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Case Report

Splenic histiocytic sarcoma in an African hedgehog: a case report with immunohistochemical analysis

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Abstract

This case report details the diagnosis and surgical management of splenic histiocytic sarcoma in a 3-year-old female African pygmy hedgehog (*Atelerix albiventris*). The hedgehog presented with non-specific clinical signs including lethargy, decreased appetite and weight loss. Abdominal ultrasonography revealed splenomegaly with two hypoechoic nodules. A definitive diagnosis was made through total splenectomy, followed by histopathological and immunohistochemical (IHC) analyses. The tumor cells showed intense positive cytoplasmic staining for the pan-macrophage marker IBA-1, confirming a histiocytic origin, whereas staining for CD3 and CD20 markers ruled out lymphoid tumors. Despite the initial postoperative improvement following splenectomy, the hedgehog's condition worsened, and the patient died 60 days after surgery. This report highlights the aggressive nature of splenic histiocytic sarcoma in hedgehogs and underscores the importance of a comprehensive diagnostic approach, including advanced IHC markers, for accurate diagnosis and management.

Keywords: *Atelerix albiventris,* Histopathology, IBA-1 Marker, Splenectomy, Tumor markers

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INTRODUCTION

Splenic histiocytic sarcoma (HS) is a relatively rare and aggressive neoplasm originating from histiocytes that specialize in phagocytosis and antigen presentation. Although more frequently documented in canines, HS is a significant and comparatively common neoplasm in African pygmy hedgehogs (*Atelerix albiventris*) (Koizumi and Kondo, 2019; Sirivisoot et al., 2021). HS is a significant neoplasm that can manifest in both localized and disseminated forms (Makishima et al., 2021; Sirivisoot et al., 2021; Zanoti et al., 2023). The aggressive nature of the neoplasm highlights the urgent need to raise awareness and adopt proactive approaches to diagnosis and treatment. Diagnosing HS typically involves a multifaceted approach, combining clinical evaluation and advanced imaging techniques, with definitive confirmation achieved through histopathological examination and immunohistochemical (IHC) analysis (Makishima et al., 2021). IHC markers, such as the Ionized Calcium-binding Adapter molecule 1 (IBA-1), are particularly crucial. IBA-1 positively stains macrophages and dendritic cells (histiocytic lineage), and when used with Cluster of Differentiation (CD) markers such as CD3 and CD20, it enhances the diagnostic accuracy of HS by differentiating it from other lymphoid tumors and identifying the specific immune cells involved (Son et al., 2020; Zhou et al., 2024).

Despite these diagnostic tools, the prognosis for HS is generally poor, with survival times often limited due to its aggressive behavior and metastatic potential (Koizumi and Kondo, 2019). In canine medicine, surgical intervention, notably total splenectomy, has shown success in treating localized HS, suggesting that early tumor detection and excision may improve outcomes in hedgehogs (Latifi et al., 2020). However, managing HS in hedgehogs is challenging because of the aggressiveness of the tumor and the potential for metastasis, which can limit the efficacy of surgery alone. While post-surgical chemotherapy using agents such as CCNU (lomustine) or potentially bortezomib is considered in dogs and explored in hedgehogs (Skorupski et al., 2007), there remains a significant knowledge gap regarding rare neoplasms in exotic species. Early detection is often complicated by non-specific clinical signs, further emphasizing the need for refined diagnostic approaches, including the strategic use of IHC markers, and better postoperative management to improve survival rates.

This study details the diagnostic process, including the application of a panel of IHC markers (IBA-1, CD3 and CD20), and surgical management via total splenectomy for splenic histiocytic sarcoma in an African pygmy hedgehog. This study aims to contribute to the understanding of this condition in exotic pets and highlight a comprehensive approach to its diagnosis and treatment.

CLINICAL HISTORY AND SYMPTOMS

An intact, 3-year-old female African pygmy hedgehog (*Atelerix albiventris*), weighing 374 grams, was presented with an uncertain onset of clinical signs, characterized by a gradual decrease in appetite and activity levels for 2 weeks. At the previous animal hospital, radiographs were obtained, which revealed spondylosis between the L4-L5 and L6-L7 vertebra without other abnormalities detected. Before referral, the animal received supportive subcutaneous fluid therapy with unspecified amounts and no other medications.

DIAGNOSIS AND TREATMENT

During the physical examination, the hedgehog was in lateral recumbency, exhibiting depression, increased respiratory effort, pale mucous membranes, black-green feces, and mild abdominal pain when palpated. Bradycardia was also observed. Fresh fecal examination was unremarkable.

Abdominal ultrasonography revealed splenomegaly featuring two hypoechoic nodules, one measuring 2.39 cm × 1.75 cm and the other 1.00 cm × 0.75 cm (Figure 1). The liver exhibited homogeneous echotexture, and sediment accumulation was noted within the gallbladder. These findings suggested a liver with a normal, even texture and the presence of sediment in the gallbladder. Differential diagnoses included splenic tumors, inflammation, and infections along with gastrointestinal disorders because of the dark feces. Skin lesions were considered as potentially separate or contributing factors. General signs of depression, bradycardia and bradypnea can be associated with a wide range of severe underlying metabolic or systemic diseases, including those affecting major organ systems or severe metabolic disturbances. The presence of greenish, dark feces and dysbiosis observed during microscopic stool examination may suggest a gastrointestinal disorder. This condition could be attributed to infection or inflammation, potentially contributing to the overall clinical picture. Hair loss with scaling could be due to various causes common in hedgehogs, such as parasitic infestations (e.g., mites), fungal infections, nutritional deficiencies, or could be secondary to a severe systemic illness. We proposed additional diagnostic methods, such as complete blood counts and blood biochemistry profiles, to uncover any underlying conditions.

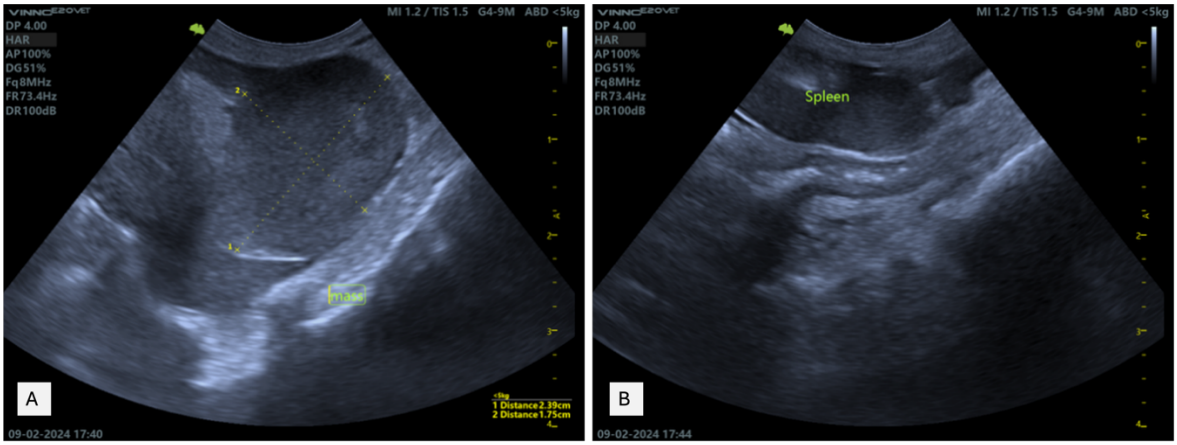

Figure 1 Ultrasonographic images showed splenomegaly with two hypoechoic nodules size 2.39 cm ×1.75 cm (A) and 1.00 × 0.75 cm (B)

Initially, the owner opted for palliative care due to concerns regarding anesthetic risks. This included subcutaneous fluid administration at a rate of 25 ml/kg/day at the junction of the furred skin and spined mantle, ensuring that no more than 10 ml was administered per site (Carpenter and Marion, 2017). For postoperative analgesia, tramadol (4 mg/kg twice daily) and meloxicam (0.2 mg/kg once daily) were administered subcutaneously (Carpenter and Marion, 2017). Pain was assessed using behavioral indicators, including activity level, posture and appetite, which were monitored regularly during the postoperative period (Mayer, 2007). Body temperature was kept constant at an ambient temperature of 29°C. Home-based feeding was advised (Critical Care Carnivore, Oxbow Animal Health, USA).

However, two days later, the patient's condition worsened significantly. She exhibited increased weakness and lethargy, hypoxia, severe bradycardia accompanied by arrhythmia, and severe bradypnea. The patient's body weight decreased to 326 g. Given this decline, the owner consented to further investigation and exploratory surgery. Blood samples were collected from the heart for a complete blood count and blood biochemistry evaluation prior to surgery (Table 1). The results indicated a slight decrease in the hematocrit, while the red blood cell count remained within normal limits. There was also a marked decrease in thrombocyte count.

Table 1 Hematological and biochemical profiling of the hedgehog (Okorie-Kanu et al., 2015)

Parameter	Result	Reference value	Interpret
HCT (%)	32.7	35.00-47.00	decrease
RBC (10^{12}/L)	4.89	4.47-5.96	normal
HGB (g/dL)	10.9	11.25-14.75	decrease
MCV (fL)	67.0	76.34-99.78	decrease
MCH (pg)	22.2	24.84-31.09	decrease
MCHC (g/dL)	33.3	29.69-33.17	normal
PLT (10^9/L)	84	250-610	decrease
WBC (10^9/L)	53.14	6.30-10.0	increase
Neutrophil (10^9/L)	44.81	6.85-14.63	increase
Lymphocyte (10^9/L)	4.686	3.29-8.74	normal
Eosinophil (10^9/L)	1.200	0.00-0.30	increase
Basophil (10^9/L)	0.616	0.00-0.15	increase
Monocyte (10^9/L)	1.828	0.00-0.48	increase
ALP (U/L)	35	18.18-25.45	increase
ALT (U/L)	192	15.23-28.79	increase
Glucose (mg/dL)	152	69-125	increase
Total protein (g/dL)	4.6	5.08-6.80	decrease
Creatinine (mg/dL)	0.17	0.2-1	Slight decrease
BUN (mg/dL)	23.7	34.67-57.33	decrease

Exploratory surgery was performed. The hedgehog received a maintenance infusion of acetated Ringer's solution at a rate of 1 mL/kg/hour. Anesthesia and surgical procedures were performed carefully. Anesthesia began with pre-oxygenation, administering oxygen at a flow rate of 3 L/min for 5 minutes in an induction chamber measuring 33 x 20 x 13 cm. Following this, induction was achieved by incrementally increasing the isoflurane concentration to 1%, 2% and 3% within the same chamber until an appropriate anesthetic depth was reached. The anesthetic depth was determined based on the absence of righting reflex and jaw tone (Bellini et al., 2019; Hausmann et al., 2021). Throughout the surgery, the hedgehog was kept under a facemask with 2% isoflurane, accompanied by an oxygen flow rate of 1 L/min. Vital signs were closely monitored, including a heart rate between 200-240 bpm, a respiratory rate between 20-30 breaths/min, oxygen saturation between 94-100%, and an electrocardiogram (ECG). All monitored values remained within normal ranges, with the exception of body temperature, which was between 34.0-36.5°C.

Ventral midline celiotomy was performed as an exploratory laparotomy with total splenectomy, and the surgical site was first prepared and cleaned. Ventral midline celiotomy was then performed with an incision made using a scalpel, extending from the xiphoid process caudally to the umbilicus. The incision was made to pass through the skin, subcutaneous tissue, and abdominal musculature. To facilitate abdominal exploration, stay sutures using USP 5/0 polyglactin 910 were placed, and 12 cm Allis-Baby tissue forceps were used for retraction and exposure. The spleen was then located and gently elevated using sterile cotton-tip applicators. Macroscopic examination of the spleen revealed three distinct masses. These included one yellowish mass measuring 1.00 × 0.75 cm, and a separate, green-discolored hemorrhagic mass which had two components measuring 2.39 × 1.75 cm and 0.60 × 0.60 cm (Figure 2). The splenic pedicle, including the splenic artery, splenic vein, and gastrosplenic vessels, was secured using a double ligation technique with USP 5/0 polyglactin 910 suture material and hemostatic clamps. Hemostasis was achieved using a veterinary ultrasonic scalpel. The entire spleen was removed via total splenectomy, collected as a whole mass, and preserved in 10% formalin. The abdominal wall was closed in layers, with the muscle layer closed using USP 5/0 polyglactin 910 in a simple interrupted pattern to minimize dead space. Finally, the skin was closed using 4/0 nylon monofilament suture material.

Figure 2 Surgical procedure depicting an intraoperative view of the affected spleen (S) with associated masses (*) measuring 1.00 x 0.75 cm, 2.39 x 1.75 cm and 0.60 x 0.60 cm in proximity to the small intestine (ST)

Following the surgical procedure, the hedgehog received postoperative care to manage the pain and prevent infection. This involved administering meloxicam subcutaneously at a dosage of 0.2 mg/kg once daily (Metacam®, Labiana Life Sciences S.A., Barcelona, Spain), marbofloxacin at 5 mg/kg once daily (Marbocyl®, VETOQUINOL, France), and tramadol at 4 mg/kg twice daily (T.P. Drug Laboratories Co., Ltd, Bangkok, Thailand). Follow-up appointments were scheduled seven days later. Pain assessment was based on behavioral indicators, including activity level, posture, and appetite, all of which showed progressive improvement during the postoperative period, as evidenced by increased food intake, greater mobility, absence of a curled posture, and stable vital parameters. Clinical signs improved postoperatively, and the patient survived for 2 months following the surgery.

Histopathological and immunohistochemical findings: the firm, dark red splenic mass was characterized as a non-encapsulated, poorly demarcated and multilobulated tumor. The tumor was characterized by dense clusters of histiocytic cells that replaced the lymphoid follicles within the white pulp, accompanied by severe congestion. The tumor cells were medium to large and round, featuring nuclei that were either round or cleaved, along with a noticeable nucleolus. These cells were typically arranged in dense solid nests; however, in some areas, they infiltrated as solid sheets intermingled with lymphocytes and plasma cells. Significant variations in cell size (anisocytosis), and nuclear size and shape (anisokaryosis) were observed. Furthermore, the splenic tissue exhibited a focal massive hemorrhagic necrotic infarction and multifocal dystrophic calcification.

Immunohistochemical staining was performed with the primary antibodies including CD3 (rabbit polyclonal), CD20 (rabbit polyclonal), and IBA-1 (rabbit polyclonal). Detection employed an HRP-labeled streptavidin system. The tissue sample was submitted to the Veterinary Diagnostic Laboratory, Faculty of Veterinary Science, Chulalongkorn University, Thailand; therefore, exact working dilutions and kit lot numbers were unavailable. To precisely identify the cellular origin of the tumor, immunohistochemical analysis was performed using a panel of specific markers. The results indicated the presence of lymphocyte populations, showing intense positive cytoplasmic staining for the T-cell marker CD3 (Figure 3A) and the B-cell marker CD20 (Figure 3B) in small lymphocytes within the splenic white pulp, indicating reactive lymphoid infiltration rather than neoplastic co-expression. Crucially, the pan-macrophage marker IBA-1, which identifies cells of the monocyte/macrophage lineage, showed intense positive cytoplasmic staining in the infiltrative neoplastic cells (Figure 3C), confirming their histiocytic origin. This immunophenotypic pattern excludes both T- and B-cell lymphoma and supports a

definitive diagnosis of splenic histiocytic sarcoma. An appointment was scheduled for the 7th postoperative day to remove sutures, conduct a physical examination, perform a blood test, and perform abdominal ultrasonography. On that day, the animal appeared responsive and exhibited a normal appetite; however, the owner declined a blood test and ultrasonography due to budget constraints. The hedgehog initially showed improved clinical signs during the first month after surgery. However, these signs worsened, including loss of appetite, reduced eating, dark feces and bradypnea. Despite supportive treatment, the patient died during sleep on day 60 without evidence of pain or signs of distress.

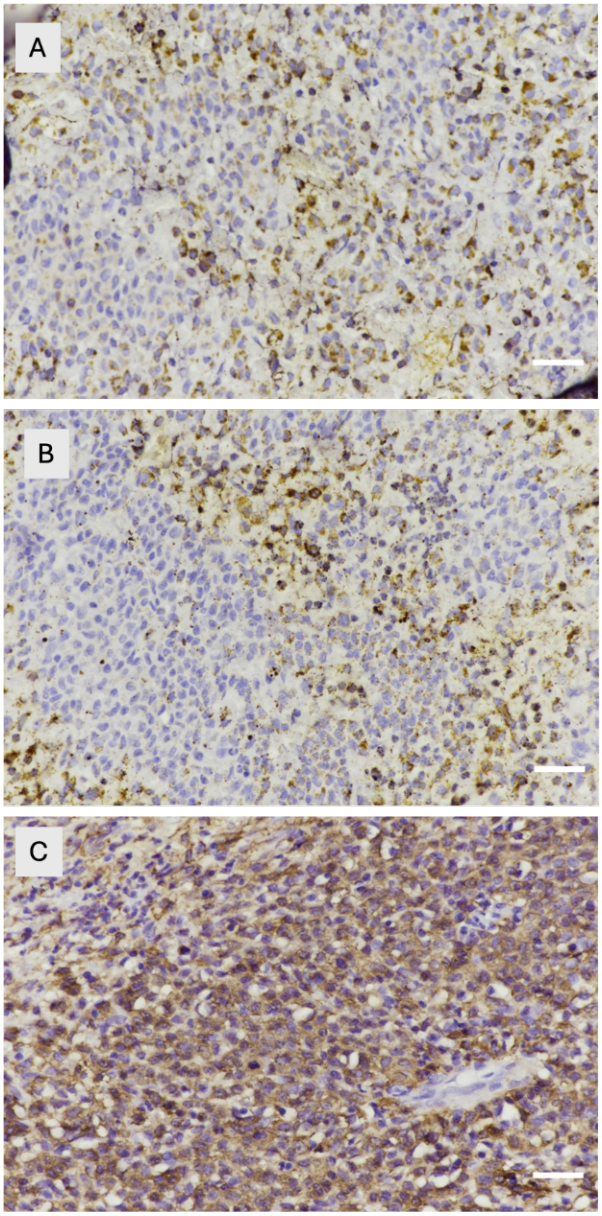

Figure 3 Immunohistochemical analysis of the splenic mass (400×). (A) Staining for the T-cell marker CD3, showing positive staining in reactive lymphocytes. (B) Staining for the B-cell marker CD20, also showing positive staining in reactive lymphocytes. (C) Intense, diffuse positive cytoplasmic staining for the pan-macrophage marker IBA-1 in the neoplastic cells, confirming the diagnosis of histiocytic sarcoma. (Scale bars = 50 µm).

DISCUSSION

This case report of splenic histiocytic sarcoma in an African pygmy hedgehog provides insights into the diagnosis and management of rare cancers in exotic pets. Hematological and biochemical profiles revealed the systemic effects of sarcoma. These findings highlight the importance of integrating clinical signs, blood analysis, and imaging with histopathology and immunohistochemistry for diagnosis and treatment. The blood profiles, encompassing both hematological and biochemical analyses, offered critical insights into the hedgehog's systemic health and pointed towards the impact of a potential disseminated histiocytic sarcoma. The key hematological findings were significant abnormalities, particularly anemia, which was evidenced by decreased hematocrit (HCT 32.7%) and hemoglobin (HGB 10.9 g/dL). Such a presentation is characteristic of anemia in chronic disease, a frequent hematological finding in animals suffering from neoplastic conditions (Childress, 2012). Anemia may be exacerbated by blood loss from the tumor or the body's response to the neoplastic process (Chervier et al., 2012).

A markedly elevated white blood cell count, characterized by pronounced neutrophilia, indicates a significant inflammatory response, a condition frequently observed in cases of malignant neoplasia. This leukocytosis likely reflects the immune system's reaction to the tumor itself (Schernberg et al., 2017) or secondary inflammation arising from tissue invasion and necrosis (Xiong et al., 2021). The elevated eosinophil and basophil counts suggest a complex immune response, likely linked to the tumor or secondary infection (Balan et al., 2017; Held and Mochizuki, 2023). Another critical finding was thrombocytopenia, as evidenced by the markedly decreased platelet count. This condition is frequently associated with advanced neoplastic disease, as the malignant process can disrupt bone marrow function, accelerate platelet consumption, or trigger immune-mediated destruction (Botsch et al., 2009). The relationship between malignancy and altered hemostatic mechanisms, such as thrombocytopenia, is well documented in veterinary medicine (O'Keefe and Couto, 1988), and these pathophysiological processes account for the low platelet counts observed in animals with advanced cancer.

The biochemical profile revealed widespread systemic distress, reflecting the severity of the underlying cancer. Evidence of liver damage was evident, with elevated levels of alanine aminotransferase (ALT) and alkaline phosphatase (ALP). In addition to hepatic dysfunction, analysis revealed other metabolic disturbances. The decreased levels of blood urea nitrogen (BUN) and creatinine indicated altered hepatic dysfunction and reduced muscle mass associated with weight loss rather than renal dysfunction (Misbach et al., 2014; Hokamp and Nabity, 2016). Alternatively, the findings may reflect reduced creatinine production during sepsis; experimental data indicate that sepsis can suppress creatinine generation and thus attenuate serum creatinine increases (Doi et al., 2009). While sepsis was not confirmed in this case, sepsis-associated suppression of creatinine production remains a plausible contributor and may blunt early creatinine rises. Although a liver biopsy was not performed due to perioperative risk–benefit considerations and owner preference, these biochemical and clinical data collectively support impaired hepatic synthetic capacity and cachexia as the primary contributors to the low BUN/creatinine. The low total protein or hypoproteinemia likely indicated a combination of systemic inflammation, reduced protein production by the compromised liver, or cancer-related muscle wasting (cachexia) (Porporato, 2016; Oliveira et al., 2022). Furthermore, the hedgehog's blood sugar was high (hyperglycemia), which could have been a stress response to its severe illness or a direct consequence of the cancer altering its metabolism (Vasquez and Borniger, 2020). The hematological and biochemical abnormalities observed in this case, including anemia, leukocytosis with neutrophilia, thrombocytopenia, and elevated hepatic enzyme levels, highlight the systemic impact of splenic histiocytic sarcoma. Such alterations are consistent with the paraneoplastic syndromes and chronic inflammatory responses that are frequently reported in malignant neoplasia (Childress, 2012; Schernberg et al., 2017). These systemic effects, together with

histopathological evidence of necrosis and hemorrhage within the splenic masses, suggest a biologically aggressive tumor and support a cautious prognosis. Collectively, these biochemical changes are common in animals with advanced neoplastic diseases and highlight the far-reaching effects of cancer on the body. Understanding these systemic impacts through a comprehensive biochemical assessment is crucial for guiding diagnosis and treatment.

The successful general anesthesia achieved in this case highlights the efficacy of isoflurane for major surgeries in African pygmy hedgehogs. The protocol involved five minutes of pre-oxygenation followed by 6 minutes of chamber induction using incrementally increased concentrations of isoflurane and facemask maintenance, resulting in smooth induction and rapid establishment of a surgical plane of anesthesia. Anesthetic depth was confirmed by the absence of the righting reflex and jaw tone, allowing for a successful exploratory celiotomy and splenectomy with stable vital signs throughout; only mild hemorrhage was noted. The patient's postoperative improvement further suggests a smooth recovery without noticeable complications, with the exception of hypothermia, a condition that is commonly observed following general anesthesia.

In splenic surgeries, anesthetic management requires careful consideration because of the risks of intraoperative hemorrhage and hemodynamic instability. Inhalant anesthesia with isoflurane provides superior control over anesthetic depth and duration compared to injectable protocols, which often show variable induction times and fixed anesthetic durations (Bellini et al., 2019; Hausmann et al., 2021). These characteristics are particularly advantageous during splenectomy, in which rapid adjustments in anesthetic depth are critical for maintaining cardiovascular stability and minimizing perioperative complications. In this case, isoflurane facilitated a stable surgical plane with smooth recovery, consistent with previous reports that highlighted its suitability over injectable protocols for major surgical procedures in hedgehogs (Bellini et al., 2019; Hausmann et al., 2021).

This case is most consistent with Localized Histiocytic Sarcoma (LHS), as the tumor was confined to the spleen without evidence of dissemination (Disseminated Histiocytic Sarcoma; DHS). Based on a review of eight studies encompassing 34 cases of histiocytic sarcoma in hedgehogs, the spleen is the most frequently affected organ (Ogihara et al., 2017, 2016; Koizumi and Kondo, 2019; Koizumi et al., 2020; Son et al., 2020; Makishima et al., 2021; Sirivisoot et al., 2021; Zanoti et al., 2023). In five of these eight studies, the spleen was identified as the sarcoma site. Three studies identified the spleen as the primary location of the tumor, and in one notable case, the spleen was the only organ affected (Zanoti et al., 2023). When the disease becomes more widespread, splenic tumors are often found alongside secondary tumors in other organs. The most common sites for this secondary involvement were the lymph nodes, liver and lungs, which have been reported in three separate studies (Koizumi and Kondo, 2019; Son et al., 2020; Makishima et al., 2021). The skin is also a less frequent site of secondary tumors, as noted in two studies (Son et al., 2020; Makishima et al., 2021). Despite some variability in how the tumor cells appeared under a microscope across these cases, a consistent finding was the positive staining for the IBA-1 marker in immunohistochemical analyses, which helped confirm the diagnosis of histiocytic sarcoma. Consistent positive staining for IBA-1 is invaluable for achieving a definitive diagnosis. This reliability is critical for differentiating histiocytic sarcoma from other neoplasms, such as lymphomas, ensuring an accurate diagnosis, and guiding subsequent treatment decisions.

In this case, gross examination of the spleen revealed three distinct masses, including a yellowish nodule and a green-discolored hemorrhagic lesion with multifocal components. These macroscopic features, particularly hemorrhage and necrosis, are consistent with previous reports of splenic histiocytic sarcoma in African pygmy hedgehogs, where multifocal to coalescing nodules with areas of necrosis and vascular invasion are commonly observed (Koizumi and Kondo, 2019; Makishima et al., 2021; Zanoti et al., 2023). Microscopically, the tumor was

characterized by a poorly demarcated, non-encapsulated and multilobulated proliferation of pleomorphic histiocytic cells with anisocytosis, anisokaryosis, hemorrhagic necrosis and multifocal dystrophic calcification. These features correlate well with earlier descriptions of histiocytic sarcoma in hedgehogs and other species where aggressive cellular pleomorphism and destructive growth patterns have been reported (Ogihara et al., 2016; Son et al., 2020; Sirivisoot et al., 2021). Taken together, the correlation between the macroscopic hemorrhagic splenic masses and microscopic evidence of aggressive histiocytic proliferation observed in this case is consistent with previously published reports and provides a valuable context for the pathological spectrum of splenic histiocytic sarcoma in hedgehogs.

Histopathological examination revealed that the neoplastic histiocytic cells extensively replaced the lymphoid follicles of the splenic white pulp. Immunohistochemically, the tumor cells exhibited diffuse and strong cytoplasmic positivity for IBA-1, which confirmed their histiocytic origin. In contrast, CD3 (T-cell marker) and CD20 (B-cell marker) immunoreactivity was confined to scattered small lymphocytes and the paracortical areas of splenic lymphoid follicles, representing reactive lymphoid populations rather than true neoplastic co-expression. This finding indicates that while CD3 and CD20 positivity was observed, it reflected background lymphocytic infiltration within and around the tumor rather than lymphoid neoplasia. This immunophenotypic profile excludes both T-cell and B-cell lymphomas from differential diagnosis and underscores the diagnostic specificity of IBA-1 for histiocytic sarcoma. These results are consistent with previous reports in hedgehogs and other species, where IBA-1 positivity in neoplastic cells and concurrent CD3/CD20 expression in non-neoplastic lymphocytes have been highlighted as key features that distinguish histiocytic sarcoma from lymphoid tumors (Borch et al., 2019; Son et al., 2020; Zhou et al., 2024). Collectively, these findings provide robust evidence that the splenic mass represents a histiocytic sarcoma and reinforce the diagnostic utility of IBA-1 in confirming histiocytic origin in exotic animal oncology.

Given the invasive nature of the tumor, splenectomy is the recommended treatment for localized splenic histiocytic sarcoma (Latifi et al., 2020). This treatment has been widely practiced in veterinary medicine, particularly in dogs, where removal of the spleen can offer significant survival benefits if there is no evidence of metastasis (Monnet, 2023). In this report, the hedgehog underwent splenectomy under general anesthesia with isoflurane. The surgical technique involved ventral midline celiotomy, which allowed for appropriate exposure and removal of the spleen, while ensuring hemostasis using an ultrasonic scalpel and ligation (Charlesworth, 2014; Miwa and Sladky, 2016). The postoperative use of analgesics, such as meloxicam, marbofloxacin and tramadol, is crucial for pain management and the prevention of secondary infections (Lupu et al., 2022). Additionally, supportive care, including fluid and nutritional support, plays a role in ensuring appropriate recovery during the postoperative period. Splenectomy remains the treatment of choice for localized splenic histiocytic sarcoma, which requires specialized anesthesia and analgesia protocols for exotic species. Comprehensive postoperative care is essential for managing pain, preventing infection, and supporting successful recovery.

Early diagnosis and surgical removal remain the mainstay of treatment for splenic histiocytic sarcoma. In dogs, postoperative chemotherapy with lomustine (CCNU) has shown variable efficacy and can be considered for exotic species, although no reports exist in hedgehogs. Recently, bortezomib has also been proposed as a potential antitumor agent in African pygmy hedgehogs, offering novel therapeutic perspectives (Skorupski et al., 2007; Inanaga et al., 2024).

Based on the confinement of the tumor to the spleen, this case is consistent with the classification of Localized Histiocytic Sarcoma (LHS). Nevertheless, reports in hedgehogs have demonstrated that splenic histiocytic sarcoma can progress to Disseminated Histiocytic Sarcoma (DHS), with common metastatic

sites, including the lymph nodes, liver, and lungs (Koizumi and Kondo, 2019; Son et al., 2020; Makishima et al., 2021). Therefore, while splenectomy may provide temporary disease control, the prognosis remains guarded, and close follow-up is essential to monitor potential metastatic spread. Consistent with the outcome of the present case, the prognosis of hedgehogs diagnosed with histiocytic sarcoma is generally poor, although the reported survival times are variable. Many animals survive for less than three months (Makishima et al., 2021). Based on the clinical signs and the tumor's malignancy, follow-up is essential to monitor for metastasis to intra-abdominal lymph nodes and the liver; for example, one study reported 50% mortality within 90 days (Son et al., 2020), while another noted a three-month survival time (Zanoti et al., 2023). Several other reports have confirmed death as the final outcome, without specifying the exact duration (Ogihara et al., 2016, 2017; Sirivisoot et al., 2021). However, some studies have reported a wider range of outcomes. A case series documented individual survival times of 48, 64, and 113 days, with one notable case surviving over 207 days and being still alive at the time of reporting (Koizumi and Kondo, 2019). This variability may be linked to the tumor's cellular characteristics, and one retrospective study identified a significant difference in median survival between the more aggressive round-polygonal cell type (27.5 days) and the spindle cell type (112.5 days) (Makishima et al., 2021). Therefore, while most hedgehogs have a grim prognosis, these findings suggest that a subset of patients, potentially those with specific tumor morphologies, may experience longer survival. This case report on splenic histiocytic sarcoma in an African pygmy hedgehog provides critical species-specific insights that build upon the foundational knowledge of such tumors in other companion pet species. For instance, a comprehensive review by Thongtharb (2018) detailed the pathology, diagnosis and multimodal treatment of histiocytic sarcoma (HS) in dogs. While that review established the aggressive nature of HS and the essential role of immunohistochemistry (IHC) in canine diagnostics, our study presents the novelty of applying these diagnostic principles to a non-traditional companion animal. We demonstrated the practical and definitive use of an IHC panel (IBA-1, CD3, CD20) to confirm splenic HS in a hedgehog, a species with far less available literature. Therefore, our work extends the established understanding from the well-documented canine model to the field of exotic animal oncology, reinforcing the aggressive nature of the disease and the universal importance of IHC, while contributing new clinical data for a rarely studied species.

However, a notable limitation of this case was the absence of computed tomography (CT) imaging, which may have resulted in the underestimation of potential metastatic spread to other organs. Given the rapid clinical progression observed, the possibility of undetected metastases cannot be excluded, and advanced imaging should be considered in future cases to improve the staging accuracy and prognostic assessment.

CONCLUSIONS

This case report details the diagnosis and management of splenic histiocytic sarcoma in an African pygmy hedgehog, a rare and aggressive cancer of exotic pets. The hedgehog initially presented with non-specific signs such as lethargy and weight loss. A definitive diagnosis was made through a comprehensive approach that integrated clinical examination, abdominal ultrasonography revealing splenomegaly, and surgical splenectomy. The diagnosis was ultimately confirmed by histopathology and a panel of immunohistochemical markers (IBA-1, CD3, and CD20), which were crucial in differentiating the sarcoma from other lymphoid tumors. Although the surgical intervention initially improved the hedgehog's clinical signs, leading to a survival period of two months, the case underscores the aggressive nature of this neoplasm and the guarded long-term prognosis. This report highlights the critical need for early detection, advanced diagnostic tools

such as immunohistochemistry, and prompt surgical treatment to improve outcomes in hedgehogs with this condition.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

AUTHOR CONTRIBUTIONS

Ratchanon Kusolsongkhrokul: Investigation (lead); Resources (equal); Data Curation (equal); Writing - Review & Editing (equal).
Rattanin Chiewcharnvalijkit: Conceptualization (supporting); Methodology (supporting); Supervision (supporting); Writing - Review & Editing (equal).
Natthapat Prathumjorn: Investigation (supporting); Resources (equal); Data Curation (equal); Writing - Review & Editing (equal).
Tarid Purisotayo: Conceptualization (lead); Supervision (lead); Funding Acquisition (lead); Writing - Original Draft (lead); Writing - Review & Editing (equal).

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