

Cutaneous perivascular wall tumor in a geriatric mixed-breed dog

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ABSTRACT

Perivascular wall tumor (PWT) is a type of soft tissue sarcoma that arises from vascular non-endothelial mural cells. It is generally considered a less aggressive and locally invasive tumor, with metastatic spread occurring only rarely. This case involved a 13-year-old female Golden Retriever-Labrador Retriever mixed-breed dog that presented to the Veterinary Surgery and Radiology Laboratory, Faculty of Veterinary Medicine, Udayana University, with a mass located on the caudolateral aspect of the proximal right antebrachial region, resulting in impaired limb function. According to the previous medical history, the dog had undergone surgical excision of a tumor at the same site approximately two years earlier. Clinical examination revealed a well-defined, firm-elastic mass measuring approximately 6 × 5 × 3 cm that was non-painful on palpation. Histopathological examination demonstrated spindle-shaped cells arranged in a whorling pattern around capillary blood vessels, a characteristic finding consistent with PWT. *En bloc* surgical resection was performed to remove the tumor. Postoperative management included amoxicillin as an antibiotic, meloxicam as an analgesic, a hematopoietic supplement (Sangobion®), and routine wound care with Bioplacenton® gel. Twelve days after surgery, the surgical wound had dried completely, and the dog had returned to a normal clinical condition. A three-month postoperative follow-up revealed no evidence of tumor recurrence; however, this period represents only a short-term follow-up and is insufficient to assess long-term tumor recurrence.

Introduction

Soft tissue sarcomas (STSs) are a heterogeneous group of malignant mesenchymal neoplasms that arise from soft connective tissues. They can develop in various anatomical locations but most commonly occur in the skin and subcutaneous tissues (Fonseca-Alves *et al.*, 2026). Despite their diverse histological origins, STSs share similar histomorphological and clinicobiological characteristics (Liptak and Christensen, 2020). They account for approximately 8-15% of all cutaneous and subcutaneous tumors in dogs and are most frequently diagnosed in medium- to large-breed dogs between 5 and 17 years of age (Moretti and Bufalari, 2024). STSs encompass a variety of tumor types, including fibrosarcoma, myxosarcoma, liposarcoma, leiomyosarcoma, rhabdomyosarcoma, perivascular wall tumor (PWT), peripheral nerve sheath tumor (PNST), lymph-angiosarcoma, undifferentiated pleomorphic sarcoma (malignant fibrous histiocytoma), and mesenchymoma (Liptak and Christensen, 2020).

Canine PWT, formerly referred to as hemangiopericytoma, is a neoplasm originating from various vascular non-endothelial mural cells, including pericytes, myopericytes, smooth muscle cells, fibroblasts, and myofibroblasts (Avallone *et al.*, 2007). Histopathological examination helps establish the diagnosis based on characteristic vascular growth patterns. Cytology may provide supportive diagnostic information; it is not considered definitive (Avallone *et al.*, 2007; Loures *et al.*, 2019). PWTs are generally less aggressive and locally invasive, with rare metastatic spread. However, they are characterized by a high propensity for local recurrence following surgical excision (Stefanello *et al.*, 2011; Avallone *et al.*, 2020; Godizzi *et al.*, 2024). Most PWTs arise in the skin and subcutaneous tissues, with the extremities being the most common anatomical site (53.7%), particularly around the elbow (11%), followed by the trunk (22.8%) and the head and neck (6.6%) (Sapierzyński *et al.*, 2019).

Several studies have demonstrated that complete surgical excision with adequate margins is the treatment of choice for PWT. Early diagno-

sis, particularly when the tumor measures <5 cm in diameter, combined with complete excision achieving histologically clean margins, is associated with a favorable prognosis (Avallone *et al.*, 2014; Godizzi *et al.*, 2024). Compared with other STSs, PWT generally responds more favorably to surgical treatment alone. Although local recurrence remains a concern, the recurrence rate is lower than that reported for other STS subtypes (Spugnini *et al.*, 2019). This case report describes the clinicopathological features and surgical management of a perivascular wall tumor in a Golden Retriever-Labrador Retriever mixed-breed dog.

Materials and Methods

Clinical history and presentation

A 13-year-old spayed female Goldador (Golden Retriever-Labrador Retriever crossbreed) weighing 20 kg was presented to the Veterinary Surgery and Radiology Laboratory, Faculty of Veterinary Medicine, Udayana University, in May 2026 with a complaint of a mass on the right forelimb (Fig. 1). According to medical history, the owner first noticed a mass at the same location in late 2023. The attending veterinarian initially suspected the lesion to be lipoma. The first surgical excision was performed in June 2024. Approximately one year after the initial surgery (late 2025), the owner observed regrowth of the mass, which gradually increased in size and eventually interfered with the dog's locomotion. The increasing weight of the pendulous mass also caused the dog to adopt a hunched posture while walking.

Clinical examination revealed a mass located on the caudolateral aspect of the proximal right antebrachial region of the forelimb, measuring approximately 6 × 5 × 3 cm (Fig. 1). The mass was well-circumscribed, firm-elastic in consistency, non-ulcerated, and non-painful on palpation. Rectal temperature, heart rate, pulse quality, respiratory rate, capillary refill time (CRT), and skin turgor were all within normal limits.



Figure 1. Tumor mass located on the right forelimb.

Hematological examination

A hematological examination was performed to evaluate the dog's general health status. Blood was collected from the cephalic vein into an EDTA anticoagulant tube and analyzed using an automated hematology analyzer (CC3200 Vet, Shenzhen Licare Biomedical Technology Co., Ltd., China).

Histopathological examination

Histopathological evaluation was performed to confirm the tumor type. An incisional biopsy was obtained from the central portion of the lesion according to the technique described by Sewoyo *et al.* (2026). The tissue sample was immediately fixed in 10% neutral buffered formalin at a

tissue-to-fixative ratio of 1:10. The specimen was subsequently processed using standard histological procedures and stained with hematoxylin and eosin (H&E). Following surgery, the excised tumor tissue along with the surrounding healthy tissue was also processed and histologically evaluated to assess the surgical margins. The tumor margins were classified as dirty when neoplastic cells were present at the surgical margin, clean but close when neoplastic cells were located 1–3 mm from the margin, and clean when more than 3 mm of normal tissue separated the neoplastic cells from the surgical margin (Avallone *et al.*, 2014). Histologic grading of the tumor was performed according to the grading system established for canine STSs (Dennis *et al.*, 2011). The parameters assessed included degree of differentiation, mitotic count (per 10 HPFs), and the extent of tumor necrosis (Table 1). Microscopic evaluation was conducted at the Veterinary Pathology Laboratory, Faculty of Veterinary Medicine, Udayana University using an Olympus CX33 microscope (Olympus, Japan) equipped with morphometric software to calculate the surgical margin.

Results

Hematological examination revealed mild normocytic hypochromic anemia (Table 2). Histopathological examination of the biopsy specimen demonstrated spindle-shaped cells arranged in a characteristic perivascular whorling pattern surrounding capillary blood vessels (Fig. 2AB). Based on these findings, the mass was diagnosed as PWT. Histologic grading indicated that the tumor was classified as Grade II (intermediate grade), with a differentiation score of 2, a mitotic score of 1 (5 mitoses per 10 HPFs), and a necrosis score of 1 (focal necrosis involving $\leq 50\%$ of the tumor area), yielding a total score of 4 according to the grading system for canine STSs. Focal areas of tumor necrosis were observed in a small portion of the neoplastic tissue (Fig. 2C). Surgical excision was subsequently performed to remove the tumor. Based on hematological findings, the patient was stabilized prior to surgery. Intravenous (IV) ad-

Table 1. Soft Tissue Sarcoma Grading System.

Category	Score 1	Score 2	Score 3
Score A: Differentiation	Closely resembles normal adult mesenchymal tissue	Histologic type can be determined, although differentiation is poor	Poorly differentiated / undifferentiated
Score B: Mitotic count (per 10 HPFs)*	0-9	10-19	≥ 20
Score C: Tumor necrosis score	None	$\leq 50\%$	$> 50\%$
Grade I: Low grade	Score A+Score B+Score C = ≤ 3		
Grade II: Intermediate grade	Score A+Score B+Score C = 4–5		
Grade III: High grade	Score A+Score B+Score C = ≥ 6		

*Note: Mitosis was assessed in areas of highest cellularity. Reference: Dennis *et al.* (2011).

Table 2. Hematological examination results.

Parameter	Unit	Results	Reference range
WBC	$10^3/\mu\text{L}$	8.3	6-17
Lymphocyte	$10^3/\mu\text{L}$	2.2	0.8-5.1
Mid	$10^3/\mu\text{L}$	0.6	0-1.8
Granulocytes	$10^3/\mu\text{L}$	5.5	4.0-12.6
RBC	$10^6/\mu\text{L}$	4.61*	5.5-8.5
Hb	g/dL	8.9*	11-19
HCT	%	30.7*	39-56
MCV	fL	66.8	62-72
MCH	pg	19.3*	20-25
MCHC	g/dL	28.9*	30-38
Platelet	$10^3/\mu\text{L}$	112*	117-460
MPV	fL	9.1	7-12.9

Note: *Below normal range. Abbreviations: WBC=White blood cells; Mid= Mixed Cells (Monocytes, Eosinophils, and Basophils); RBC=Red blood cells; Hb=Hemoglobin; HCT=Hematocrit; MCV= Mean Corpuscular Volume; MCH=Mean Corpuscular Hemoglobin; MCHC=Mean Corpuscular Hemoglobin Concentration; MPV=Mean Platelet Value. Reference range according to the veterinary hematology analyzer (CC3200 Vet, Shenzhen Licare Biomedical Technology, Co. Ltd, China).

ministration of 0.9% sodium chloride (NaCl) solution was initiated as part of preoperative preparation. The surgical site was aseptically prepared, and the hair surrounding the tumor was clipped.

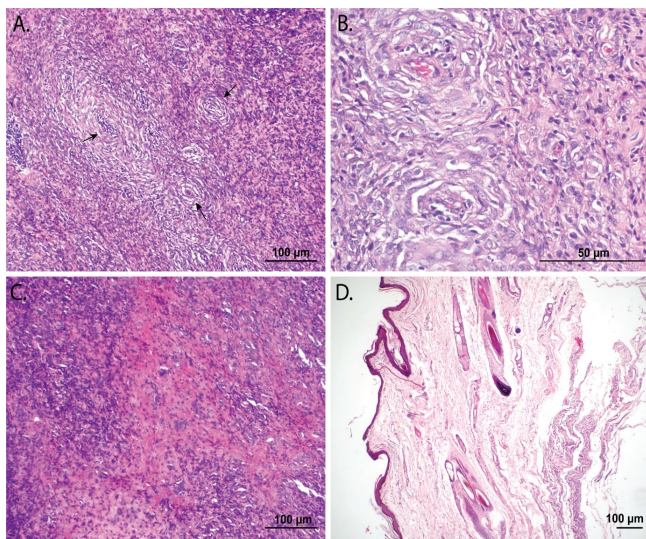


Figure 2. Photomicrographs of the tumor mass from the affected dog's forelimb. (A) Perivascular whorling pattern around capillary blood vessels (arrow). (B) Spindle-shaped neoplastic cells with round to ovoid nuclei. Mild lymphocytic inflammatory cell infiltration is present in the perivascular region. (C) Focal area of necrosis within the tumor mass. (D) Clean surgical margin. (H&E stain; $\times 100$ and $\times 400$).

Premedication consisted of atropine sulfate (0.02 mg/kg BW) administered subcutaneously. After 10-15 minutes, xylazine (1 mg/kg BW) was administered intramuscularly, followed by slow IV administration of ketamine (10 mg/kg BW). Once an adequate depth of anesthesia was achieved, 2% lidocaine was infiltrated subcutaneously along the planned incision line to provide additional local sensory blockade. The tumor was removed by *en bloc* surgical resection. Throughout the procedure, all transected blood vessels were immediately identified, clamped using artery forceps, and ligated with 3-0 absorbable polyglycolic acid suture. Prior to wound closure, tranexamic acid (10 mg/kg BW) was administered IV to reduce intraoperative hemorrhage. The surgical wound was closed using 2-0 silk in a simple interrupted suture pattern. A topical gel containing 10% placental extract and 0.5% neomycin sulfate (Bioplacenton®, PT Kalbe Farma Tbk., Jakarta, Indonesia) was applied to the incision before the wound was covered with sterile gauze, adhesive tape, and an elastic bandage. Gross examination revealed an irregular, yellowish tumor mass with prominent areas of vascularization (Fig. 3A). The excised tumor tissue, including the surrounding normal tissue, was subsequently subjected to histopathological examination to evaluate the surgical margins. No neoplastic cells were detected at the surgical margins, and more than 3 mm of normal tissue separated the neoplastic tissue from the surgical margins (Fig. 2D), indicating a clean surgical margin.

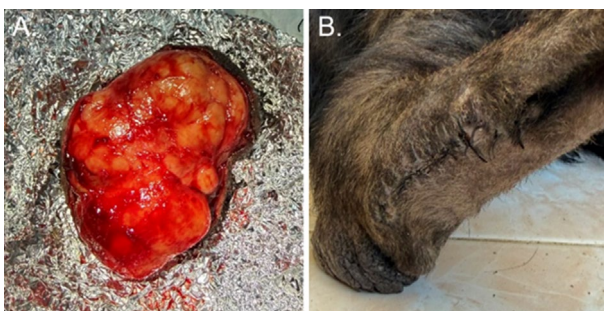


Figure 3. (A) Gross appearance of the tumor mass following surgical excision. (B) Surgical wound 12 days postoperatively, showing complete drying and satisfactory healing.

Postoperatively, the dog received a single IV dose of long-acting amoxicillin (15 mg/kg BW), followed two days later by oral amoxicillin

(12 mg/kg BW, q.d.) for three days. Meloxicam was administered IV at 0.2 mg/kg BW immediately after surgery, followed by oral administration at 0.1 mg/kg BW (q.d.) for four days. The dog also received oral hematopoietic supplementation containing ferrous gluconate, copper sulfate, folic acid, vitamin C, vitamin B12, and vitamin B6 (Sangobion®, PT Merck Tbk., Jakarta, Indonesia) (q.d.) for five days. Postoperative wound care was performed regularly by removing wound exudate with sterile gauze moistened with 0.9% NaCl solution, followed by topical application of Bioplacenton® gel to the surgical site. Twelve days after surgery, the surgical wound had completely dried (Fig. 3B), and the skin sutures were removed. The dog was able to ambulate normally without signs of lameness or the previously observed hunched posture. During the three-month postoperative follow-up period, no clinical evidence of tumor recurrence was observed.

Discussion

Although PWT is classified as an STS, it generally exhibits less aggressive biological behavior. The tumor has a low metastatic potential but an intermediate risk of local recurrence (Avallone *et al.*, 2015). Stefanello *et al.* (2011) reported that among 53 dogs diagnosed with PWT, 18.86% developed local recurrence, 1.88% developed metastatic disease, and 1.88% experienced both recurrence and metastasis. Similarly, Avallone *et al.* (2014) found that among 56 dogs with PWT, 17.85% experienced local recurrence, whereas only 1.78% developed metastatic disease. Tumor size has been identified as an important predictor of recurrence. Tumors measuring >5 cm are associated with a significantly increased risk of local recurrence (Stefanello *et al.*, 2011; Avallone *et al.*, 2020). More specifically, Godizzi *et al.* (2024) demonstrated that increasing tumor diameter and incomplete surgical margins are associated with a higher likelihood of local recurrence.

In the present case, the tumor exceeded 5 cm in diameter, indicating an increased risk of recurrence. Nevertheless, *En bloc* surgical resection, including an adequate margin of surrounding healthy tissue, was successfully performed. Histopathological examination confirmed a clean surgical margin, with more than 3 mm of normal tissue separating the neoplastic tissue from the surgical margin. No evidence of tumor recurrence was observed during the three-month postoperative follow-up period. Continued long-term monitoring is recommended to detect any potential recurrence or changes in the dog's clinical condition. The tumor that developed approximately two years earlier may have represented the same tumor; however, this could not be confirmed because histopathological examination was not performed following the initial surgery. The adequacy of the previous surgical margins could not be determined. Inadequate initial excision may have contributed to the subsequent regrowth of the tumor.

PWTs have been reported in 30.18% of mongrel dogs among 53 canine PWT cases, while the highest breed prevalence was observed in Boxers (15.09%), followed by German Shepherds (9.43%) and Labrador Retrievers (7.54%), with a median age of 10 years at diagnosis (Stefanello *et al.*, 2011). These findings are consistent with those of Sapierzyński *et al.* (2019), who reported that PWT most commonly affects older dogs between 8 and 12 years of age. Several studies have consistently shown that the extremities are the most frequent anatomical site for PWT, followed by the trunk, and then the head and neck (Stefanello *et al.*, 2011; Avallone *et al.*, 2014; Sapierzyński *et al.*, 2019; Godizzi *et al.*, 2024). The dog described in the present case was a geriatric Golden Retriever-Labrador Retriever mixed-breed dog, consistent with the reported age and breed profile of dogs at increased risk for developing PWT.

The histopathological findings in this case were consistent with previously published reports, further supporting the role of histopathology as the definitive diagnostic method for PWT. The diagnosis of PWT can be established histopathologically by identifying characteristic vascular growth patterns (staghorn, placental, perivascular whorling, and bun-

dles arising from the tunica media) and cell shape (spindle to polygonal and stellate) (Avallone *et al.*, 2007; Loures *et al.*, 2019). In addition, immunohistochemical staining can identify several PWT subtypes, including hemangiopericytoma, myopericytoma, angioleiomyoma/sarcoma, adventitial tumor, and angiofibroma (Avallone *et al.*, 2007). Immunohistochemistry was not performed in the present case; therefore, the diagnosis was limited to PWT without further subtype classification. Histopathologically, the main differential diagnosis for PWT is PNST, as both tumors may exhibit concentric whorling growth patterns. However, PNST is characterized by well-defined Antoni A and Antoni B patterns, which were not observed in the present case (Loures *et al.*, 2019). In diagnostically challenging cases, immunohistochemical staining for Glial Fibrillary Acidic Protein (GFAP) and S100 may be useful for differentiating PWT from PNST, as PWTs are typically negative for both markers (Avallone *et al.*, 2007). To further differentiate PWT from PNST, immunohistochemical staining for α -SMA and/or desmin may be useful, as PNSTs are generally negative for these markers (Palmieri *et al.*, 2012). Among 12 dogs histopathologically diagnosed with PWT, Palmieri *et al.* (2012) reported that only one case showed weak S100 immunoreactivity, while all cases were negative for GFAP. In the same study, all tumors (100%) were positive for vimentin, whereas 75% and 25% showed positive immunoreactivity for desmin and α -SMA, respectively. However, Loures *et al.* (2019) subsequently reported that some tumors histopathologically diagnosed as PWT may also express neural markers, such as S100, GFAP, and neuron-specific enolase (NSE). This finding suggests that some STSs may exhibit mixed histogenesis within the same tumor.

A limitation of this case report is the relatively short postoperative follow-up period. Although no evidence of tumor recurrence was observed during the three-month follow-up, this period represents only a short-term outcome and is insufficient to assess long-term recurrence. Longer-term follow-up would be necessary to better evaluate tumor behavior and recurrence in this case. Another limitation is the absence of additional diagnostic imaging, such as radiography or computed tomography (CT), to assess metastatic disease. Although it rarely occurs in PWTs, advanced imaging is recommended to evaluate the presence of metastasis, particularly in cases with suspected tumor progression or recurrence.

Conclusion

Histopathological examination of the forelimb tumor mass confirmed the diagnosis of PWT. This case highlights the importance of histopathology in establishing a definitive diagnosis and guiding surgical management. *En bloc* resection was successfully performed, and histopathological examination confirmed a clean surgical margin.

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Conflict of interest

The authors have no conflict of interest to declare.

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