

Squamous cell carcinoma of the midventral abdominal pad in three gerbils

Todd A. Jackson, DVM; Lisa A. Heath, DVM; Marc S. Hulin, DVM; Christopher L. Medina, DVM; Lori M. Scarlett, MS, DVM; Karen L. Rogers, DVM; Clarence E. Chrisp, MS, DVM; Robert C. Dysko, DVM

- The midventral abdominal pad of gerbils is a common site for tumor formation.
- Squamous cell carcinoma is the most common tumor reported in the midventral abdominal pad of male gerbils.
- Excision of squamous cell carcinoma tumors of the midventral abdominal pad can be curative.

A 2-year-old 100-g male Mongolian gerbil (*Meriones unguiculatus*; gerbil 1) was examined because it had a red mass on the midventral abdomen. The mass was first noticed by the owner on the day of examination. The gerbil did not have a prior history of disease.

Physical examination revealed a 1-cm in diameter, red, round, ulcerated mass on the ventral midline in the area of the umbilicus (Fig 1). Other abnormalities were not found. On the basis of the appearance and location of the lesion, neoplasia of the midventral abdominal pad was suspected. An excisional biopsy was performed to gather samples that would enable us to confirm the diagnosis.

Ketamine hydrochloride (40 mg/kg of body weight) and xylazine hydrochloride (2 mg/kg) were mixed in the same syringe and administered intraperitoneally. A surgical plane of anesthesia was not reached by use of this regimen, and supplemental anesthesia was provided with methoxyflurane administered via a nosecone. Radiography was performed on the anesthetized gerbil, but did not reveal abnormalities in the thorax or abdomen.

Hair was clipped from around the mass, and the gerbil was placed in dorsal recumbency on a circulating-water heating pad. The surgery site was prepared by scrubbing it 3 times with a chlorhexidine-based surgical scrub^a and rinsing it with a solution of 70% alcohol. An elliptical incision was made in the skin approximately 5 mm from the margins of the mass. Larger margins could not be obtained without requiring excessive tension to be put on the sutures at closure. The mass was easily removed from the abdominal musculature by blunt dissection, and the incision was closed, using 4-0 nylon suture material in a simple interrupted pattern. Recovery from anesthesia was uneventful, and the gerbil was discharged to its owner

From the Unit for Laboratory Animal Medicine, 018 Animal Research Facility, University of Michigan, Ann Arbor, MI 48109-0614. Dr. Scarlett's present address is Durham Animal Hospital, 4306 Roxboro Rd, Durham, NC 27704.

Supported by Training Grant RR07008 and Resource Grant RR00200 of the Comparative Medicine Training Program, National Center for Research Resources, National Institutes of Health.



AVMA 09046

Figure 1—Photograph of a male gerbil with a 2 X 2-cm mass involving the midventral abdominal pad. The tumor (arrowheads) was diagnosed as a squamous cell carcinoma.

the same day. The mass was fixed in neutral-buffered 10% formalin and submitted for histologic examination.

Microscopic examination revealed 1 border of the mass to be covered by normal skin with islands of squamous cells extending into the dermis. Multiple foci of central necrosis were evident within islands of neoplastic squamous cells, and deposits of keratin were found in other foci of cells. Mitotic figures (≤ 12 figures/high-power field) were detected (Fig 2). On the basis of histologic examination, a diagnosis of squamous cell carcinoma was made. Neoplastic cells extended to the borders of the mass, and the owner was advised of the potential for local recurrence.

The gerbil was determined to be clinically normal during all examinations for nearly 2 years. Twenty-three months after tumor removal, the gerbil was hospitalized for treatment of severe bite wounds inflicted by 3 new cagemates. A 1-mm in diameter, ulcerated, draining lesion was evident in the dermis on the ventral midline. It was not possible to determine whether this was a bite wound or recurrence of the tumor.

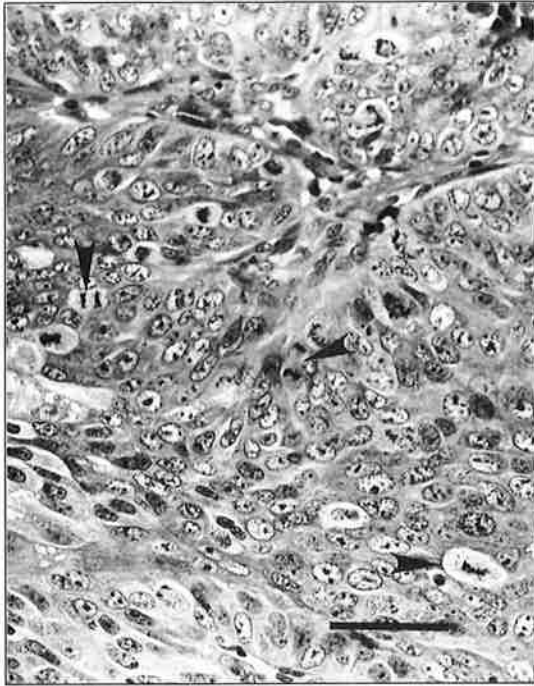


Figure 2—Photomicrograph of a section of a mass from a squamous cell carcinoma in the midventral abdominal pad of a male gerbil. Notice the mitotic figures (arrowheads). H&E stain; bar = 60 μ m.

Despite treatment that included cleansing of the wounds, application of topical preparations of antibiotics, and subcutaneous administration of fluids, the gerbil became moribund and was euthanized. Histologic examination revealed the abdominal lesion to be caused by a small focus of neoplastic squamous cells.

A 4-year-old male gerbil (gerbil 2) was examined because it had had a seizure and was lethargic. The gerbil did not have a history of illness prior to being found lying on its side, shaking, and unable to stand. Physical examination revealed a 1 \times 2-mm, red, dome-shaped lesion on the surface of the midventral abdominal pad. The left testis was approximately a fourth of its expected size, and the gerbil was mildly lethargic.

On the basis of the owner's description, a tentative diagnosis of idiopathic seizure was made. Because seizures develop in about 20% of gerbils, and the refractory period can last several days,¹ the owner opted to monitor the gerbil at home to see whether the seizures would continue.

During examination 4 days later, the owner reported that seizure activity had not recurred, but the gerbil continued to be lethargic. Physical examination findings had not changed. To rule out the possibility of neoplasia of the testes or midventral abdominal pad, the owner elected to have the gerbil castrated, and the midventral abdominal pad was excised.

Whole-body radiography was performed with the gerbil awake and unrestrained. Abnormalities were not detected. Anesthesia was induced by use of 5% isoflurane in an aquarium-type induction chamber, and was maintained by use of 0.75 to 1.5% isoflurane administered via a nosecone. A blood sample was obtained via

retro-orbital puncture, a procedure commonly used in rodents,² and was submitted immediately for analysis, using a dry-slide chemistry analyzer.^b Thoracic radiography was performed on the anesthetized gerbil, but abnormalities were not detected.

Results of serum biochemical and hematologic analysis were within reference ranges, except for a low serum urea nitrogen concentration (15 mg/dl; reference range, 17 to 27 mg/dl) and a low PCV (40%; reference range, 43 to 49%).

Number of WBC/ μ l was estimated by comparing a blood smear made from a sample obtained from gerbil 2 to blood smears made from samples with known numbers of WBC/ μ l. Number of WBC/ μ l was estimated at 5×10^3 cells/ μ l (reference range, 7×10^3 to 15×10^3 cells/ μ l). Numbers of various WBC/ μ l were calculated from the estimated total number of WBC/ μ l, and were within reference ranges, except for a low number of lymphocytes (3,500 cells/ μ l; reference range, 4,200 to 14,250 cells/ μ l).

Actual measurement of the number of WBC/ μ l and additional serum biochemical testing were not possible because of the limited volume of blood that could be collected. On the basis of radiography and analysis of results of CBC and biochemical tests, the gerbil was considered a good candidate for surgery.

Hair was clipped from the ventral portion of the abdomen, inguinal region, and scrotum. Gerbil 2 was placed in dorsal recumbency on a circulating-water heating pad, and the surgery sites were prepared as for gerbil 1. An elliptical incision was made in the skin surrounding the midventral abdominal pad, and the entire pad was separated from the abdominal musculature by blunt dissection. The wound was closed, using 3-0 nylon suture material^c in a simple interrupted pattern.

Bilateral incisions were made through the skin and musculature directly over each testis. Spermatic cords were ligated and the musculature was closed, using 3-0 polyglactin 910.^d Skin incisions were closed by use of 3-0 nylon.^c

Warmed lactated Ringer's solution (1.8 ml) was administered subcutaneously to replace the volume of blood estimated to have been lost during surgery and collection of the retro-orbital blood sample. The gerbil recovered from anesthesia and was returned to its owner the same day. The next day, the owner reported that the gerbil ate and drank normally, but was reluctant to move around the cage.

Microscopic examination of tissues revealed the lesion of the midventral abdominal pad to be a squamous cell carcinoma in situ without indication of local invasion. Microscopic examination of the testes revealed bilateral testicular atrophy consistent with aging.

All incisions had healed normally by 10 days after surgery, and the skin sutures were removed. The gerbil's lethargic condition had resolved by that time. Periodic examinations during the next 4 months did not reveal abnormalities.

Four months after surgery, the gerbil was examined because it was dyspneic. Physical examination revealed the gerbil to be thin with a severe decrease in

thoracic compliance. Radiography of the thorax revealed severe cardiomegaly with tracheal compression. The gerbil was given a poor prognosis and was euthanized. Histologic examination did not detect neoplastic cells in sections of tissues obtained from the skin and abdominal wall at the site of the midventral abdominal pad.

A male gerbil of unknown age (gerbil 3) was hospitalized with an approximately 1-cm in diameter, round, ulcerated, nodular mass on the ventral portion of the abdomen. One week prior to admission, the gerbil had become anorectic and lethargic. On physical examination, the gerbil was thin, severely dehydrated, and cool to the touch. Although it was given 1.5 ml of a sterile solution of 0.9% NaCl subcutaneously and placed under a heating lamp, it died before diagnostic testing could be performed.

Necropsy revealed the mass to be a squamous cell carcinoma. Multiple foci of hemorrhage in the adrenal glands, mesenteric lymph nodes, and liver were consistent with a diagnosis of disseminated intravascular coagulation secondary to septicemia. Ulceration of the tumor may have allowed bacterial invasion that led to septicemia and death.

The midventral abdominal pad of gerbils is found on the abdominal midline near the umbilicus. It consists of large sebaceous glands that are under the control of gonadal hormones. The surface of the pad is slightly raised above the skin. In males, the pad is approximately 2.5 × 0.5 cm, but it is slightly smaller in females.¹ Secretions from the pad are used for territorial marking and identification of pups.³

Although sebaceous adenoma,⁴⁻⁶ sebaceous carcinoma,^{4,7} and squamous cell carcinoma,^{1,5} as well as a papilloma arising from the skin near the pad,⁸ have been reported, only squamous cell carcinoma tumors have been reported to metastasize.¹ Of 15 tumors of the pad, 11 have developed in male gerbils. All 8 of the squamous cell carcinoma tumors that have developed in the pad were in males. Three of the 4 neoplasms reported in female gerbils have been adenomas, and the other one was a sebaceous carcinoma.⁷

The apparent sex predilection may be attributable to the fact that the pad is under the control of gonadal hormones. The pad hypertrophies at sexual maturity or when androgens or estrogens are administered. The pad involutes after castration.¹ Therefore, castration of male gerbils with neoplasms of the pad may decrease the chance of recurrence or slow the rate of growth of these tumors.

Although surgical removal of the tumors in gerbils 1 and 2 was relatively easy, maintaining a surgical plane of anesthesia proved difficult in gerbil 1. Ketamine provides surgical anesthesia in gerbils when given intramuscularly at a dosage of 44 mg/kg.⁹ We chose to administer the ketamine intraperitoneally, however, be-

cause ketamine causes muscle necrosis in other rodents when given intramuscularly.¹⁰ To provide additional analgesia, xylazine was given at a dosage commonly used in other rodents. When this regimen failed to produce a surgical plane of anesthesia, we chose to administer methoxyflurane, rather than risking prolonged recovery by administering additional doses of ketamine or xylazine.

Although there are numerous reports of tumors of the midventral abdominal pad in gerbils, we were unable to find recommendations for treatment of these tumors. For gerbil 1, removal of the tumor in that 2-year-old gerbil extended its life by nearly 2 years. This was impressive, considering that the typical life span of gerbils is only 3 years.³ In gerbil 2, tumor removal and concurrent castration were curative. However, the lack of recurrence in gerbil 2 may have been the result of complete surgical resection, rather than the removal of hormonal effects by means of castration.

Any mass of the midventral abdominal pad of gerbils should be regarded with suspicion. A definitive diagnosis should be made by histologic examination of samples obtained by means of excisional biopsy with wide surgical margins. Because of the high incidence of malignant tumors in the midventral abdominal pads of male gerbils, we recommend that castration be part of the treatment.

^aNolvasan Surgical Scrub, Fort Dodge Laboratories, Fort Dodge, Iowa.

^bKodak Ektachem DT60 Analyzer, Eastman Kodak Co, Rochester, NY.

^cEthilon, Ethicon, Somerville, NJ.

^dVicryl, Ethicon, Somerville, NJ.

References

1. Harkness JE, Wagner JE. *The biology and medicine of rabbits and rodents*. 3rd ed. Philadelphia: Lea & Febiger, 1989;73.
2. Rowe SE, Simmons JL, Ringler DH, et al. Spontaneous neoplasms in aging gerbillidae. *Vet Pathol* 1974;11:38-51.
3. Harkness JE, Wagner JE. *The biology and medicine of rabbits and rodents*. 3rd ed. Philadelphia: Lea & Febiger, 1989;34.
4. Vincent AL, Ash LR. Further observations on spontaneous neoplasms in the Mongolian gerbil, *Meriones unguiculatus*. *Lab Anim Sci* 1978;28:297-300.
5. Vincent AL, Porter DD, Ash LR. Spontaneous lesions and parasites of the Mongolian gerbil, *Meriones unguiculatus*. *Lab Anim Sci* 1975;25:711-722.
6. Benitz KF, Kramer AW. Spontaneous tumors in the Mongolian gerbil. *Lab Anim Sci* 1965;15:281-284.
7. Bingel SA. Pathologic findings in an aging Mongolian gerbil (*Meriones unguiculatus*) colony. *Lab Anim Sci* 1995;45:597-600.
8. Meckley PE, Zwicker GM. Naturally occurring neoplasms in Mongolian gerbil (*Meriones unguiculatus*). *Lab Anim* 1979;13:203-206.
9. Smith SM, Kaplan HM. Ketamine-methoxyflurane anesthesia for the Mongolian gerbil (*Meriones unguiculatus*). *Lab Anim* 1974; 8:213-216.
10. Smiler KL, Stein S, Hrapkiewicz KL, et al. Tissue response to intramuscular and intraperitoneal injections of ketamine and xylazine in rats. *Lab Anim Sci* 1990;40:60-64.