should remain on the body, as it gives a place to anchor the skin and help obliterate dead space during closure. If only a hemi-mastectomy is being performed, the right and left half

of the median suspensory ligament can be separated and only the half of the median suspensory involved with the amputated half is severed.

Once the udder has been amputated, the skin is closed. In performing the skin closure, dead space is obliterated if possible. This usually includes taking bites of the median suspensory ligament as the skin is closed. It may be advisable to place a Penrose drain in the dead space for several days following surgery.

Post-operatively we should hope for first-intention healing, although second-intention seems to be more common. Although umbilical tape has been recommended in the literature as the ligature of choice, post-operative infection is much less of a problem if absorbable ligatures are used. If absorbable sutures are used, one should be aware of the large sized vessels that are being ligated, and appropriate sized suture should be used.

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Injectable Solution 50 mg/mL Veterinary

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CAUTION: Federal law restricts this drug to use by or on the order of a licensed veterinarian.

DESCRIPTION: Each milliliter of BANAMINE Injectable Solution contains flunixin meglumine equivalent to 50 mg flunixin, 0.1 mg edetate disodium, 2.5 mg sodium formaldehyde sulfoxylate, 4.0 mg diethanolamine, 207.2 mg propylene glycol; 5.0 mg phenol as preservative, hydrochloric acid, water for injection q.s.

INDICATIONS: *Cattle:* BANAMINE Injectable Solution is indicated for the control of pyrexia associated with bovine respiratory disease and endotoxemia. BANAMINE Injectable Solution is also indicated for the control of inflammation in endotoxemia.

DOSE AND ADMINISTRATION: *Cattle:* The recommended dose for cattle is 1.1 to 2.2 mg/kg (0.5 to 1 mg/lb; 1 to 2 mL per 100 lbs) given by slow intravenous administration either once a day as a single dose or divided into two doses administered at 12-hour intervals for up to 3 days. The total daily dose should not exceed 2.2 mg/kg (1.0 mg/lb) of body weight. Avoid rapid intravenous administration of the drug.

CONTRAINDICATIONS: *Cattle:* There are no known contraindications to this drug in cattle when used as directed. Do not use in animals showing hypersensitivity to flunixin meglumine. Use judiciously when renal impairment or gastric ulceration are suspected.

RESIDUE WARNINGS: Cattle must not be slaughtered for human consumption within 4 days of the last treatment. Not for use in lactating or dry dairy cows. A withdrawal period has not been established for this product in pre-ruminating calves. Do not use in calves to be processed for veal. Not for use in horses intended for food.

PRECAUTIONS: As a class, cyclo-oxygenase inhibitory NSAIDs may be associated with gastrointestinal and renal toxicity. Sensitivity to drug-associated adverse effects varies with the individual patient. Patients at greatest risk for renal toxicity are those that are dehydrated, on concomitant diuretic therapy, or those with renal, cardiovascular, and/or hepatic dysfunction.

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SAFETY: *Cattle:* No flunixin-related changes (adverse reactions) were noted in cattle administered a 1X (2.2 mg/kg; 1.0 mg/lb) dose for 9 days (three times the maximum clinical duration). Minimal toxicity manifested itself at moderately elevated doses (3X and 5X) when flunixin was administered daily for 9 days, with occasional findings of blood in the feces and/or urine. Discontinue use if hematuria or fecal blood are observed.

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