Mastectomy in ten mares: indications, surgical technique, complications, and long-term outcome

Morgan N. Steiner, DVM1; Lindsey H. Boone, DVM, PhD, DACVS2; Lyndsey Hayden, DVM, MS3; Jim Schumacher, DVM, DACVS4; Carolyn E. Arnold, DVM, PhD, DACVS5

1Department of Large Animal Clinical Sciences, School of Veterinary Medicine and Biomedical Sciences, Texas A&M University, College Station, TX
2Department of Clinical Sciences, College of Veterinary Medicine, Auburn University, Auburn, AL
3Department of Clinical Sciences, College of Veterinary Medicine, University of Missouri, Columbia, MO
4Las Cruces, NM
5School of Veterinary Medicine, Texas Tech University, Amarillo, TX

*Corresponding author: Dr. Steiner (msteiner2013@tamu.edu)

OBJECTIVE
To describe the indications for and surgical technique of mastectomy of mares and to describe the outcome of 10 mares that underwent mastectomy in a retrospective case series.

ANIMALS
10 mares having disease of one or both mammary glands.

CLINICAL PRESENTATION
Medical records (1995 to 2022) from 2 university teaching hospitals were searched to identify mares that had undergone unilateral or bilateral mastectomy. Data regarding history, signalment, diagnostic tests, preoperative treatment, surgical procedure, and postoperative management were reviewed. Follow-up information was obtained by interviewing the owners by telephone.

RESULTS
One (n = 4 mares) or both mammary glands (6 mares) were excised for the following reasons: chronic bacterial mastitis (4), neoplasia (3), lymphangiectasia (1), pythiosis (1), and lymphoid hamartoma (1). None of the mares experienced intraoperative complications. The surgical site was closed primarily in 2 mares and left unsutured in 8 mares. Both sutured wounds developed a seroma, and 1 dehisced. The owners reported that the surgical wound, whether sutured or unsutured, was healed within 3 months. All mares returned to use for their intended purpose, but 3 mares were euthanized 2 to 4 years after surgery due to progression of disease. One mare drowned 1 year after discharge.

CLINICAL RELEVANCE
Mastectomy can be an effective treatment for mares suffering from disease of one or both mammary glands when the mare is refractory to medical treatment.

Keywords: mare, mammary gland, mastitis, mammary neoplasia, mastectomy

Mastectomy of mares, whether unilateral or bilateral, is uncommonly performed. Reported indications for mastectomy include bacterial mastitis and mammary neoplasia, but other indications include trauma to a mammary gland and recurrent galactorrhea. Antimicrobial treatment of mares for bacterial mastitis is frequently successful, so mastectomy is indicated only when the mare is refractory to appropriate medical treatment. Neoplasia of a mammary gland is rare, but neoplasms reported to be found in the mammary gland include adenocarcinoma, carcinoma, and lymphosarcoma.

The technique of mastectomy of ruminants has been well described. Reported complications associated with mastectomy of ruminants include severe intraoperative hemorrhage, infection and dehiscence of the sutured wound, and formation of a seroma at the sutured wound. We found only a single description of the surgical technique of mastectomy in mares, and this description included neither the intraoperative and postoperative complications of mastectomy nor the long-term outcome of mares undergoing mastectomy.
The objective of this retrospective study was to describe the indications, surgical technique, intraoperative and postoperative complications, and long-term outcome of 10 mares that underwent unilateral or bilateral mastectomy.

Methods

Medical records from 1995 to 2023 from Texas A&M University’s Veterinary Medical Teaching Hospital and Auburn University’s Veterinary Teaching Hospital were searched to identify mares that had undergone unilateral or unilateral mastectomy. Mares with incomplete medical records or follow-up were excluded. Data collected from the medical record included the signalment, presenting complaint, history, results of diagnostic testing, preoperative and postoperative treatment, details of the operative report, and outcome at the time of discharge (ie, the short-term outcome). Owners completed a survey, conducted by telephone, to determine the long-term outcome, defined as the outcome ≥ 1 year after surgery.

Statistical analysis

Descriptive statistics (median) were calculated for the age of the mares in the study, duration of clinical signs, and duration of antibiotic therapy administered.

Results

Ten horses aged 3.5 months to 22 years old (median, 13 years) underwent mastectomy. Breeds included Clydesdale (n = 2), American Quarter Horse (2), American Paint Horse (2), donkey (1), Gypsy Vanner (1), Arabian (1), and Shire (1). Mastectomy was performed for the following reasons: chronic bacterial mastitis (n = 4), neoplasia (3), lymphangiectasia (1), pythiosis (1), and lymphoid hamartoma (1). The duration of clinical signs of disease of one or both mammary glands displayed by these mares prior to mastectomy ranged from 2 days to 36 months (median, 5 months).

Four of the 10 mares underwent a unilateral (n = 1) or a bilateral (3) mastectomy because of chronic bacterial infection of one mammary gland diagnosed preoperatively by the referring veterinarian. These mares ranged in age from 4 to 19 years old (median, 15 years). One was lactating and was presented 2 months after foaling. Three were not lactating, and 2 of these had never foaled. None were pregnant. All 4 had been administered 1 to 4 courses of systemically administered antimicrobial treatment for 1 to 8 months (median, 5 months) prior to admission. One mare had received only 1 course of systemically administered antimicrobial treatment, and 3 had received 3 or 4 courses of systemically administered antimicrobial treatment. Three mares had also been treated 1 or more times by infusion of an antibiotic into the affected gland prior to admission.

The duration of clinical signs displayed by these mares suffering from chronic bacterial mastitis ranged from 2 to 12 months (median, 3.5 months) and included swelling and edema of 1 mammary gland (n = 4 mares), ventral edema (2), purulent discharge from the teat of the affected gland (4), and signs of discomfort when the infected gland was palpated (4). Bacterial mastitis was diagnosed on the basis of the presence of clinical signs typical of bacterial mastitis and cytological examination and bacterial culture of mammary secretions from the teat of the infected gland(s). Typical signs of bacterial mastitis can include heat, pain, or swelling of the local gland as well as ventral edema less commonly. Bacteria cultured at the referral hospital from mammary secretions from these 4 mares included Streptococcus equi (n = 1), Pseudomonas aeruginosa (2), and Streptococcus zooepidemicus with P aeruginosa (1). The nucleated cell counts in the mammary secretions of the diseased gland of 1 mare that was lactating was reported by the referring veterinarian to be 425 X 10⁶ neutrophils/μL. The predominant cells were neutrophils, most of which had moderate-to-marked degenerative changes. Though the mammary secretions of the other 3 mares were examined cytologically by the referring veterinarians, the results of these examinations were not known. Enlargement of the gland, subcutaneous edema, and accumulation of purulent exudate within the gland and its ducts were identified during ultrasonographic examination of the diseased mammary gland of each of these 4 mares, but the mammary tissue appeared to be normal.

Three mares underwent bilateral mastectomy because of mammary carcinoma, diagnosed preoperatively (1 mare) or postoperatively (2 mares) by histologic examination of diseased tissue removed from the affected gland. One mare, 22 years old, displayed signs of mammary disease for 3 months, and another mare, also 22 years old, displayed signs of mammary disease for 6 months before being presented for examination of its mammary glands. The exact duration of clinical signs of mammary disease displayed by the third mare, an 11-year-old donkey, was unknown because the mare had signs of mammary disease when the owner acquired it 6 months earlier from a facility that rescued horses and donkeys. Clinical signs of mammary disease included the presence of a mammary mass and edema surrounding the affected mammary gland or glands. The mass of 1 mare was ulcerated, and purulent discharge exuded from it.

All 3 mares that underwent mastectomy because of mammary carcinoma also suffered from carcinoma of the external genitalia. All 3 mares had 1 or more granulomatous lesions on 1 labium of the vulva, and 1 mare, in addition to having a granulomatous lesion on a labium, also had a mass of similar appearance on its clitoris.

The lesions on the external genitalia of 2 of these 3 mares were determined to be carcinomas on the basis of histologic examination of biopsies performed 2 or 3 years before carcinoma of the mammary gland was identified. Treatment of the mares for these vulvar and clitoral lesions during the intervening years, included, at different times, photodynamic laser therapy, injection of 5-fluorouracil into the neoplas-
tic tissue, and cryoablation and excision of the neoplastic tissue. The vulvar and clitoral carcinomas of 1 mare had resolved with these treatments several months before the mare was presented for examination of its mammary glands. The vulvar carcinoma of the other of these 2 mares had not resolved, despite these treatments, at the time it developed signs of mammary disease, and so the diseased vulvar tissue was excised during the same anesthetic period that a bilateral mastectomy was performed.

The vulvar carcinoma of 1 mare, a donkey, was determined preoperatively at the referral center to be a carcinoma by histologic examination. The vulvar lesion and both mammary glands were removed from the donkey during the same anesthetic period.

The left mammary gland of a 10-year-old mare was removed at the owner’s request because it had gradually become so enlarged during the previous 12 months that it interfered with locomotion. Diffuse edema, but no intramammary mass, was identified during ultrasonographic examination of the affected gland. Lymphangiectasia was determined, by histologic examination of the excised gland, to be responsible for the enlargement.

Both mammary glands of a yearling filly were removed because they were infected with *Pythium insidiosum*. The filly, when 4 months old, had sustained a laceration to the ventral abdomen that also involved both mammary glands. Despite receiving antimicrobial treatment, the filly developed progressively enlarging erosive, cutaneous lesions of the mammary glands that extended into a network of draining tracts containing hard, yellow caseous masses typical of pythiosis during the 8 months prior to admission. Infection of the glands by *P. insidiosum* was confirmed by histologic examination of the mammary glands after the glands were excised.

A 3-month-old filly was presented because of progressive enlargement of its left mammary gland first noticed when the filly was a few days old. The affected gland, which was removed at the owner’s request, was found by histologic examination of excised tissue to be enlarged because it contained a lymphoid hamartoma, which is a benign growth that contains multiple aggregates of lymphocytes organized into lymph nodes.

Eight of the 10 mares received a preoperative hematological examination. This examination included determination of PCV and total serum protein, a CBC, and serum biochemical analyses. No major hematological abnormalities were identified during these examinations. Minor abnormalities observed during hematological examination of some mares included mild neutrophilia, a stress leukogram (neutrophilia, lymphopenia, monocytosis, and eosinopenia), mild hyperglobulinemia, mild hyperfibrinogenemia, and mild hypocalcemia. There was no clear pattern of abnormality in these minor hematological abnormalities between the mares diagnosed with neoplasia and those diagnosed with other mammary disease.

Feed, but not water, was withheld from all the mares for 12 hours prior to induction of anesthesia, except for the only foal in this study, which was restricted from nursing, with a muzzle, for 2 hours before surgery. All horses were administered flunixin meglumine (1.1 mg/kg, IV, q 12 h) and tetanus toxoid before surgery. Antimicrobial treatment administered preoperatively included ceftriaxone crystalline free acid (6.6 mg/kg, IM, q 96 h) in 1 mare, doxycycline (10 mg/kg, PO, q 12 h) in 5 mares, or a combination of potassium penicillin (22,000 IU/kg, IV, q 6 h) or procaine penicillin (22,000 IU/kg, IM, q 12 h) and gentamicin sulfate (6.6 mg/kg, IV, q 24 h) in 4 mares. Antibiotic choice was primarily made by surgeon preference and maintained for a range of 1 to 5 days postoperatively.

The mares were sedated with xylazine HCl (0.2 to 1 mg/kg, IV) or detomidine HCl (0.01 to 0.02 mg/kg, IV) and butorphanol tartrate (0.01 mg/kg, IV) or morphine (0.1 mg/kg, IV). Anesthesia was induced with a combination of ketamine HCl (3.3 mg/kg, IV) and midazolam (0.06 to 0.1 mg/kg, IV) or diazepam (0.02 to 0.2 mg/kg, IV). Anesthesia was maintained with sevoflurane or isoflurane delivered, with oxygen, through an endotracheal tube by use of a circle system. The mares were positioned in dorsal recumbency, and the ventral aspect of the abdomen, from the ribs to the pubis, was prepared and draped for surgery.

The surgical technique of mastectomy performed on each mare closely resembled that described by Wolfe and Moll. An elliptical incision was made around the base of the affected gland (4 mares) or glands (4 mares) if the surgical site was to be left open to heal by second intention (8 mares). Four connecting, elliptical cutaneous incisions were made around both mammary glands if both glands were to be removed and the surgical site was to be closed primarily (2 mares; Figure 1). The apex of each of these connecting incisions was located ventrally toward the teat, and the base of the incisions was located at the base of the mammary gland. These incisions were made to preserve as much skin as possible for closure.

The diseased mammary gland was separated from the sheath of the rectus abdominis muscle in a cranial to caudal direction by use of a combination of blunt and sharp dissection with a Mayo or Metzenbaum scissor. When mastectomy was performed for suspected neoplasia, wide margins of up to 1 cm were attempted. The large vessels entering and exiting the mammary gland, such as the cranial mammary artery and vein (branches of the caudal superficial epigastral branch of the external pudendal artery and vein) and the caudal mammary artery and vein (branches of the external pudendal artery and vein), were double ligated with No. 1 (USP) polyglactin 910 and coagulated and transected distal to the site of ligation by use of a vessel-sealing device (Atlas; LigaSure). Small vessels were not ligated but sealed with the vessel-sealing device. Dissection continued caudally until the gland was freed from the suspensory ligaments attaching the gland to the abdominal tunic. Enlarged inguinal lymph nodes, if encountered, were removed by use of blunt and sharp dissection with a Mayo or Metzenbaum scissor and LigaSure.
The wound of 2 mares that underwent bilateral mastectomy was closed primarily. Before closing the wound of these 2 mares, two 2.54-cm-wide Penrose drains (Cardinal Health) were placed into the wound, and each end of one of the drains exited through a stab incision larger than the diameter of the drain, created cranial and caudal to the wound (Figure 2). The second drain had one end tied to the first drain in the wound, and the other end exited through a similar stab incision created cranial or caudal to the wound. Each end was secured to the skin with No. 2-0 (USP) polydioxanone suture. Dead space was decreased by suturing the subcutaneous tissue to the fascia of the rectus abdominis muscle with simple-interrupted sutures of No. 1 (USP) polyglactin 910 placed in a staggered fashion, taking care to avoid incorporating the drains in the sutures. An interrupted cruciate pattern could also be used to close this dead space in a similar staggered fashion when a large amount of tension is present. The cutaneous incisions were closed with No. 1 (USP) poliglecaprone 25 sutures placed in a simple-interrupted or simple-continuous pattern in a stellate pattern with each end sutured toward the center of the wound.

A tie-over bandage, composed of laparotomy sponges held in place with umbilical tape laced through loops of monofilament suture (0 Prolene) inserted in the skin surrounding the wound, was placed over the sutured wound, and an impervious adhesive drape (Ioban; 3M Healthcare LLC) was placed over the tie-over bandage. The adhesive drape was removed after the mare recovered from anesthesia, the tie-over bandage was removed 24 or 48 hours after surgery, and the drains were removed at 3 or 5 days depending upon the decreasing amount of fluid produced by the surgical wounds. The absorbable skin sutures were not removed.

The affected mammary tissue of 6 of the 10 mares was submitted for histologic examination, and on the basis of the results, 1 mare was diagnosed with mammary lymphangiectasia, 1 with mammary lymphoid hamartoma, 1 with chronic bacterial mastitis, 1 with mastitis caused by *P. insidiosum*, and 2 with mammary carcinoma. Results of histologic evaluation of the margin of a mammary gland and the regional lymph nodes of 2 mares, removed because of mammary carcinoma, indicated that excision was complete with no evidence of metastasis to regional lymph nodes for one mare, but excision was incomplete and the carcinoma had metastasized to regional lymph nodes for the other mare. The margins of the excised mammary gland and the regional lymph nodes of a third mare that had undergone mastectomy because of mammary carcinoma were not examined histologic-
cally. Flunixin meglumine (1.1 mg/kg, IV, q 12 h) was administered to all mares for 5 to 7 days after surgery. The antimicrobial treatment administered before surgery continued for 3 to 5 days. All mares were placed on complete stall rest and walked in hand twice daily for 15 minutes, while hospitalized, to alleviate the mild edema that developed on the ventral aspect of the abdomen and the pelvic limbs. The mares with surgical sites left unsutured were treated once daily with low-pressure hydrotherapy by use of a garden hose directly in the wound.

One of the 2 mares that had its surgical site closed primarily was administered trimethoprim-sulfamethoxazole (24 mg/kg, PO, q 12 h) for 10 days after the antimicrobial treatment that had been initiated before surgery (procaine penicillin and gentamicin) was discontinued, 3 days after surgery. This mare developed a seroma at the surgical site based on its appearance on ultrasound. It was treated conservatively and resolved by day 10 after surgery, and the incision healed by primary intention. The surgical site of the other mare that had its surgical site closed primarily began to exude purulent discharge 7 days after surgery, and soon after, the incision dehisced. Pre- and postoperative administration of trimethoprim-sulfamethoxazole was extended until 21 days after surgery, by which time infection at the surgical site appeared to have resolved. This mare was also administered firocoxib (0.13 mg/kg, PO, q 24 h) for a week after exudate was first observed.

The mares were discharged from the hospital 5 to 23 days (median, 5.5 days) after surgery. All medications were discontinued at the time of discharge, and owners were instructed to perform wound care in the case of incisions that healed by second intention. Mares with unsutured incisions were allowed to exercise in a small paddock after 2 to 3 weeks, after which time they were allowed unrestricted exercise. Solely on the basis of clinician preference, the owners of 4 other mares whose surgical site was left unsutured were instructed to turn their mare out into a small paddock to allow free-choice walking. The owners of the 2 mares that had their surgical site closed primarily were instructed to confine their mare to a stall for 30 days before allowing unrestricted exercise but to walk the mare in hand twice daily during this period of confinement.

Owners were unable to specify when the surgical site was completely healed, but all reported that they believed the surgical site to be healed by 3 months after surgery. All mares returned to their intended purpose after mastectomy. These purposes included pleasure riding (n = 6), therapeutic riding (1), driving (1), racing (1), and pasture companionship (1).

Long-term follow-up, by telephone, of the mares was performed 1 to 7 years after surgery (median, 2.5 years). Four mares survived for at least 3 years after mastectomy was performed to resolve chronic bacterial mastitis but were lost to additional follow-up. A mare that underwent excision of a vulvar carcinoma and bilateral mastectomy because of mammary carcinoma during the same anesthetic period was euthanized 6 years after surgery for reasons unrelated to the surgery. Another mare that underwent excision of a vulvar carcinoma and bilateral mastectomy because of mammary carcinoma during the same anesthetic period was euthanized 3 years after surgery due to recurrence of the mammary carcinoma. The mammary gland tissue originally excised was not submitted for histologic examination, so the margins of the tissue excised were not evaluated. A mare that underwent successful treatment for vulvar and clitoral carcinoma prior to undergoing bilateral mastectomy because of mammary carcinoma was still alive and had had no recurrence of the carcinoma 1 year after mastectomy, even though the histologic examination of the excised mammary gland was incomplete and metastasis was noted in the excised lymph node.

Though the surgical site of the mare that underwent excision of its left mammary gland because of lymphangiectasia healed without complication by second intention and the mare’s gait returned to normal, the mare’s left pelvic limb began to enlarge 2 years after surgery, the cause of which was suspected to be lymphangiectasia. The limb became so severely enlarged by 3 years after surgery that the mare was euthanized at the owner’s request. The mare that underwent bilateral mastectomy because of mammary pythiosis drowned in a flood 1 year after mastectomy but had had no signs of recurrence of pythiosis at the surgical site. One mare, a racehorse, that underwent unilateral mastectomy to remove a lymphoid hamartoma had raced and produced and raised 1 foal by the time of follow-up 6 years after surgery. All owners reported that they were pleased with the cosmetic outcome of mastectomy.

Discussion

Lactating and nonlactating mares can develop bacterial mastitis, with 5% to 10% of mares on equine breeding farms being affected during their lifetime. Bacterial mastitis results from the introduction of bacteria directly into the gland from the mouth of a nursing foal or through a break in the skin overlying the gland. Mares that accumulate milk within a gland due to a blocked milk duct or lack of vigorous sucking to strip the gland predisposes mares to developing mastitis. Nonlactating mares can develop bacterial mastitis secondary to trauma to the teat canal. The cause of the chronic mastitis in 4 mares in this study remains unknown.

Clinically, mares with mastitis have heat and swelling of the infected gland and are sensitive to palpation. Mares may also have purulent discharge from the affected teat and edema of the ventral aspect of the abdomen. While mares may display signs of systemic infection, such as fever, anorexia, and depression, the mares in this study had only localized inflammation reported. Streptococcus zooepidemicus is the most commonly identified bacterial cause of mastitis of mares, but Staphylococcus spp, Klebsiella spp, Actinobacillus spp, and Escherichia coli have also been identified.
as causes.\textsuperscript{1,3,7} *Pseudomonas aeruginosa*, seemingly an uncommon cause of mastitis of mares, was cultured from the mammary sections of 3 of the 4 mares that underwent mastectomy as a treatment for chronic bacterial mastitis.

The cytologic threshold for mastitis is defined as mammary secretions having > 100 X 10\(^6\) neutrophils/\(\mu L\) when the mare is lactating, or 400 X 10\(^6\) neutrophils/\(\mu L\) when the gland is involuted.\textsuperscript{2,7} Only 1 mare, which was lactating, of this study received cytologic evaluation of mammary secretions from the infected gland at the referral center, and the concentration of neutrophils in this fluid was 425 X 10\(^6\) neutrophils/\(\mu L\). The predominant cell type seen on cytology were neutrophils with a small number of erythrocytes present. There was a mild-to-moderate amount of degeneration of the neutrophils and gram-positive bacteria seen extracellularly.

Neoplasia of the mammary gland occurs most commonly in mares \(\geq 12\) years old.\textsuperscript{12,16} Carcinoma, the most common type of mammary neoplasia, is locally invasive but slow to metastasize.\textsuperscript{16} Two of the mares of this study developed carcinoma of one or both mammary glands 2 years after vulvar carcinoma was diagnosed, perhaps because of metastasis of the vulvar carcinoma. The owner of a mare presented with vulvar and mammary carcinoma knew neither the duration of disease nor which carcinoma appeared first. Mares diagnosed with genital carcinoma should also be evaluated for mammary carcinoma. Any abnormalities can be detected by digital palpation of the mammary gland and diagnosed via biopsy of the affected tissue.

Clinical signs displayed by mares with mammary neoplasia may initially mimic those of bacterial mastitis,\textsuperscript{16,17} and a mistaken diagnosis may delay appropriate treatment. Affected mammary tissue must be examined histologically to confirm a diagnosis of mammary neoplasia.\textsuperscript{12,18,19} The inguinal region should be examined by external palpation and palpation per rectum to determine whether neoplasia of a mammary gland has metastasized to inguinal lymph nodes. Mild enlargement of the inguinal lymph nodes due to metastatic spread may be difficult to discern from lymphadenopathy secondary to bacterial infection from mastitis.\textsuperscript{11} Only one of the mares of this report underwent palpation of the inguinal area per rectum, and during palpation, no abnormalities were noted. Inguinal lymph nodes encountered during mastectomy, whether enlarged or not, should be removed. The inguinal lymph nodes were removed during mastectomy of 2 of the 3 mares that underwent mastectomy because of neoplasia. Histopathologic examination of the lymph nodes showed evidence of metastasis in one of these cases. While no recurrence has been reported to date, it is imperative for owners to understand the importance for continued monitoring for recurrence or metastasis to other locations.

Other diseases experienced by 3 of the mares in this study that necessitated a mastectomy included lymphangiectasia, pythiosis, and lymphoid hamartoma. Lymphangiectasia is a rarely encountered disease of human beings and domestic animals, including horses, characterized by dilatation of lymphatic vessels of any organ, but especially those of the intestinal tract.\textsuperscript{22-25} Lymphangiectasia can be classified as primary or secondary. Primary lymphangiectasia is a congenital disorder but can manifest at any age.\textsuperscript{21} The etiology of lymphangiectasia is poorly understood,\textsuperscript{24} but causes of secondary intestinal lymphangiectasia of human beings include cardiac and hepatic diseases, inflammatory lesions, and malignancy of the mesenteric lymph nodes.\textsuperscript{22} The few cases of horses affected with intestinal lymphangiectasia had a favorable prognosis for resolution of disease with conservative therapy, which included antibiotic treatment and administration of an anti-inflammatory drug, probiotics, and gastrointestinal protectants.\textsuperscript{24} We were unable to determine whether the horse of this report received antimicrobial and anti-inflammatory treatments before mastectomy or after the horse developed lymphangiectasia of the limb.

Pythiosis is an invasive, pyogranulomatous disease of the skin and subcutaneous tissue caused by *P. insidiosum*.\textsuperscript{26} Zoospores of this protistal organism gain access to the body through open wounds.\textsuperscript{26} Complete excision of the lesion, as was performed for the horse of this report, is curative.\textsuperscript{26}

A hamartoma is a benign, tumor-like growth composed of normal, well-differentiated cells, consisting of the same tissue as the tissue from which it arises. Most develop in utero.\textsuperscript{27} A lymphoid hamartoma, such as the one found in the mammary gland of a mare in this study, is an uncommonly encountered mass composed of smooth muscle, blood vessels, collagenous stroma, and adipocytes arising from a lymph node.\textsuperscript{27} Surgical removal of any type of hamartoma is generally curative, though recurrence has been reported.\textsuperscript{28} Regardless of the indication for mastectomy, the diseased mammary gland is best separated from the body wall in a cranial-to-caudal direction because the fibroelastic capsule surrounding the gland is more prominent cranially.\textsuperscript{1,21} When removing a neoplastic mammary gland, the cutaneous margins of the excised tissue should be wide (up to 1 cm beyond grossly abnormal tissue) to ensure all neoplastic tissue is removed. After a plane of dissection has been established between the fibroelastic capsule of the gland and the underlying external sheath of the rectus abdominis muscle, dissection is continued caudally, where the fatty, nonglandular mammary tissue is more abundant and the capsule less evident. Using a vessel-sealing device, such as the Atlas (LigaSure), on smaller vasculature (< 7 mm) may reduce surgical time by helping to ameliorate hemorrhage during dissection.

The mares of this study developed few complications after mastectomy. The 2 mares that had the surgical site closed primarily developed a seroma. This occurred even though precautions were taken to avoid formation of a seroma, such as decreasing dead space with sutures and inserting gravity drains.
into the wound. Whereas leaving the large wound produced by excising a mammary gland of a human patient to heal by second intention may be cosmetically unacceptable, leaving the wound produced by removing one or both mammary glands open to heal by second intention in the mares of this study resulted in no complications, and the wound healed with little to no scar present. The owners found the aftercare of the mares that had the site of mastectomy left unsutured easy to manage.

The 10 mares described in this report had good short-term outcomes, and most had a favorable long-term outcome after undergoing unilateral (n = 4) or bilateral (6) mastectomy. All mares returned to their intended purposes. Long-term follow-up was available for 9 of the 10 mares, with survival averaging 2.5 years following the surgery. Two were euthanized 2 or 3 years after undergoing bilateral mastectomy to remove carcinomas because they developed recurrence of the vulvar carcinoma, and 1 was euthanized 3 years after mastectomy due to massive enlargement of a hind limb, presumably caused by progression of lymphangiectasia originating in the excised mammary gland. One mare was able to sustain its foal’s nutritional requirements while having just 1 mammary gland.

Mares with chronic mastitis, neoplasia, or other disease of one or both mammary glands unresponsive to medical treatment can be treated successfully by mastectomy. The results of this study indicate that unilateral or bilateral mastectomy can be performed with equipment found in most surgical referral centers and that surgery is accompanied by no or minimal intraoperative or postoperative complications. The mastectomies that were left open to heal by second intention developed fewer postoperative complications than the ones closed primarily. The owners of the mares in this report were pleased with the outcome, and the mares were able to return to their intended function. Mastectomy should be considered when a mare with disease of one or both mammary glands is refractory to medical treatment.

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ORCID

M. Steiner https://orcid.org/0009-0002-7854-2988
L. Boone https://orcid.org/0000-0002-6489-0141

References