



SPONTANEOUSLY ARISING DISEASE

Retrospective Pathological Studies of Splenic Lesions in Domestic Hamsters (*Phodopus* spp.)

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Summary

Fifteen splenic biopsy specimens from a total of 212 biopsy specimens and necropsy cases of domestic hamsters (*Phodopus* spp.) from the Division of Wild (Exotic) Animal Medicine, Veterinary Medical Teaching Hospital, National Chung Hsing University, Taiwan, collected between 2010 and 2017, were studied retrospectively. The incidence of lesions in the spleen was 7.1% (15/212). The mean age of affected hamsters was 16.6 months and females were affected more than males. The lesions consisted of 10 neoplasms and five non-neoplastic lesions. The most common tumours were histiocytic sarcoma (HS), lymphoma, malignant fibrous histiocytoma (MFH) and hemangiosarcoma. Immunohistochemistry revealed the HSs and MFHs to express lysozyme. The lymphomas were negative for CD20; however, one case was positive for CD3 and another was positive for CD79a. The hemangiosarcoma expressed von Willebrand factor. The non-neoplastic lesions were all fibrotic nodules and these were all identified in ageing female hamsters. The nodules consisted of collagen fibres identified with Masson's trichrome stain, and they were related to repair of trauma in the spleen.

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Introduction

Hamsters are popular domestic pets in Taiwan and include *Phodopus* spp. (Djungarian) hamsters (Siberian hamster, *Phodopus sungorus*; Campbell hamster, *Phodopus campbelli*; Roborovski hamster, *Phodopus roborovskii*) and *Mesocricetus* spp. hamsters, also known as golden hamsters (Syrian hamster; *Mesocricetus auratus*). Animals of these two genera have different numbers of chromosomes (44 for *Phodopus* spp. and 28 for *Mesocricetus* spp.) (Kondo *et al.*, 2008). Before being kept as pets, hamsters were originally kept as laboratory animals for use in cancer research (i.e. for investigation of spontaneously arising tumours or tumours induced by chemical carcinogens or onco-

genic viruses) and cytogenetic studies (Pogosianz, 1975; Kamino *et al.*, 2001). They were also used in toxicological pathology; however, they were not always suitable candidates because of limited biological and histological knowledge (Shirai, 1997).

There are few reports of tumours in domestic hamsters, with most studies being of laboratory hamsters (Pogosianz, 1975). The top two most common spontaneously arising tumours in laboratory Djungarian hamsters are mammary gland tumours and squamous cell carcinomas (SCCs) of the muzzle, with incidence rates of 4.0–12.7% and 1.8–4.1%, respectively. Other tumours, such as pulmonary or hepatic adenomas or cutaneous papillomas, have also been reported. In laboratory Syrian hamsters, adrenal carcinomas and tumours of the digestive system were the

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most common, with mammary gland and skin tumours being rare (Pogosianz, 1975). In domestic Djungarian hamsters, the most common spontaneously arising tumours are skin tumours, including mammary gland tumours, papillomas, SCCs and atypical fibromas (i.e. ganglion-like cell tumours) (Kondo *et al.*, 2008). There have been few reports of tumours affecting the internal organs of domestic hamsters, especially tumours of the spleen. Therefore, the aim of this study was to investigate the occurrence of spontaneously arising splenic lesions in domestic *Phodopus* spp. hamsters.

Materials and Methods

Fifteen splenic biopsy specimens from a total of 212 biopsy specimens and necropsy cases involving hamsters were collected from the Division of Wild (Exotic) Animal Medicine, Veterinary Medical Teaching Hospital (VMTH), National Chung Hsing University (NCHU), Taiwan, between 2010 and 2017. All 15 of the splenic biopsy specimens were from *Phodopus* spp. hamsters that were kept as domestic pets in Taiwan. In these cases, the specimens were surgically removed after being found during clinical examination, routine ovariohysterectomy or at necropsy examination. All specimens were fixed in 10% neutral buffered formalin, processed routinely and embedded in paraffin wax. Sections (3 μ m) were stained with haematoxylin and eosin (HE). Serial sections were also stained with Masson's trichrome stain. Diagnoses were made according to the International Histological Classification of Tumors of Domestic Animals (Jacobs *et al.*, 2002). Additional sections were subjected to immunohistochemistry (IHC) using mouse monoclonal antibody specific for human CD79a (diluted 1 in 100; Leica, Milton Keynes, UK), mouse monoclonal anti-human CD3 (diluted 1 in 300; Leica), mouse monoclonal anti-human CD20 (diluted 1 in 200; Genemed, San Francisco, California, USA), rabbit polyclonal anti-human lysozyme (diluted 1 in 100; Zeta Corporation, Sierra Madre, California, USA) and mouse monoclonal anti-human von Willebrand Factor (VWF) (diluted 1 in 200; Leica). Secondary anti-mouse or anti-rabbit IgG reagents were from Leica and 3,3'-diaminobenzidine (Leica) was used as chromogen. Hamster spleens were used as an internal control in this study. The species, age and sex of the hamsters were also recorded.

Results

The number of cases and the year of presentation are shown in Fig. 1. There were 15 cases out of a total of 212 that involved splenic lesions in *Phodopus* spp. ham-

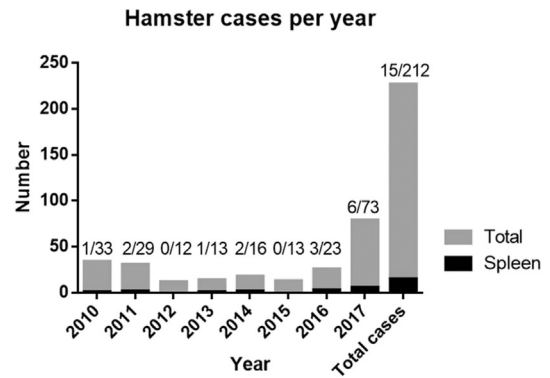


Fig. 1. Pathological specimens (total number and number of samples of spleen) submitted from domestic hamsters to the Division of Wild (Exotic) Animal Medicine, Veterinary Medical Teaching Hospital (VMTH), National Chung Hsing University (NCHU), Taiwan, from 2010 to 2017.

sters: one case in 2010, two cases in 2011, one case in 2013, two cases in 2014, three cases in 2016 and six cases in 2017, which accounted for 7.1% (15/212) of the study population. Diagnoses were separated into neoplastic and non-neoplastic lesions. The diagnosis, number, sex and age distribution of affected *Phodopus* spp. hamsters are summarized in Table 1.

Neoplastic lesions were found in two male and eight female hamsters and consisted of five cases of histiocytic sarcoma (HS) (one male and four females), two cases of malignant fibrous histiocytoma (MFH) (two females), two cases of lymphoma (one male and one female) and one of hemangiosarcoma (female). Five cases with non-neoplastic lesions (all fibrotic nodules) were found in female hamsters. The mean age of all the affected animals was 17.7 ± 6.2 months. The mean ages of animals with specific lesions were: lymphoma, 11 months; hemangiosarcoma, 12 months; HS, 16.6 months; MFH, 22 months; and non-neoplastic lesions, 24.0 ± 2.4 months.

In all cases of HS, gross examination of the surface of the spleen revealed one to three, pale tan to white, raised, firm nodules measuring $0.2\text{--}0.5 \times 0.5\text{--}1.0 \times 0.5\text{--}1.0$ cm. In addition, variably-sized white plaques were observed on the cut surface of the spleen. Microscopically, the nodules were well demarcated, unencapsulated, expansile, densely-cellular neoplasms composed of polygonal cells arranged into solid lobules supported by fine fibrovascular stroma. Neoplastic cells displayed moderate anisocytosis and anisokaryosis and were occasionally accompanied by small numbers of lymphocytes and megakaryocytes (Fig. 2). Immunohistochemically, the neoplastic histiocytes were negative for CD79a, CD20, CD3 and VWF, but showed strong positive expression of lysozyme (Fig. 3, Table 2).

In the two cases of MFH, the splenic surface displayed white and dark red, raised, $1.0 \times 1.0 \times$

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