A Primary Retroperitoneal Seminoma Invading the Kidneys of a Cryptorchid Dog

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Abstract: The relationship between cryptorchidism and testicular tumors has been well established in canines, and the tumor has been proposed as a model for studying its human counterparts. Herein we report canine malignant retroperitoneal seminoma in a 4-year-old castrated Basset hound, most likely without testicular involvement, similar to that of the classic seminoma of humans.

Key words: cryptorchidism, dog, kidney, retroperitoneal, seminoma

The relationship between cryptorchidism and increased risk of testicular tumors has long been recognized in canines, and canine testicular tumors have been proposed as a model for studying their human counterparts [5, 8–9, 13–14]. Testes normally descend from their abdominal sites, through the inguinal canal, into the scrotum in early postnatal life. Germ cells of extragonadal or retained testicles, abdominal or inguinal, may undergo neoplastic transformation. In dogs, seminomas arising from the retained abdominal or inguinal testicles, without scrotal involvement, are usually benign [2, 7, 13], although a malignant one with extensive metastasis has been reported [15]. The reports, however, did not indicate the biological behavior or pathologic findings of the abdominal seminomas except for clues, such as discrete movable masses or surgically excisable masses, suggesting a benign nature in some cases [2, 12–14]. Seminoma arising from the extragonadal germ cells has not been identified in dogs. In humans, primary extratesticular seminomas were first reported by Friedman and subsequently by various authors [6], and the incidence rate is approximately 2.5\% of all seminomas [3]. In this study, a malignant retroperitoneal seminoma, most likely arising from the extragonadal germ cells, with subsequent invasion into the kidney, of a castrated dog is reported.

Case History: A male, 4-year-old Basset hound was referred to the National Taiwan University Animal Hospital because of an enlarged abdominal mass. Two years before the admission, both testicles had been removed by orchidectomy, due to acute colic pain in the right cryptorchid torsion. The resected right testicle was swollen, congested, \(18 \times 5 \times 7\) cm in size, and the ductus deferens was twisted with 6 turns. The left testicle in the scrotum was normal in size. The testicular specimens were not examined histologically. Recently, the patient showed polyuria, polydipsia, and an abdominal mass without pain by palpation. Radiography and ultrasonography identified the mass associated with the right kidney, while excretory urography indicated that the kidney was dysfunctional.
Hematology, blood chemistry and urinalysis revealed no remarkable changes, except for a polycythemia interpreted as a renal ischemia caused by the tumor mass. Two weeks after conservative treatment, the tumor size remained unchanged, and laparotomy revealed a pale firm mass infiltrating the right kidney and surrounding area. Subsequently a nephrectomy was performed to remove the right kidney and surrounding mass, together with a presumed invaded para-aortic lymph node. The ureter was suspected to be involved based on the examinations mentioned above and the gross impression during the surgery, but was not confirmed pathologically. The patient's condition returned to normal in 2 weeks postoperatively. Five months later, enlargement of the left kidney associated with severe azotemia was noticed. The animal was euthanatized but was not necropsied due to the owner's refusal.

**Gross findings:** The mass involving the right kidney measured about $14 \times 9 \times 10$ cm, and was pale and firm. The main mass was located extracapsularly next to the hilus (Fig. 1), and it extended to cover the anterior dorsal surface of the kidney. Inwardly, it invaded following the framework of the pelvis and its recess, into the medulla and cortex, making them thick and pale. The grossly non-invaded medulla appeared atrophic and dark red. The para-aortic lymph node, which measured about $2.5 \times 2 \times 0.5$ cm in size, appeared uniformly pale and firm.

**Histopathological and immunohistochemistry:** The surgically excised mass was immersion-fixed in 10% neutral buffered formalin. After waxing and embedding, 6-µm sections were stained with hematoxylin and eosin (HE), periodic acid-Schiff (PAS) for neutral polysaccharide, toluidine blue for metachromatic granules, and silver for argyrophilic granules. Immunohistochemistry was performed as described by Pang *et al.* [11]. Briefly, following deparaffinization and trypsinization, sections were incubated with mouse antibodies against human S-100, synaptophysin, chromogranin and chorionic gonadotropin (hCG) (Dako, Carpinteria, CA, U.S.A.), at 1:20, 1:50, 1:50 and 1:100 dilutions, respectively, followed by the avidin-biotin method (Vectastain Kit, Vector Labs, Burlingame, CA, U.S.A.), using diaminobenzidine as a substrate.

**Histopathological findings:** The main mass was encapsulated, separated by thick fibrous septa or trabeculae, and consisted of sheets of medium to large polygonal cells, arranged in a pseudoalveolar pattern (Fig. 2). Lymphoid cell infiltration with occasional granulomatous reaction was noted in the lesion. Tumor cell emboli were present in lumens of the venules, arteries, and lymphatics. Areas of necrosis with hemorrhages were not uncommon. Neoplastic cells had no cell junctions, and had large nuclei containing regular-sized and regularly arranged dotted chromatin mimicking those of primary spermatocytes (Fig. 3). Mitotic figures were not uncommon, and occasional cells with spireme-like chromatin were observed. Some cells had fine eosinophilic cytoplasmic granules, presumably postmortem artefacts, which were stained negative with PAS and toluidine blue. In the invaded renal parenchyma, the tumor cells had similar morphology to those of the extracapsular mass, but, in addition, the cells were arranged in a nodular pattern (Fig. 4). The histological features of the para-aortic lymph node were similar to those of the extracapsular mass. Tumor cells were negative for S-100, synaptophysin, and chromogranin, while the staining with hCG was inconclusive.

According to histopathological findings, the present tumor was diagnosed as seminoma. However, the hilar location of this tumor and the morphology of the tumor cells require a differential diagnosis from pheochromocytoma of the adrenal glands and nephroblastoma. The negative reaction of the tumor cells to S-100, synaptophysin and chromogranin ruled out the possibility of a neuroendocrine origin. The extra-renal location of the main mass, the apparent secondary invasion of the renal parenchyma, and the lack of either epithelial or mesenchymal components histologically ruled out nephroblastoma [1]. In this case, the malignant behavior, the lymphoid infiltration and the characteristic chromatin pattern in the tumor cells had much in common with the classic seminoma of humans [4]. Some cases of canine seminoma are also similar to spermatocytic seminoma of humans in several respects [9].

In this case, both testicles had been castrated 2 years before the tumor operation, when gross inspection revealed no gross evidence of testicular seminoma. Therefore, the possibility that this tumor originated from
a retained abdominal testicle was low. It is possible that the seminoma could have arisen from residual extragonadal germ cells located in the perihilar region, or alternatively had already arisen from the removed testicle and metastasized but was unnoticed during the castration procedures. The former is more possible, because such a long inapparent term (2 years) is unlikely. Primary retroperitoneal seminomas, without testicular involvement, have been reported in humans [3, 6, 10], but not in dogs.

Tumor in the pelvis and renal parenchyma is believed to be the result of both metastasis (via blood vessels) and direct invasion from the extracapsular hilar mass. Metastasis was evident due to a) the presence of tumor cell emboli within the vascular lumen in the extracapsular mass and in the renal medulla, and b) involvement of the para-aortic lymph node.

We suggest that the dog can serve as a model for studying primary retroperitoneal seminoma in humans,
because the cellular morphology and biological behavior of canine seminoma are similar to their human counterparts.

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