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Original Article
Small Animal Diseases

Epidemiological, clinical, and therapeutic aspects of canine transmissible venereal tumor in Rio de Janeiro, Brazil (2015-2020)[1]

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ABSTRACT.- Costa T.S., Paiva F.N., Manier B.S.M.L., Araújo D.C., Ribeiro G.B & Fernandes J.I. 2023. **Epidemiological, clinical, and therapeutic aspects of canine transmissible venereal tumor in Rio de Janeiro, Brazil (2015-2020)**. *Pesquisa Veterinária Brasileira 43:e07189, 2023.* Instituto de Veterinária, Universidade Federal Rural do Rio de Janeiro, Rodovia BR-465 Km 7, Zona Rural, Seropédica, RJ 23890-000, Brazil. E-mail: n-paiva@hotmail.com

Canine transmissible venereal tumors (TVT) have a high incidence in Brazil. This is partly due to the large population of stray dogs and the ineffectiveness of epidemiological control programs. This study aimed to describe the epidemiological data, clinical manifestations, and treatments used in dogs affected by TVT. Data were retrospectively collected from the 2015-2020 records of the Veterinary Hospital of the Federal Rural University of Rio de Janeiro. A total of 252 dogs were diagnosed with TVT during the study period. Of these, 81.3% were mixed-breed, 50.4% were males, and 88.9% were young or adult animals. The genital region only was affected in 77.3% of cases. Exclusively extragenital lesions were observed in 22.6% of cases. Among the animals seen, 40.1% received no treatment. Of those treated, 99.3% underwent a vincristine sulfate protocol, and in 77.2%, the treatment resulted in total remission of the neoplasm after 4 to 6 chemotherapy sessions. It was concluded that TVT is a neoplasm most often seen in mixed-breed dogs and located in the genital region, with hemorrhagic secretion being the main clinical sign reported by owners. Vincristine sulfate is currently the most used therapy, with high efficacy. However, despite the good prognosis, there was a high rate of non-adherence or abandonment of treatment, and this is an important factor to be considered and addressed by veterinarians.

INDEX TERMS: Chemotherapy, dogs, transmissible neoplasms, transmissible venereal tumor, TVT, Brazil.

RESUMO.- [**Aspectos epidemiológicos, clínicos e terapêuticos do tumor venéreo transmissível canino no Rio de Janeiro, Brasil (2015-2020).**] O tumor venéreo transmissível (TVT) apresenta elevada incidência no Brasil, relacionada a elevada população de caninos errantes e a ineficácia dos programas de controle epidemiológicos. O objetivo do estudo foi descrever dados epidemiológicos, manifestação clínica e o tratamento empregado em cães acometidos pelo TVT no Hospital Veterinário da Universidade Federal Rural do Rio de Janeiro entre os anos de 2015 e 2020. Foram diagnosticados 252 cães com TVT durante o período do estudo, sendo 81,3% cães sem raça definida, 50,4% machos e 49,6% fêmeas, e com 88,9% animais jovens ou adultos. A região genital foi acometida em 77,3% dos casos. Lesões exclusivamente extragenitais foram observadas em 22,6% dos casos. Quanto ao tratamento, 40,1% dos cães não receberam tratamento. Entre os animais tratados, 99,3% utilizaram protocolo com sulfato de vincristina e em 77,2% o tratamento resultou em remissão total da neoplasia, com a realização de 4 a 6 sessões do quimioterápico. Conclui-se que o TVT é uma neoplasia frequentemente relacionada a cães sem raça definida, localizados na região genital, com secreção hemorrágica sendo o principal sinal clínico reportado pelos proprietários. O sulfato de vincristina é a terapia mais empregada, com alta eficácia. Entretanto, apesar de ser uma neoplasia com bom prognóstico, o alto índice de não adesão

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ou abandono ao tratamento representa um importante fator a ser considerado e trabalhado pelos médicos veterinários.

TERMOS DE INDEXAÇÃO: Cães, neoplasias transmissíveis, quimioterapia, TVT, Brasil.

INTRODUCTION

Canine transmissible venereal tumors (TVT) are also known as Sticker's sarcomas, transmissible venereal sarcomas, granuloma venereum, infectious sarcomas, transmissible lymphosarcomas, canine condylomas, and contagious venereal tumors (Ganguly et al. 2016, Woods 2019) They are primarily transmitted sexually and affect both domestic canines and wild canids (Agnew & MacLachlan 2017, Woods 2019).

TVT is transmitted through the allogeneic transfer of living cancer cells without malignant cell transformation in the affected host (Santos et al. 2005, Agnew & MacLachlan 2017). Mechanically, the transmission may be through copulation, licking, biting, or scratching; via the mucous membranes or skin abrasions (Agnew & MacLachlan 2017, Santos et al. 2005, Ganguly et al. 2016). The number of transplanted cells is considered relevant, and it is estimated that only 13% of transplanted cells remain viable and survive in the new host (Holmes 1981, Murchison et al. 2014).

TVT is known to occur in all parts of the world but Antarctica (Ganguly et al. 2016), with a higher prevalence in countries with tropical and subtropical climates and in developing countries, where the stray dog population is greater, and early castration and population control policies are less widespread (Murchison et al. 2014, Agnew & MacLachlan 2017, Woods 2019).

In Brazil, TVT has a high incidence and wide distribution. It is present in at least 19 states and the federal district (Pimentel et al. 2021). This is likely due to the high population of stray canines and ineffective epidemiological control programs (Sousa et al. 2000, Brandão et al. 2002, Silva et al. 2007, Huppes et al. 2014, Araújo et al. 2016, Peixoto et al. 2016). A greater incidence is observed in females, mixed breeds, and dogs of sexually active age. Lesions are predominantly in the genital region (Sousa et al. 2000, Brandão et al. 2002, Silva et al. 2007, Huppes et al. 2014, Araújo et al. 2016, Peixoto et al. 2016, Pimentel et al. 2021).

The objective of the present study was to elucidate the epidemiological profile, the most common clinical manifestations, the sites of greatest involvement, the macroscopy of clinical lesions, the treatment modalities used, and the clinical responses observed in TVT in Brazil.

MATERIALS AND METHODS

This study was a five-year retrospective of relevant medical records from the Oncology Service of the Veterinary Hospital of the "Universidade Federal Rural do Rio de Janeiro" (UFRRJ) from January 2015 to January 2020. The UFRRJ Veterinary Hospital is located in Seropédica, Rio de Janeiro, in the Southeast region of Brazil. The patients were from the cities of Seropédica and Rio de Janeiro and the metropolitan area.

The medical records evaluated were of dogs diagnosed with TVT at our institution during the study period. Only patients whose diagnosis had been confirmed by cytopathological or histopathological evaluation were included. Criteria established in the literature were used to confirm the diagnosis (Ganguly et al. 2016, Woods 2019). The percentage of diagnoses obtained by each method was not included in the survey. Data referring to the care of these animals were evaluated individually. The data collected pertained to anamnesis from owners, clinical examination, diagnosis, treatment, and follow-up.

The epidemiological data analyzed were gender, age, breed, and size of the affected animals. The cohort was categorized into four age groups, adapted from Creevy et al. (2019). Those up to one year old were defined as pups, those between two and four years old as young, those between four and 10 years old as adults, and those over 10 years old as elderly.

We also analyzed the clinical manifestations and anatomical locations of the disease, as described in the care form completed by the treating veterinarian. Treatment was classified according to the chosen therapeutic modality. In cases of chemotherapy, the protocol employed, the number of sessions, and the response to treatment were also evaluated. Response to treatment was described using the criteria of Ferreira & De Nardi (2021). For confirmation in cases considered cured, the standard procedure of our institution is a cytology examination to verify the absence of any remaining neoplastic cells.

The collected data were analyzed as simple descriptive statistics, i.e., frequencies and percentages. Where necessary, the percentage values given were approximated. As this was a retrospective study, there was no interference with the clinical and therapeutic decisions. The study was authorized by the "Instituto de Veterinária" (Veterinary Institute) of the UFRRJ Ethics Committee on Animal Use (CEUA-IV-UFRRJ).

RESULTS

A total of 252 animals that met the inclusion criteria were identified in our medical records, averaging approximately 50 cases per year.

Epidemiological data evaluated included breed, sex, and age. Of those evaluated, 205/252 (81.3%) were mixed-breed (SRD), 8/252 (3.2%) were Poodles, 8/252 (3.2%) were Labradors, 5/252 (2.0%) were Chow chows, 5/252 (2.0%) were Pinschers, and 4/252 (1.6%) were Pit bulls. Other breeds accounted for less than 1.5% of cases. As for sex, 127/252 (50.4%) animals were male and 125/252 (49.6%) were female. Regarding age, 12/252 (4.8%) were classified as puppies, 85/252 (33.7%) as young, 139/252 (55.2%) as adults, and 16/252 (6.3%) as elderly. The age range was four months to 17 years, with a mean age of 5.4 years.

Our assessment of the anatomical locations affected found that 232/252 (92.1%) cases were affected at a single anatomical site, 19/252 (7.5%) were affected at two anatomical sites, and 1/252 (0.4%) cases were affected at three different anatomical sites. The most common manifestation was single-site genital lesions, which represented 179/252 (71%) cases. The next most frequent were single-site nasal lesions, with 25/252 (9.9%) cases, followed by single-site cutaneous lesions, with 13/252 (5.2%) cases. Extragenital cases with single or multiple-site involvement totaled 57/252 (22.6%) cases. Multiple-site cases involving the genital region totaled 16/252 (6.3%). The specific locations of involvement are described in Table 1.

The macroscopic appearance of the lesion(s) was recorded in the medical records and classed as hemorrhagic in 162/252 (64%) cases, friable in 89/252 (35%) cases, ulcerated in 41/252 (16%) cases, irregular in 34/252 (13%) cases, and

hyperemic in 17/252 (7%) cases. These classifications were not considered exclusive, so different characteristics were attributed to the same tumor in some cases. In our evaluation of each type of clinical manifestation in each anatomical location, both single-site and multiple-site cases were included. The results of this comparison are described in Table 2.

Regarding treatment, 150/252 (59.5%) cases were treated with chemotherapy as a single modality, 1/252 (0.4%) cases were treated with surgery as a single modality, and 101/252 (40.1%) cases did not receive any form of treatment. In the surgically treated case, there was a subsequent recommendation for adjuvant chemotherapy treatment, but this was declined by the patient's owner. Among the patients treated with chemotherapy, 149/150 (99.33%) received vincristine sulfate as a single agent weekly at a dose of 0.7 to 0.75mg/m^2. In 1/150 (0.66%), the patient was started on the vincristine protocol, but treatment was changed to doxorubicin every 21 days at a dose of 30mg/m^2. Among the patients who received the vincristine sulfate protocol, 115/149 (77.2%) showed complete remission by the end of the treatment. In 34/149 (22.8%) patients. the protocol was stopped before its completion at the behest of the animal's owner. The patient treated with doxorubicin also showed complete remission. The anatomical location of the neoplasia and the number of sessions received by the 115 patients treated with vincristine sulfate who showed complete remission are described in Table 3. Cases with lesions in multiple locations were evaluated as a single group, with no location cited in the table.

Table 1. Anatomical location of canine transmissible venereal tumor expressed in absolute value and percentage (in approximate values)

Involvement	Anatomical location	N	%
Single anatomical site	Genital	179	71.0%
	Nasal	25	9.9%
	Cutaneous	13	5.1%
	Ocular	4	1.6%
	Oral	4	1.6%
	Lymph nodes	3	1.2%
	Perianal	2	0.8%
	Pharynx	1	0.4%
	Uterine	1	0.4%
Multiple anatomical site	Genital + Cutaneous	7	2.8%
	Genital + Nasal	3	1.2%
	Genital + Lymph nodes	2	0.8%
	Genital + Breast	1	0.4%
	Genital + Ocular	1	0.4%
	Genital + Perianal	1	0.4%
	Nasal + Oral	1	0.4%
	Cutaneous + Ocular	1	0.4%
	Cutaneous + Oral	1	0.4%
	Cutaneous + Perianal	1	0.4%
	Genital + Cutaneous + Nasal	1	0.4%

Table 2. Clinical aspect associated with the anatomical location of the canine transmissible venereal tumor, expressed in absolute value and percentage (in approximate values)

Anatomical location	Hemorrhagic	Friable	Hyperemic	Ulcerated	Irregular
Genital (N=195)	137/195 (70%)	84/195 (43%)	16/195 (8%)	19/195 (10%)	26/195 (13%)
Nasal (N=30)	19/30 (63%)	8/30 (27%)	0	2/30 (7%)	2/30 (7%)
Cutaneous (N=24)	7/24 (29%)	4/24 (17%)	1/24 (4%)	10/24 (42%)	2/24 (8%)
Ocular (N=6)	1/6 (17%)	1/6 (17%)	0	5/6 (83%)	2/6 (33%)
Oral (N=6)	2/6 (33%)	3/6 (50%)	1/6 (17%)	2/6 (33%)	0
Lymph nodes (N=5)	0	0	0	0	0
Perianal (N=4)	3/4 (75%)	1/4 (25%)	0	2/4 (50%)	0
Uterine (N=1)	0	0	0	1/1 (100%)	0
Breast (N=1)	0	0	0	0	0
Pharynx (N=1)	0	0	0	0	0

Table 3. Absolute and percentage distribution (in approximate values) of canines with transmissible venereal tumor (TVT) according to the anatomical location and the number of chemotherapy sessions with vincristine sulfate necessary for clinical cure

Anatomical location	Up to 4 sessions	Between 5 and 6 sessions	Over 6 sessions
Genital (N=77)	47/77 (61%)	27/77 (35%)	3/77 (4%)
Nasal (N=12)	3/12 (25%)	9/12 (75%)	0
Cutaneous (N=6)	4/6 (67%)	2/6 (33%)	0
Ocular (N=3)	3/3 (100%)	0	0
Oral (N=4)	1/4 (25%)	3/4 (75%)	0
Lymph nodes (N=1)	0	1/1 (100%)	0
Perianal (N=1)	1/1 (100%)	0	0
Pharynx (N=1)	0	1/1 (100%)	0
Multiple anatomical sites* (N=11)	3/11 (27%)	8/11 (73%)	0

* Included all cases of multiple-site involvement, regardless of anatomical region.

DISCUSSION

All the dogs included in the study had their diagnosis confirmed by cytopathology or histopathology, which are known to obtain accurate diagnoses (Das & Das 2000, Woods 2019). Cytopathological evaluation is widely used due to its ease of use, the marked cytomorphological characteristics of cells, and its less invasiveness nature (Lima et al. 2011, Ganguly et al. 2016, Birhan & Chanie 2015).

The number of mixed-breed dogs in our TVT cohort was greater than the sum of all purebred animals, with a ratio close to 4/1. The number found was similar to that observed in studies conducted in other Brazilian states (Sousa et al. 2000, Brandão et al. 2002, Silva et al. 2007, Huppes et al. 2014, Araújo et al. 2016, Peixoto et al. 2016) as well as foreign studies (Rogers et al. 1998, Papazoglou et al. 2001, Chikweto et al. 2013, Woods 2019). This is likely due to the association of TVT prevalence with the number of stray and semi-domiciled dogs and/or unrestricted access to the street in a given location. These animals generally belong to families with low socioeconomic status, and the animals themselves are usually of low zootechnical value, without a defined breed (Rogers et al. 1998, Papazoglou et al. 2001, Brandão et al. 2002, Lima et al. 2011, Strakova & Murchison 2014, Araújo et al. 2016).

The main breeds in which TVT was seen in our sample were poodles, Labradors, chow chows, and pinschers. However, this corresponded with the breeds most common in the analyzed region (Araújo et al. 2016). There was no clear vulnerability to TVT in specific breeds, as has been suggested by other authors (Rogers et al. 1998, Sousa et al. 2000, Papazoglou et al. 2001, Brandão et al. 2002, Lima et al. 2011, Huppes et al. 2014, Araújo et al. 2016, Peixoto et al. 2016, Woods 2019).

There was a difference of less than 1% in the distribution of TVT between the sexes. Although some authors argue that the incidence of TVT does not differ between male and female canines (Rogers et al. 1998, Chikweto et al. 2013, Strakova & Murchison 2014, Woods 2019), most studies have found a greater incidence in females (Sousa et al. 2000, Silva et al. 2007, Huppes et al. 2014, Araújo et al. 2016, Peixoto et al. 2016). The higher rate in females is thought to be due to the acceptance of multiple males by female dogs and the hormonal changes that ensure a greater blood supply to the genital region during the female's fertile period (Sousa et al. 2000, Huppes et al. 2014, Araújo et al. 2016). A smaller number of studies have reported greater incidence in males (Rogers et al. 1998, Papazoglou et al. 2001, Amaral et al. 2004). We posit that this disagreement between observed rates between studies supports our finding that there is no greater predisposition to TVT in either sex.

We found a higher prevalence of TVT in dogs classified as adults (aged 4-10 years), followed by those classified as young (aged 2-4 years), both being sexually active age ranges. This was in line with the findings of similar studies (Sousa et al. 2000, Brandão et al. 2002, Silva et al. 2007, Chikweto et al. 2013, Huppes et al. 2014, Araújo et al. 2016, Peixoto et al. 2016, Woods 2019) and is thought to be due to greater sexual activity in these age groups, which increases the risk of TVT transmission. The common age range for TVT in the literature extends between 1 and 10 years. In the present study, two animals in the cohort were younger than one year old, the youngest being four months old. Both of these showed extragenital manifestations of TVT. TVT in prepubescent dogs may be largely due to maternal transmission (Ganguly et al. 2016, Costa et al. 2022).

In 7.9% of our cases, multiple anatomical regions were affected. Cases with multiple-site involvement are rarely described and are most often seen in isolated reports. Most such cases are thought to result from metastasis (Mostachio et al. 2007, Filgueira et al. 2013, Horta et al. 2014, Komnenou et al. 2015, Nalubamba, 2015, Araújo et al., 2016, Faccini et al., 2019). In the present study, there was insufficient data in the medical records to distinguish between primary and metastatic lesions, so multiple-site cases were regarded as simultaneously occurring lesions. Metastatic cases are uncommon and occur with an incidence of 1-15% (Rogers et al. 1998, Woods 2019). They are even rarer in locations distant from the infection site (Agnew & MacLachlan 2017). Metastatic tumors are difficult to differentiate from multiple-site implantations of primary tumors (Das & Das 2000, Birhan & Chanie 2015).

Genital lesions were seen in 179/232 single-site cases and 16/20 multiple-site cases. The genitals are the most common region for the development of TVT due to its transmission predominantly through copulation (Rogers et al. 1998, Brandão et al. 2002, Silva et al. 2007, Huppes et al. 2014, Araújo et al. 2016, Peixoto et al. 2016, Woods 2019).

Extragenital involvement, including single-site and multiple-site cases, occurred in 22.6% of our cohort. This is a high incidence compared to that seen in previous research, which has found rates of extragenital lesions between 3.4% and 10.4% (Rogers et al. 1998, Silva et al. 2007, Lima et al. 2011, Huppes et al. 2014). However, higher rates, between 21.9% and 31.4%, have been observed in other Brazilian surveys (Brandão et al. 2002, Araújo et al. 2016), and the incidence in the present study falls within this range. Extragenital manifestations of TVT are most often transmitted through licking, biting, and sniffing between dogs, which lead to TVT that affects the nasal, oral, ocular, perianal, or cutaneous regions (Silva et al. 2007, Ganguly et al. 2016, Huppes et al. 2014, Agnew & MacLachlan 2017, Woods 2019).

The most frequent extragenital location in our sample was the nasal region, representing 9.9% of single-site cases and 2.0% of multiple-site cases. Nasal manifestations are contracted through sniffing of the genital region of a TVT-positive dog (Peixoto et al. 2016, Agnew & MacLachlan 2017, Woods 2019). Thus, most nasal lesions are likely to be primary tumors, although metastasis to this location can occur (Woods 2019). The incidence of nasal TVT has also been high in similar studies (Rogers et al. 1998, Brandão et al. 2002, Amaral et al. 2004, Kabuusu et al. 2010, Rodriguez et al. 2011, Filgueira et al. 2013, Huppes et al. 2014, Birhan & Chanie 2015, Rezaei et al. 2016, Veloso et al. 2018), and this is the most common extragenital form (Papazoglou et al. 2001).

The incidence of cutaneous lesions was 5.1% in single-site cases and 4.8% in multiple-site cases. The skin is a common extragenital location for TVT (Rogers et al. 1998, Brandão et al. 2002, Silva et al. 2007, Kabuusu et al. 2010, Lima et al. 2011, Birhan & Chanie 2015, Rani & Pazhanivel 2015, Araújo et al. 2016, Fathi et al. 2018, Faccini et al. 2019). Its contraction is through licking, scratching, and biting between dogs, with neoplastic cells being transmitted through areas of broken skin (Das & Das 2000, Lima et al. 2011). Cutaneous

lesions may also be metastatic (Rogers et al. 1998, Agnew & MacLachlan 2017, Woods 2019).

Oral manifestations of TVT were seen in 1.6% of the single-site cases and 0.8% of the multiple-site cases. This is concordant with the rates previously reported in the literature, which range from 0.7% to 2.9% (Brandão et al. 2002, Huppes et al. 2014) and is a low-incidence location (Kabuusu et al. 2010, Birhan & Chanie 2015, Nalubamba 2015, Rezaei et al. 2016). Oral involvement occurs through direct contact of mucous membranes between dogs, leading to the implantation of neoplastic cells in the oral mucosa (Peixoto et al. 2016, Woods 2019).

Ocular lesions affected 1.6% of our single-site cases and 0.8% of our multiple-site cases. Other studies have reported similarly low frequencies (Brandão et al. 2002, Veloso et al. 2018). Most reports are single cases affecting multiple sites (Rodriguez et al. 2011, Filgueira et al. 2013, Rezaei et al. 2016, Faccini et al. 2019). Primary ocular tumors result from contact between the affected mucous membranes of the transmitting animal with the ocular mucosa of the target animal during social interaction (Komnenou et al. 2015, Woods 2019).

Lesions of the lymph nodes represented 1.2% of our single-site cases and 0.8% of our multiple-site cases. Reports of these in the literature are scarce, presumably due to their low incidence (Rogers et al. 1998, Brandão et al. 2002, Amaral et al. 2004). However, the lymph nodes are the most common location of TVT metastasis (Rogers et al. 1998, Das & Das 2000, Agnew & MacLachlan 2017, Woods 2019). Cases in which non-genital lymph nodes were affected were attributed to resistance to previous treatments, with clinical regression of the primary lesion and TVT cells remaining only in the lymph nodes.

Perianal manifestations of TVT occurred in 0.8% of our single-site cases and 0.8% of our multiple-site cases. This was in agreement with the previous literature, which also reports this to be an uncommon TVT location (Brandão et al. 2002, Rodriguez et al. 2011, Nalubamba 2015). TVT in this area is generally acquired through the incidental implantation of cells during intercourse, by licking the genital region of a dog with genital lesions, or through hierarchical mating between males (Peixoto et al. 2016).

The single case of uterine involvement represented 0.4% of the sample and occurred at a single site. This is a low-incidence location, and both Rodriguez et al. (2011) and Kabuusu et al. (2010) have reported single cases but a small percentage of total cases with uterine lesions. A single-site case of uterine involvement has also been described by Mostachio et al. (2007). The only case of breast involvement co-occurred with genital manifestation and accounted for 0.4% of the cohort. Despite its rarity, breast TVT has been described in the literature, both in isolation (Rani & Pazhanivel 2015) and as one of multiple lesions (Horta et al. 2014).

The pharynx was affected in one single-site case, representing 0.4% of the sample. There is little on TVT affecting the pharynx in the literature. A report by Filgueira et al. (2013) describes a multiple-site case in which the pharynx and the oral and nasal cavities were affected, among other sites.

In our cases, the most frequently observed clinical characteristic of the TVT was hemorrhagic. This was in accord with previous research findings (Rogers et al. 1998, Brandão et al. 2002, Santos et al. 2005, Silva et al. 2007, Lima et al. 2011, Huppes et al. 2014, Peixoto et al. 2016). Friable, ulcerated, irregular, and hyperemic macroscopic characteristics are frequently related to this type of neoplasia (Rogers et al. 1998, Das & Das 2000, Santos et al. 2005, Lima et al. 2011, Huppes et al. 2014, Peixoto et al. 2016, Fathi et al. 2018).

Most of the animals in this study were treated with chemotherapy. This is considered the treatment of choice in the literature and is used in most cases (Rogers et al. 1998, Das & Das 2000, Silva et al. 2007, Ganguly et al. 2016, Woods 2019). Surgery is currently considered an ineffective therapeutic modality for TVT (Sousa et al. 2000, Brandão et al. 2002, Silva et al. 2007, Lima et al. 2011, Ganguly et al. 2016). However, it can be indicated in specific cases (Sousa et al. 2000, Woods 2019), usually with adjuvant chemotherapy (Das & Das 2000, Fathi et al. 2018, Woods 2019). The only surgical case in the study was that with uterine TVT. In this case, post-surgical chemotherapy was recommended after surgical excision but was declined by the dog's owner.

The most frequently used chemotherapy protocol is the weekly administration of vincristine sulfate (Strakova & Murchison 2014). This requires constant clinical and hematological monitoring to avoid serious adverse effects (Biller et al. 2016). This weekly commitment can pose difficulties for the guardians of affected animals, which may explain the high percentage of animals in our sample who did not receive treatment (40.1%), with no indication that treatment was being given at another institution. As suggested by Huppes et al. (2014), non-adherence and/or withdrawal from treatment by the owner of the animal may be due to financial limitations, travel limitations, difficulty attending regular treatment sessions, and, in fewer cases, cultural factors and reluctance based on their understanding of the necessity, toxicity, and/or efficacy of the treatment.

Of the patients who received chemotherapy, the majority (99%) underwent the vincristine sulfate protocol. Doxorubicin has also been described as a treatment for TVT, especially in cases resistant to vincristine sulfate (Ganguly et al. 2016, Huppes et al. 2014, Woods 2019). Most of our cases treated with vincristine sulfate achieved complete remission (77.2%). As previously observed by Huppes et al. (2014), partial remission was seen only in patients whose treatment was ended early at the behest of the owner.

In those cases treated with vincristine sulfate that achieved a complete response, we recorded the number of sessions and anatomical location of the TVT. We found that, with genital involvement, only four chemotherapy sessions were necessary in most cases (61%). This is in line with the findings of previous studies (Brandão et al. 2002, Silva et al. 2007, Lima et al. 2011, Huppes et al. 2014). The difference in the number of sessions may be related to variations such as the initial size of the neoplasm and the patient's general medical and immunological state.

Most extragenital cases affecting the cutaneous, ocular, and perianal areas were resolved with only four chemotherapy sessions. Most extragenital cases associated with the nasal, oral, and laryngeal areas and the lymph nodes required more than four sessions to achieve complete remission. The same chemotherapy requirements were observed in cases involving multiple sites analyzed as an isolated group. Thus, in extragenital cases, four to six sessions of chemotherapy with

vincristine sulfate are recommended (Komnenou et al. 2015, Nalubamba 2015, Rani & Pazhanivel 2015, Veloso et al. 2018).

CONCLUSIONS

Transmissible venereal tumors (TVT) represent an important neoplasm in the veterinary clinical routine and are predominantly seen in sexually mature and mixed-breed animals, with lesions most commonly occurring in the genitals. Extragenital presentations are considered atypical, but their incidence is still significant. In the present study, 22.6% of our cases were extragenital. Thus, TVT is an important consideration in the differential diagnosis of both genital and extragenital neoplasms.

We found chemotherapy with vincristine sulfate effective in resolving most cases of TVT; however, the high percentage of dog owners who refused or abandoned treatment was worrying, and further research into reasons and solutions for this is needed.

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