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Case Report

Mammary tubular carcinoma in a guinea pig (*Cavia porcellus*): case report

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Abstract: Mammary carcinomas are common malignant tumors encompassing the main diagnostic mammary gland tumor cause in female dogs and cats. Few reports in wild animals are, however, available. In this context, this study aimed to characterize the clinical and histological aspects of a mammary tubular carcinoma case in a guinea pig (*Cavia porcellus*). A four-year-old non-spayed female guinea pig was seen at a veterinary clinic in the municipality of Natal, Rio Grande do Norte, Brazil. Upon clinical examination, the animal was active, with a normal body condition, weighing 660 grams, hydrated, and presenting normal-colored mucous membranes. Increased left breast volume was observed, about 3.5 cm in diameter, non-adherent and with an ulcerated surface located medially to the mammary papilla, about 1.8 cm in diameter. The observed clinical findings indicated a presumptive neoplastic lesion diagnosis. A unilateral mastectomy was performed (left breast) and breast tissue fragments were histologically evaluated, confirming the tubular mammary carcinoma diagnosis. The surgical procedure and post-surgical treatment recommended in this report were proven efficient. Knowledge of diseases that affect non-conventional pets, such as the tubular mammary carcinoma reported herein, is paramount in improving the quality of life of these animals.

Keywords: Cancer; Histopathological; Neoplasm; Rodentia; Rodent.

1. Introduction

Guinea pigs (*Cavia porcellus*) are rodents belonging to the Caviidae family, widely employed in Brazil as a scientific research model and kept as pets, as they are easily domesticated social animals, easy to maintain and unexpensive [1,2,3]. However, even as

pets, Guinea pigs are wild animals and are treated in veterinary medicine as non-conventional pets. Due to increased breeding efforts and their popularization, studies aimed at improving the quality of life and knowledge of diseases that affect these animals are paramount.

Bronchogenic papillary adenoma is the most common neoplasm diagnosed in guinea pigs, followed by skin tumors and subcutaneous tumors [4], and more recently a case of fibroblastic osteosarcoma [5]. Regarding mammary neoplasms, adenocarcinomas [6], simple solid carcinomas and simple tubulopapillary carcinomas [7] have been reported.

Breast carcinomas comprise highly aggressive tumors with a still unknown etiology, but which may be associated with genetic, hormonal, nutritional and environmental factors [8,9]. Despite being highlighted as one of the main malignant tumors in domestic animals [10], reports concerning exotic pets are scarce in the literature. Therefore, the aim of this report was to characterize the clinical and histological findings of a mammary tubular carcinoma case in a pet guinea pig.

2. Case Report

An unspayed female guinea pig, four years old, raised as a pet, was examined on April 2, 2022, at a veterinary clinic in the municipality of Natal, Rio Grande do Norte, Brazil. During the anamnesis, the main tutor's complaint was an increase in left breast volume observed in the previous two months, and, in the previous few days, the presence of a serous secretion in the region. Upon clinical examination, the animal was active, normal body condition, weighing 660 grams, hydrated, and presenting normal-colored mucous membranes. Increased left breast volume was observed, measuring about 3.5 cm in diameter, non-adherent and with an ulcerated surface medially to the nipple, measuring about 1.8 cm in diameter (Figure 1A).

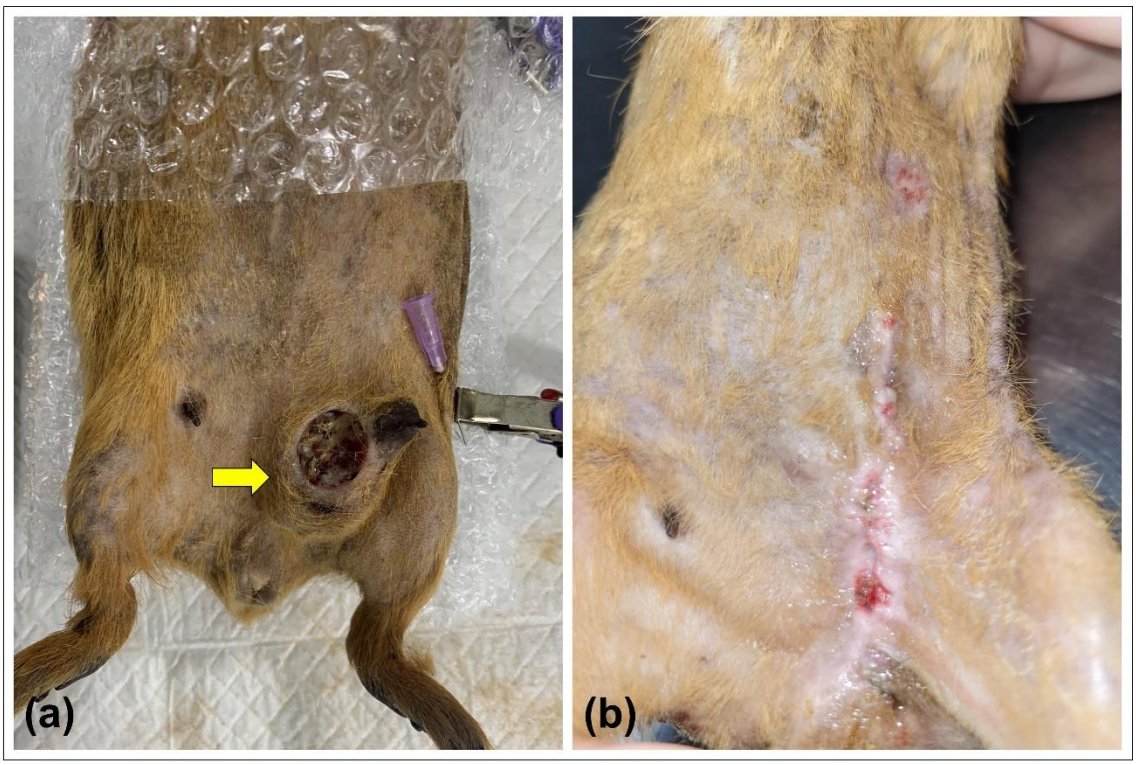

Figure 1. Mammary tubular carcinoma in a guinea pig (*Cavia porcellus*). A. Well-delimited subcutaneous tissue mass measuring 3.5 cm in diameter (arrow) with an ulcerated surface located medially to the mammary papilla measuring approximately 1.8 cm in diameter in the mammary gland. B. Cicatricial skin lesion 10 days after unilateral mastectomy.

Blood counts were within normal guinea pig reference values [11]. A cytological lesion examination was requested, but no tutor authorization was given. A unilateral mastectomy was then performed (left breast) and neoplastic breast tissue fragments were collected for histological examination. Dexmedetomidine (0.025 mg/kg/IM), midazolam (1 mg/kg/IM) and butorphanol (1 mg/kg/IM) were used as pre-anesthetic medication, isoflurane (diluent flow 0,5L/min; FiO2 100%) for anesthetic induction and maintenance in a non-rebreathing circuit (pediatric Baraka) and bupivacaine (2mg/kg) as local anesthesia. During the immediate postoperative period, atipamezole (0.001 mg/kg/SC) and flumazenil (0.25 mg/kg/IV) were used to reverse the anesthetic effects.

During the surgical procedure, a skin incision was made around the entire breast with a safety margin of 1 cm, and the tumor was dissected from the inguinal region with the aid of curved Metzembaum scissors. Blood vessel hemostasis was performed with the aid of curved Kelly-type traumatic hemostatic forceps. Finally, a simple continuous anchored suture was performed to bring together the skin edges using non-absorbable nylon thread number 3-0 (Technofio®). Antibiotic therapy was instituted after surgery, namely enrofloxacin (10 mg/kg/VO/BID) for 7 days. Analgesia with meloxicam (0.2 mg/kg/SC/SID) for 5 days and dipyrone (25 mg/kg/SC/BID) for 5 days was also administered. After 10 days, the surgical stitches were removed, and the animal showed excellent recovery and surgical wound healing (Figure 1B).

Concerning the histological examination, the obtained nodule fragments were fixed in 10% buffered formalin according to Tolosa et al. [12] and 5 µm thick paraffin block sections were prepared using a LEICA RM 2125 RT® microtome, adhered to glass slides, and left in an oven at 60°C overnight for subsequent hematoxylin and eosin (HE) and Gomori's Trichrome (GT) staining. The histological slides were then analyzed under a LEICA DM 500 HD light microscope coupled to a LEICA ICC50W camera, and images were obtained using the LAS EZ Ink program.

The tubular mammary carcinoma diagnosis was confirmed through histological examination (Figure 2).

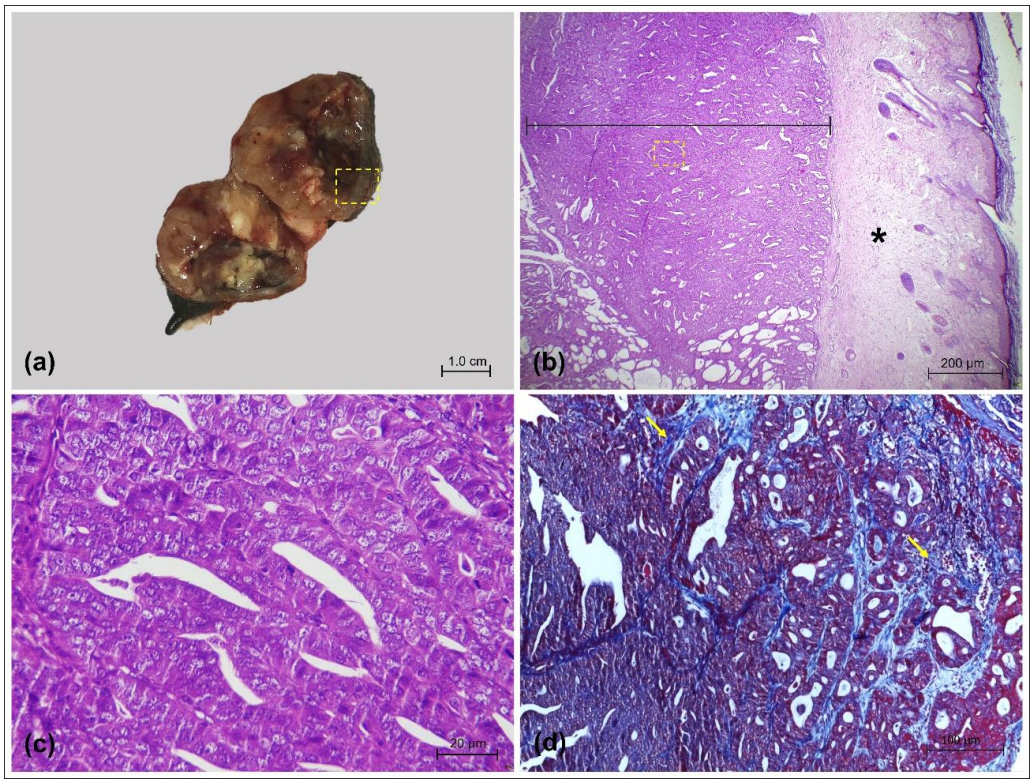

Figure 2. Histopathology of a mammary tubular carcinoma in a guinea pig (*Cavia porcellus*). A. The carcinoma was located in the left mammary gland, sectioned longitudinally, where a marked solid,

multilobulated proliferation was noted in the dermis. B, Neoplastic cells (bar), permeated by fibrovascular stroma (asterisk). C. Enlargement of Figure 2b, indicating cuboidal neoplastic cells arranged in a solid to tubular pattern, with an eosinophilic cytoplasm, oval to rounded nuclei, vesicular chromatin, and evident nucleolus. D. Blue-stained collagen fibers located in the carcinoma stroma (arrows). Staining: hematoxylin and eosin – (B and C); Gomori trichrome – (D).

Alterations were characterized by the proliferation of carcinomatous, infiltrative, multilobulated and non-encapsulated neoplastic cells, cuboidal and arranged in a solid to tubular pattern. A moderate fibrovascular stroma rich in collagen fibers was observed surrounding the neoplastic cells (Figures 2A and 2D), whose cytoplasm was eosinophilic and scarce, while the nucleus varied from oval to round, the chromatin was vesicular, and the nucleolus was evident and single (Figure 2C). Moderate anisocytosis and anisokaryosis were noted. Rare mitoses per field were observed at a higher magnification (40x=2.373). Based on the clinical staging evaluation, the tumor was classified as grade I, with no tumor emboli detected in the lymphatic and blood vessels. A radiographic examination of the animal's chest was requested to investigate possible lung metastasis but was not authorized by the owner. The animal was referred to chemotherapy treatment by a specialist, but the owner did not return.

3. Discussion

Common tumors in guinea pigs include bronchogenic papillary adenomas, trichofolliculomas, skin carcinomas, teratomas involving the ovary, mammary gland fibroadenomas [4], lymphoma [13], cutaneous vascular malformations [14], mammary adenocarcinoma [6], simple solid breast carcinoma, simple tubulopapillary breast carcinoma [7] and fibroblastic osteosarcoma [5]. This is, however, the first case reporting a mammary tubular carcinoma in *Cavia porcellus*.

Some tests are performed to diagnose neoplasms before surgical intervention. These tests include fine needle aspiration cytology, which is a low-cost and accurate technique. It helps in diagnosing conditions such as reactive hyperplasia/inflammatory conditions, granulomatous disorders, and malignancy [15, 16]. In addition, chest X-rays and abdominal ultrasound are used to detect metastases in the lungs, internal organs, or lymph nodes [17]. However, the tutor did not authorize any of these exams, which becomes a limitation in conducting a comprehensive assessment of tumor stage and potential metastatic spread. Thus, in the absence of authorization for other exams, a histopathological examination was chosen as an alternative. This simple cellular microscopic analysis proved sufficient to identify tissue alterations and provide a definitive diagnosis of the neoplastic formation [7, 12].

Suárez-Bonnet et al. [7] histologically described ten spontaneous mammary gland tumors affecting guinea pigs, three benign (two simple adenomas and one benign mixed tumor) and seven malignant (one simple solid carcinoma and six simple tubulopapillary carcinomas). Malignant mammary gland tumors were mostly wellor moderately differentiated and simple tubulopapillary carcinomas appeared as tubulopapillary proliferations of the lining epithelium supported by connective tissue, while the simple solid carcinoma was characterized by epithelial cells forming solid nests surrounded by normal or dysplastic breast tissue areas. Our report differs from previous findings, as the proliferation of carcinomatous, infiltrative, multilobulated and non-encapsulated neoplastic cells was observed, where neoplastic cells were arranged in a solid to tubular pattern.

Studies have demonstrated that tumor cell interactions with the tissue microenvironment, especially with extracellular matrix (ECM) proteins, are associated to tumor development and progression [18,19]. Type I collagen fibers are the main structural stroma component in many tumors and their presence reduces cell adhesion and contributes to cancer progression [18,20]. This type of collagen can be considered as a potential biomarker in cases of breast cancer presenting lung metastasis [21]. In our report, the presence of collagen fibers in the tumor ECM was characterized using the “Gomori trichrome”

staining method. This method, however, does not differentiate between type I and type III collagen but simply confirms the presence of collagen fibers, and a qualitative collagen I and III differentiation analysis are required by the "picrosirius" staining method [22].

The treatment of choice for breast neoplasms comprises tumor removal alongside chemotherapy as an adjuvant therapy, which, associated with surgery, aims to prevent recurrence [10]. Breast tumors are usually locally invasive, rarely metastasize and are often large and highly vascularized. Surgical excision of a primary breast tumor is possible, but recurrence is likely if the excision is incomplete [6]. In this sense, the surgical margins in our case study were verified as free of neoplastic cells in the histological assessment, as a skin incision was made surrounding the entire breast with a safety margin of 1 cm.

Therapeutic strategies for tumor treatment are species-specific, and surgical removal is often the recommended option depending on the characteristics and progression of the neoplasm [23]. For the treatment of mammary tumors in dogs and cats, doxorubicin and cyclophosphamide are widely used [24]. However, there is limited literature available on chemotherapy treatments for mammary tumors in guinea pigs. In a study by Pondugula et al. [25], they reported the safest doses of doxorubicin (2mg/kg) and cyclophosphamide (50mg/kg) for mice. These doses are currently used in other rodent species, such as guinea pigs.

4. Conclusion

Knowledge concerning diseases that affect unconventional pets, such as the tubular mammary carcinoma described herein, is paramount in improving the quality of life of these animals. The surgical procedure and post-surgical treatment recommended in this report were proven efficient. In addition, complementary tests, such as cytology and histology, are also essential to determine the best therapeutic approach and an accurate diagnosis. It should be noted that, despite the clinical tumor staging being classified as grade I, adjuvant therapy with chemotherapy is indicated to reduce the chances of possible cancer recurrence. Finally, it is always recommended that pets receive regular veterinary care and that owners are aware of any signs of abnormalities, as early neoplasm detection can lead to better chances of treatment and cure, especially if the tumor is still present and has not spread to other parts of the animal's body.

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Supplementary Materials: None.

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