

## SEMINOMA IN DANCING, BROWN, EURASIAN BEAR (*URSUS ARCTOS*)

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### ABSTRACT

In the present research, a pathomorphological study of testicular tumor formation in a dancing, Eurasian, brown bear was performed. There was a significant enlargement of the right testis, which had a pale pink, rough and slightly prominent cut surface with multiple necrotic-degenerative areas and hemorrhages. Microscopic examination revealed a diffuse tumor formation composed mainly of densely arranged, oval neoplastic cells with round nuclei and a small amount of cytoplasm. Notable lymphocyte accumulations were observed around some of the blood vessels. Based on the established morphological finding, the tumor was diagnosed as unilateral, diffuse seminoma.

**Key words:** neoplasia, testis, bear, seminoma, histopathology.

### Introduction

Testicular neoplasms are ones of the most common tumors in domestic animals. They were found mainly in adult individuals, especially in dogs and horses (Maxie et al., 2015). Testicular tumors originate mainly from germ, interstitial-endocrine (Leydig) and Sertoli cells. Less common they are with mesenchymal origin or as metastatic tumors. The three most common neoplasms affecting the testes are seminoma (germ cell origin), interstitial cell tumor, and Sertoli cell tumor. They develop mainly singly, but can also occur in combination. If they are primary tumors, they are almost always benign. However, it is sometimes difficult to differentiate benign from malignant variants due to the similarity in histological appearance. Indicative of malignant seminomas is infiltrative growth, which affects the vessels, epididymis, *vas deferens* and adjacent testicular tissues such as *tunica albuginea* (Meuten, 2017). Malignant types can give metastasis and most commonly affect the spermatic cord and scrotal lymph nodes.

Germ cell neoplasms are subdivided into seminoma, teratoma, and embryonic carcinoma. Seminomas are the most common testicular tumors in adult stallions and the second most common in dogs (Zachary, 2017). These lesions were described in bulls, rams, and cats, and were observed mainly in adult animals (Maxie et al., 2015). Seminomas originate from germ cells that constitute the spermatogenic epithelium of the testes and usually do not produce hormones. They are more common in cryptorchid testes. Multicentric origin and local invasiveness are typical for these types of tumors, and metastasis is rare (Manov, 2019). In some domestic animals, the lesion was statistically found to be usually unilateral and more commonly affect the right testis (Bush et al., 2011). The main gross sign was a significant enlargement of the affected testicle. The neoplasm was homogeneous with a soft consistency. Tumor color can vary in different species of animals. The parenchyma of the formation was usually white or pale pink, but in stallions is often tan. These tumors have a rough and prominent cut surface on which fine-fibrous trabeculae were found (Maxie et al., 2015). Microscopically, seminomas are subdivided into intratubular and diffuse, according to their histoarchitecture and manner of growth (Meuten, 2017). In intratubular formations, aggregations of neoplastic germ cells are observed, which fill the lumen of the seminiferous tubules and replace normal spermatogenic and Sertoli cells. In diffuse seminomas, the cells are not only observed in the

tubules, but affect large areas of the testicular parenchyma. Neoplastic cells are large, round with a small amount of cytoplasm. Their nuclei are also large with clearly visible prominent nucleoli. Moderate anisocytosis can be observed, but most of the cells are uniform. Mitotic activity is usually high. Sometimes mononuclear and multinuclear giant cells can be found. CD8<sup>+</sup> T lymphocyte aggregates were commonly found around blood vessels and are a useful histological finding for diagnosis because this feature is not found in other testicular neoplasms (Zachary, 2017).

In contrast of domestic animals, the data on testicular tumors in wild species are scarce. They were described in wild felids, marine mammals, birds, fish and others.

The brown bear (*Ursus arctus*) belongs to the class *Mammalia*, genus *Carnivora*, family *Ursidae*. It is one of the largest monogastric mammals. They have a short and large body with a massive head. The fur is thick, coarse and can vary from light to dark brown in color. Bears are seasonal, polygamous animals. In European regions, they meet their energy needs mainly through plant foods, spending much of the day eating (Naves et al., 2006). In the past, a large number of bears inhabited the Bulgarian forests, unlike now when the brown bear is a protected species.

Decades ago, the capture and domestication of young bears was practiced. They were trained to perform different commands and were used as an attraction - "dancing bears". Nowadays, this action is legally prohibited and such animals are confiscated from their owners. In Bulgaria, these bears are now bred in the Dancing Bear Park near the town of Belitsa. There they live in conditions as near as possible to their normal natural habitat and are under the care and attention of specialists. Due to the optimal conditions, the bears in the park reach an age that is difficult to be observed in the wild. One of the male bears there was noticed to have swelling in the testicular area. The animal showed no clinical signs of disease.

## Materials and methods

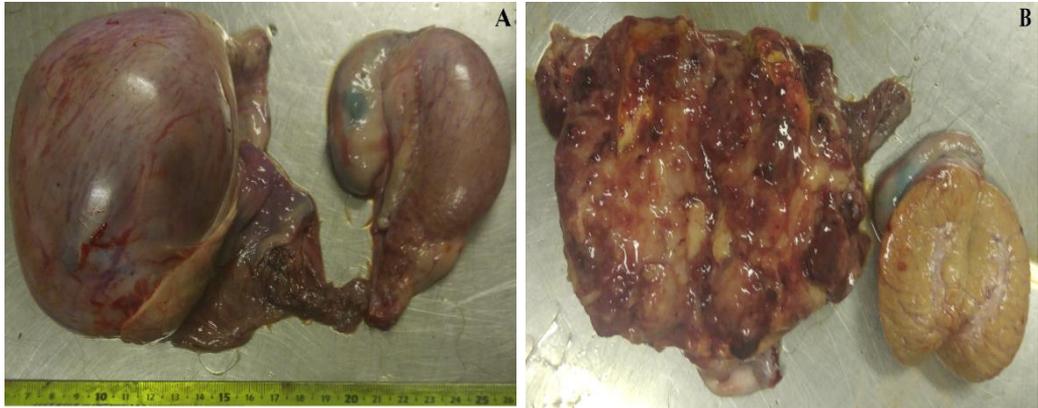
The study was performed on a male, brown Eurasian bear aged about 30 years. The animal was in good general condition. In the area of the testicles, a significant enlargement of the right testicle was found. After orchietomy, the testicles were submitted for pathomorphological examination. A tissue sample were taken from the affected testicle for histopathological analysis.

The biopsy samples from the testicle were processed according to the routine, histological procedure for obtaining specimens, for microscopic observation. The samples were 1 cm thick, fixed with 10% neutral buffered formalin and then washed under running tap water for 24 h. The tissues were dehydrated by series of passages through increasing concentrations of ethanol then cleared with xylene and embedded in paraffin. The paraffin blocks were sliced on a rotating microtome (5 µm), dewaxed, rehydrated in decreasing concentrations of ethanol and stained with Haematoxylin-Eosin (H&E). Microscopic examination and microphotographing were performed with a microscope Euromex BioBlue.

## Results and discussion

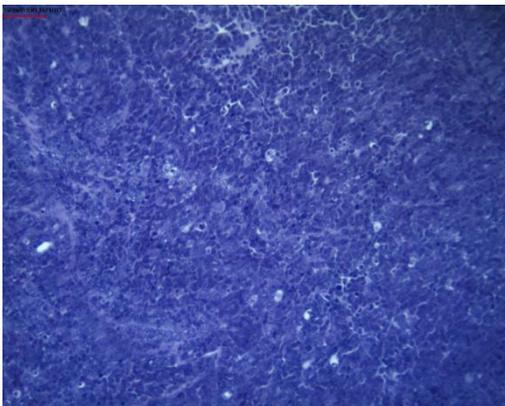
Gross examination of the testicles showed that the affected right testicle, which was approximately 15 cm long, 12 cm wide and 7 cm thick, was several times larger than the unaffected left one. Palpation revealed a soft consistency of the formation. In the right testicle, the *tunica vaginalis* was stretched, under which strongly overfilled blood vessels were seen (Fig. 1A). After a deep incision, a loss of normal morphological structure of the affected testis was established. The cut surface

was pale pink in color, rough and has many necrotic-degenerative areas and hemorrhages (Fig. 1B). No involvement of adjacent organs and regional lymph nodes were identified.

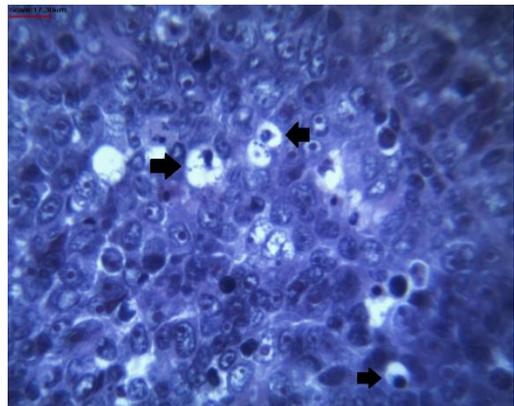


**Figure 1: Testicles of a brown bear. A. Significantly enlarged testicle (left) with overfilled blood vessels; B. Extensive areas with necrosis and hemorrhage on the affected testis, accompanied by loss of normal morphological structure.**

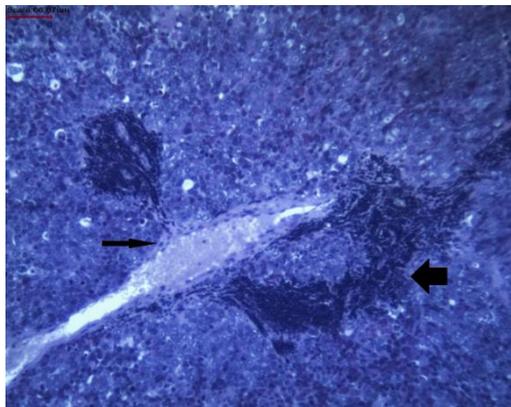
Microscopically, diffuse involvement of the affected testicle was determined. Tightly arranged, oval neoplastic cells, characterized by a small amount of cytoplasm and intensely stained round nuclei, were observed (Fig. 2). Vacuolization of the cytoplasm was seen in some of the cells (Fig. 3). Moderate anisocytosis and anisocaryosis were found. In most cells, the nuclei have distinctly prominent nucleoli. The nuclear cytoplasmic index was elevated. High mitotic activity was observed. A clear accumulations of mononuclear cells, mainly lymphocytes, were found around a part of the blood vessels (Figs. 4 and 5).



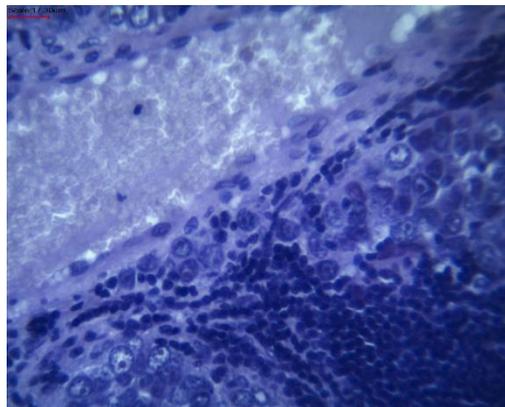
**Figure 2: Histological structure of seminoma in brown bear. Dense packs of oval neoplastic cells with a small amount of cytoplasm and intensely stained round nuclei.**



**Figure 3: Histological structure of seminoma in brown bear (fragment of Fig. 2). Moderate anisocytosis and anisocaryosis of the tumor formation. Vacuolization of the cytoplasm of some cells (arrows).**



**Figure 4: Histological structure of seminoma in brown bear. Blood vessel (thin arrow) and cell accumulations around it (thick arrow).**



**Figure 5: Histological structure of seminoma in brown bear (fragment of Fig. 4). Mononuclear cell accumulations around a blood vessel.**

There are few data about testicular neoplasia in wild animals. Seminomas were described in rhinos (Portas et al., 2010), marine mammals (Estep et al., 2005), fish (Sirri et al., 2010), birds (Sullivan et al., 2018), but in the available literature there is no information about this type of tumor in bears. In diagnosis, most authors were compared the pathomorphological finding of the lesions in wild animals with the already well-known gross and microscopic views of the respective tumors in domestic ones. In most cases, morphological matching was sufficient to be set a diagnosis.

The pathomorphological characteristic of the lesion found by us was typical for seminoma and coincided with the macro- and microscopic specificity of this type of tumors in domestic animals, described by a many authors (Maxie et al., 2015; Zachary, 2017; Manov, 2019). In the present study there was marked unilateral testicular involvement in a brown bear. We found a significant enlargement of the affected testicle, with many well-defined areas of necrosis and hemorrhage in the parenchyma, which were observed in the seminomas of domestic animals. The color of the cut surface of these tumors may vary (Maxie et al., 2015), and in the present case a pale pink color was observed.

Histologically, we found seminoma in diffuse form. We determined extensive growth of densely arranged, oval neoplastic cells with large, intensely stained, round nuclei and a small amount of cytoplasm. The nucleus-cytoplasm ratio was elevated in favor of the nucleus. Mitotic activity was high. Lymphocyte accumulations characteristic of seminomas were observed around most of the blood vessels. The adjacent tissues and organs of the testicles were intact.

## **Conclusion**

During our pathomorphological examination of a sample of testis from brown bear, a unilateral seminoma in a diffuse form was found, which has not been described so far in the available literature. A probable predisposing factor for tumor development was the age of the animal. As in most of the domestic animals, in the present case it was a benign formation that did not lead to clinically signs of illness and changes in the general condition of the animal. Orchiectomy in the present case was a sufficient intervention to prevent subsequent complications of the neoplastic formation.

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**References**

1. Bush, J. M., D. W. Gardiner, S. J. Palmer, E. Rajpert-De Meyts, D. N. R. Veeramachaneni. (2011). *Testicular germ cell tumours in dogs are predominantly of spermatocytic seminoma type and are frequently associated with somatic cell tumours*. International journal of andrology, 34(4–2), 288–295.
2. Estep, J. S., R. E. Baumgartner, F. Townsend, D. A. Pabst, W. A. Mclellan, A. Friedlaender, T. P. Lipscomb. (2005). *Malignant seminoma with metastasis, Sertoli cell tumor, and pheochromocytoma in a spotted dolphin (Stenella frontalis) and malignant seminoma with metastasis in a bottlenose dolphin (Tursiops truncatus)*. Veterinary pathology, 42(3), 357–359.
3. Naves J., A. Ferna´ Ndez-Gil, C. Rodri´Guez, M. Delibes. (2006). *Brown bear food habits at the border of its range: a long-term study*. Journal of Mammalogy, 87(5), 899–908;
4. Manov, V. (2019). *Morphological characteristics of some neoplasias in animals*. Panev Publishing, Sofia, 103–106.
5. Maxie, G., J. Kennedy, N. Palmer. (2015). *Pathology of Domestic Animals*. Elsevier Health Sciences, Guelph, 6(3), 493–497.
6. Meuten, D. J. (2016). *Tumors in domestic animals*. John Wiley & Sons. Raleigh, 5, 706–714.
7. Sirri, R., L. Mandrioli, V. Grieco, B. Bacci, B. Brunetti, G. Sarli, H. Schmidt-Posthaus. (2010). *Seminoma in a koi carp Cyprinus carpio: histopathological and immunohistochemical findings*. Diseases of aquatic organisms, 92, 83–88.
8. Sullivan, P. J., & Fasina, O. O. (2018). *Bilateral malignant seminoma with ventricular metastasis in a bald eagle (Haliaeetus leucocephalus)*. Journal of avian medicine and surgery, 32(3), 240–246.
9. Portas T. J., T. B. Hildebrandt, B. R. Bryant, F. Göritz, R. Hermesb. (2010). *Seminoma in a southern black rhinoceros (Diceros bicornis minor): diagnosis, surgical management and effect on fertility*. Australian Veterinary Journal, 88 (1–2), 57–60.
10. Zachary J. F. (2017). *Pathologic basis of veterinary disease*. Elsevier Health Sciences, Urbana, 6, 1210–1212.