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Case report

GRANULATION TISSUE-TYPE HEMANGIOMA (GTH) IN THE SPLEEN OF A CAT: A FIRST CASE REPORT

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Hemangiomas are rarely documented in cats, and to date, granulation tissue-type hemangioma (GTH) has not been reported. This report presents the first known case of GTH in the spleen of a 5-year-old cat, focusing on its histopathological and immunohistochemical characteristics. The lesion exhibited neoplastic vascular proliferation within granulation tissue, accompanied by fibrous tissue proliferation, which complicated the diagnosis. Immunohistochemical staining for von Willebrand factor (VWF) and vimentin confirmed the vascular origin of the cells, distinguishing the lesion from other splenic proliferative diseases. This case expands the diagnostic spectrum of feline splenic vascular tumors and highlights the need for further studies to refine their classification and diagnostic criteria.

Keywords: cat, hemangioma, granulation tissue, GTH, spleen

INTRODUCTION

Vascular tumors of the spleen are frequently reported in dogs, with hemangiosarcoma being the most common malignant form [1,2]. However, these tumors are relatively rare in cats [3,4]. Granulation tissue-type hemangioma (GTH) is a rare entity in veterinary medicine, with only a few reports across different species and organ systems [5-7]. For instance, a subcutaneous GTH case has been reported in a dog [7], and in human medicine, cases have been documented in the ureter [6] and internal jugular vein [5].

GTH is known to arise in response to chronic inflammation, persistent traumatic tissue injury, hormonal factors, or prolonged immune activation [5,6]. The lesions are characterized by fibroblast proliferation, newly formed blood vessels, and inflammatory cell infiltration [5-7], mimicking the histological features of both reactive

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and neoplastic processes. Therefore, it is essential to distinguish GTH from simple inflammatory granulation tissue and conventional hemangiomas.

To date, GTH has not been reported in cats. Its intricate histopathological features and biological behavior may pose distinct diagnostic and therapeutic challenges. The limited availability of veterinary-specific data underscores the necessity of documenting such cases to improve understanding and guide future diagnostic and treatment approaches.

By presenting the first reported case of GTH in a feline spleen, we aim to highlight its histopathological and immunohistochemical characteristics, expanding the diagnostic spectrum of splenic vascular proliferations in cats. Furthermore, we emphasize the need for additional studies to refine its diagnostic classification.

CASE PRESENTATION

During pre-anesthetic evaluation for tooth extraction, a 5-year-old neutered male domestic shorthair cat was incidentally found to have splenomegaly, initially diagnosed as splenitis. Progressive enlargement with newly developed hypoechoic foci on follow-up ultrasonography and persistent marked leukocytosis (WBC >30,000; reference range: 4,900–20,000) prompted splenectomy. The cat tested negative for feline leukaemia virus (FeLV), feline immunodeficiency virus (FIV), and feline coronavirus (FCoV).

Grossly, the spleen contained multifocal, irregular yet well-demarcated yellowish nodules in the head and tail regions (Figure 1A). The cut surface was firm and heterogeneous, with yellowish-white foci replacing normal splenic architecture (Figure 1B).

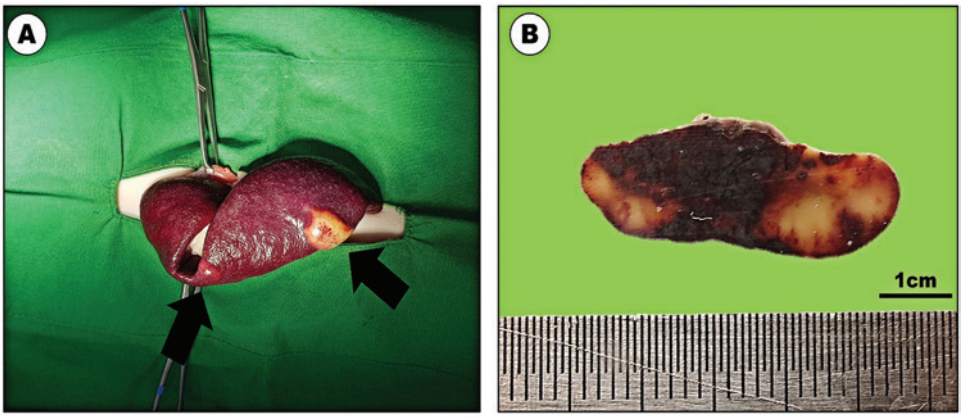

Figure 1. Gross lesions of splenic mass. (**A**) Multifocal yellowish nodules are present in the spleen, exhibiting well-defined margins. (**B**) Cut surface of the mass. The texture was firm with multiple yellowish-white foci disrupting the normal splenic architecture. Scale bar = 1cm.

Histologically, the lesion showed a biphasic pattern. One component consisted of plump, atypical endothelial cells forming irregular, anastomosing, erythrocyte-filled vascular channels that were variably dilated and slit-like (Figure 2B). The endothelial cells exhibited mild to moderate nuclear pleomorphism and occasional mitotic figures, supporting a vascular neoplasm. The second component comprised densely arranged spindle-shaped mesenchymal cells in interlacing fascicles within exuberant granulation tissue (Figure 2C), characterized by fibroblast and myofibroblast proliferation, extensive capillary formation, and mixed inflammatory infiltrates, consistent with chronic tissue injury.

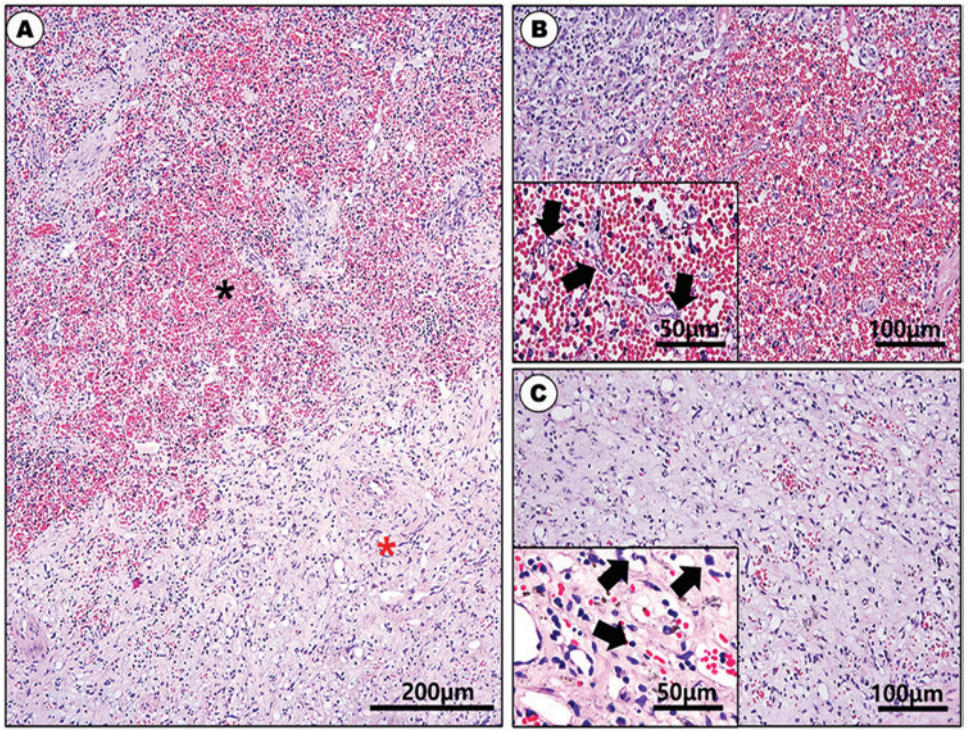

Figure 2. Histopathological lesions of the splenic mass. (**A**) A mixed histological pattern of hemangioma (black asterisk) and granulation tissue (red asterisk). (**B**) Neoplastic endothelial cells form irregular, slit-like, blood-filled vascular spaces. (**C**) Proliferative granulation tissue with extensive neovascularization, and a prominent inflammatory infiltrate, including neutrophils, lymphocytes, and macrophages. Scale bar = 100um, Inset = 50um.

The native splenic parenchyma was largely effaced, with marked white pulp atrophy and architectural distortion. Multifocal coagulative and liquefactive necrosis suggested chronic hemorrhage, ischemia, and remodeling. Overall, the findings indicated a chronic vascular neoplasm, most consistent with hemangioma, accompanied by marked secondary reparative and inflammatory changes.

Immunohistochemically, the endothelial tumor cells were diffusely and strongly positive for VWF (Figure 3A) and vimentin (Figure 3B), confirming endothelial and mesenchymal differentiation. α-SMA was negative in tumor endothelial cells but positive in pericytes and spindle cells within the granulation tissue (Figure 3C), identifying them as reactive myofibroblasts rather than neoplastic cells. Masson's Trichrome staining demonstrated abundant collagen deposition in the granulation tissue but not within the neoplastic vascular structures (Figure 3D), supporting reactive fibrosis.

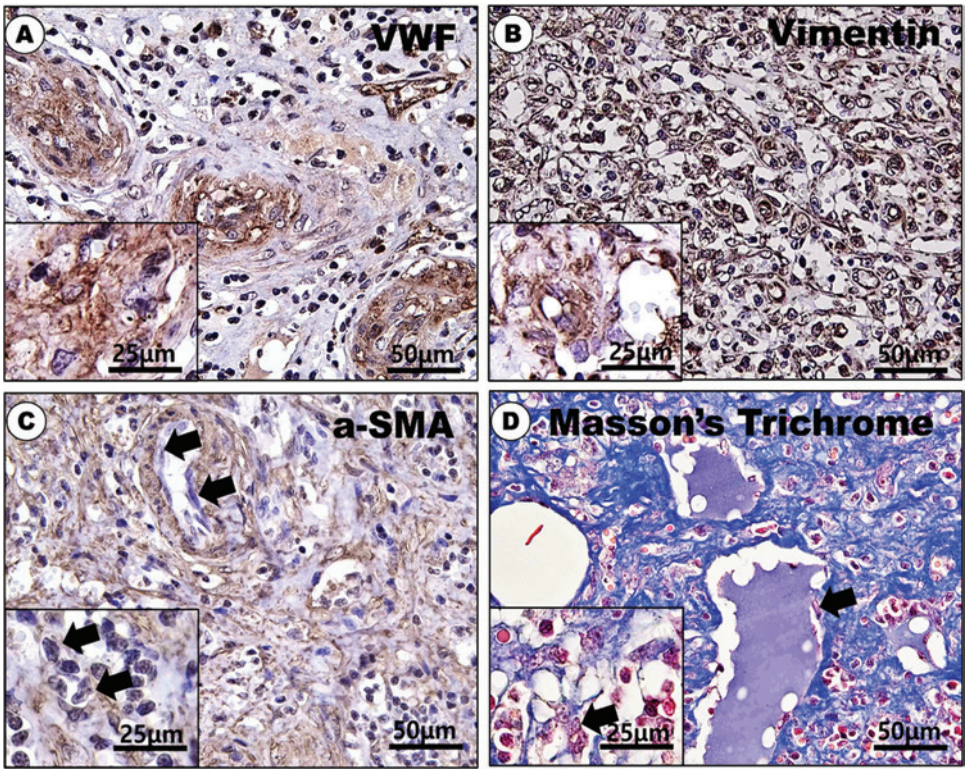

Figure 3. Representative immunohistology images for the splenic mass. The neoplastic cells were (**A**) VWF and (**B**) vimentin positive, indicating endothelial cell origin. Surrounding granulation tissues were positive for (**C**) a-SMA and (**D**) Masson's Trichrome staining while neoplastic endothelial cells were negative (arrows). Scale bar = 50um, Inset = 25um.

Collectively, the histomorphologic and immunophenotypic features support a diagnosis of granulation tissue-type hemangioma (GTH), a benign vascular proliferation that may mimic more aggressive lesions due to prominent stromal and inflammatory components but lacks overt malignant features.

DISCUSSION

This case describes a unique splenic vascular neoplasm in a cat, histologically consistent with GTH. Although the overall morphology and immunophenotype supported a diagnosis of hemangioma, the lesion exhibited extensive granulation tissue-like stroma, marked neovascularization, and prominent fibroblastic proliferation, distinguishing it from conventional hemangiomas and necessitating careful differential diagnosis.

The primary differential diagnoses included angiomatosis, inflammatory myofibroblastic tumor (IMT), and reactive granulation tissue, as described in a similar canine case [7]. Angiomatosis is a non-neoplastic, diffuse vascular proliferation often associated with mature adipose tissue and well-organized vascular channels resembling normal vasculature [8,9]. Histologically, vessels are lined by bland endothelial cells without atypia or architectural distortion [7,10]. In contrast, the present lesion lacked mature adipose stroma and demonstrated irregular, slit-like vascular spaces lined by plump, hyperchromatic endothelial cells, findings inconsistent with angiomatosis.

IMT was also considered due to spindle cell proliferation and inflammatory infiltrates. IMTs are characterized by myofibroblastic and fibroblastic cells arranged in fascicles with lymphoplasmacytic and eosinophilic infiltration [11,12]. Although α-SMA-positive myofibroblastic activity and Masson's trichrome positivity were observed in the stroma, the central proliferating cells showed strong immunoreactivity for von Willebrand factor (VWF) and vimentin (Figures 3A, 3B), confirming endothelial differentiation. As IMTs typically lack endothelial marker expression, this diagnosis was excluded [6,7,13,14].

Reactive granulation tissue was ruled out based on architectural disorganization, cytologic atypia of endothelial cells, and the formation of aberrant vascular channels replacing normal splenic parenchyma. Unlike temporally regulated reparative granulation tissue, this lesion demonstrated unregulated vascular proliferation, supporting a neoplastic process.

Immunohistochemistry was critical for diagnostic confirmation. Diffuse positivity for VWF and vimentin, established markers of endothelial differentiation [6,7,13,14], verified that the vascular channels were formed by neoplastic endothelial cells rather than reactive fibroblasts or myofibroblasts. The diagnostic value of immunohistochemical characterization is further underscored by its role in distinguishing the diverse cellular contributors involved in vascular and tissue proliferation, as endothelial progenitor cells and other bone marrow – and blood-derived cells share overlapping surface markers and participate in neovascularization and tissue remodeling [15].

The prominent fibrovascular stroma and chronic inflammatory infiltrates suggest that chronic tissue injury may have contributed to tumor development. Chronic inflammation is known to promote angiogenesis through pro-angiogenic cytokines such as VEGF, FGF, and TNF-α, which stimulate endothelial proliferation and vascular remodeling. Repetitive microvascular injury and repair within the spleen may

have facilitated aberrant endothelial proliferation, ultimately leading to neoplasia. The localization of neoplastic endothelial cells within granulation tissue-like areas further supports an inflammation-associated pathogenic mechanism (Figures 2 and 3).

To our knowledge, this is the first report of granulation tissue-type hemangioma in a cat. This case expands the morphological spectrum of feline hemangiomas and highlights the importance of integrating histopathological and immunohistochemical findings to ensure accurate diagnosis of atypical splenic vascular lesions.

Ethical approval

This clinical case did not involve experimental procedures.

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Authors' contributions

SMB performed the conceptualization, data curation, formal analysis, visualization, and wrote the original draft. JKP conceived the study, contributed to the pathological diagnosis, supervision, validation, and reviewed and edited the manuscript. All authors have read and approved the final manuscript.

Declaration of competeing interests

The authors declared that there is no conflict of interest.

Statement of informed consent

The owner understood procedure and agreed that results related to investigation or treatment of their companion animals, could be published in Scientific Journal Acta Veterinaria-Beograd.

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HEMANGIOM TIPA GRANULACIONOG TKIVA (GTH) U SLEZINI MAČKE: PRVI IZVEŠTAJ O SLUČAJU

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Hemangiomi su kod mačaka retko dokumentovani, i do danas nije prijavljen hemangiom tipa granulacionog tkiva (GTT). Ovaj izveštaj predstavlja prvi poznati slučaj GTT u slezini petogodišnje mačke, fokusirajući se na njene histopatološke i imunohistohemijske karakteristike. Lezija je pokazivala neoplastičnu vaskularnu proliferaciju unutar granulacionog tkiva, praćenu proliferacijom fibroznog tkiva, što je komplikovalo dijagnozu. Imunohistohemijsko bojenje za fon Vilebrandov faktor (VWF) i vimentin potvrdilo je vaskularno poreklo ćelija, razlikujući leziju od drugih proliferativnih bolesti slezine. Ovaj slučaj proširuje dijagnostički spektar vaskularnih tumora slezine mačaka i ističe potrebu za daljim istraživanjima kako bi se usavršila njihova klasifikacija i dijagnostički kriterijumi.