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CASE REPORT
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Synovial Histiocytic Sarcoma in a Dog - Radiographic, Ultrasonographic and Elastographic Findings

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ABSTRACT

***Background*:** Histiocytic sarcoma is a malignant tumor that commonly affects large-breed, middle-aged dogs in the form of solitary masses that may affect joints and other organs. The imaging findings (radiography, ultrasound and elastography) of synovial histiocytic sarcoma correlated with cytological, histopathological and immunohistochemical tests are still poorly described in the veterinary literature. The aim of this report was to describe the main imaging findings of an articular histiocytic sarcoma on radiography, B-mode ultrasound and shear wave elastography and to correlate them with cytology, histopathology, and immunohistochemistry tests.

***Case*:** A 7-year-old castred male Rottweiler was referred to the Veterinary Hospital (HOVET) of the Universidade de São Paulo (USP, Pirassununga campus) with the main complaint of pain and increased volume in the left thoracic limb in the region of the elbow joint. The animal received a physical examination, including palpation of the volume enlargement, which had an irregular, verrucous appearance and painful sensitivity on palpation. In order to assess the extent of the lesion and the involvement of the elbow joint, the patient was referred to the imaging department for imaging tests. The radiography revealed a lytic and proliferative bone lesion that could be of inflammatory, neoplastic, or degenerative joint disease origin. The animal was referred for cytological examination to clarify the case, which characterized the lesion as an active chronic inflammatory process. The ultrasound revealed areas of heterogeneous echotexture interspersed with anechogenic areas in the periarticular and articular regions. The areas identified by ultrasound were stained red on the color elastogram by qualitative elastography. The quantitative elastography showed an average shear wave velocity of approximately 2.80 m/s in the ROI. The elastographic examination demonstrated high tissue stiffness, which is indicative of malignancy. Based on these results, the patient was referred for bone biopsy and samples were collected for histopathologic and immunohistochemical examination. The examinations characterized the increase in volume as a synovial histiocytic sarcoma.

***Discussion*:** The aim of this report was to highlight the fundamental role of shear wave elastography in the evaluation of tumors and periarticular volume increases as a predictor of malignancy. The report described the main imaging findings of an articular histiocytic sarcoma on radiography, B-mode ultrasound, and shear wave elastography. The radiographic findings of the patient were consistent with lytic and proliferative bone lesions. Shear wave elastography was performed as a way of predicting the malignancy of the lesion and confirm the cytological finding of an inflammatory lesion. It played a fundamental role in assessing the stiffness of the mass. In this case, the qualitative and quantitative characteristics indicated that it was a malignant process. Strain and shear wave elastography can therefore be established as a diagnostic tool to help reduce the misclassification of histiocytic sarcoma and other tumors. Veterinarians can refer samples with high wave velocity values and a reddish color elastogram to the most recommended tests for diagnosing malignant tumors, which will allow for the most appropriate therapy to be instituted. This report was able to combine radiographic, ultrasound and elastographic findings to characterize an articular histiocystic sarcoma as completely as possible.

Keywords: histiocytic sarcoma, imaging, dog, elastography.

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INTRODUCTION

Histiocytic sarcoma is a malignant neoplasm that can affect both dogs and cats [11]. It is more commonly found in middle-aged, large dogs of the Rottweiler breed in the form of masses affecting the elbow joint [1,6,18,19]. Its highest incidence is in the periarticular region of the limbs, but it can also affect the lymph nodes, subcutaneous tissue, spleen, bone marrow, brain, lungs and oral cavity [8,11,15]. Clinically, histiocytic sarcoma presents as a solitary mass and may be accompanied by clinical signs such as fever and weight loss. Other systemic findings may include lytic bone lesions, hepatomegaly, and pancytopenia [20].

Immunohistochemistry is used to make a definitive diagnosis and to confirm histiocytic differentiation, excluding morphologic mimics by using positive and negative markers [12]. Even with the availability of histopathology and cytology, both can provide a non-specific diagnosis and poor differentiation, making the diagnostic process challenging and immunohistochemistry still necessary to confirm the tumor process [11-13,15].

Thus, this report provides an unprecedented insight into the role of shear wave elastography as a predictor of malignancy in the assessment of tumors and volume increases. In addition, the results of the elastography defined the decision to send the samples for immunohistochemical analysis to further investigate. The aim of this report is to describe the main imaging findings of an articular histiocytic sarcoma on radiography, B-mode ultrasound and shear wave elastography and to correlate them with cytology, histopathology, and immunohistochemistry tests.

CASE

A 7-year-old castred male Rottweiler arrived at the Veterinary Hospital (HOVET) of the Universidade de São Paulo (Pirassununga campus - USP) with the main complaint of pain and increased volume in the left thoracic limb in the region of the elbow joint. The owners reported no history of trauma, falls, impacts, or sprains during the anamnesis. The animal received a physical examination, including palpation of the volume enlargement, which had an irregular, verrucous appearance and painful sensitivity on palpation. In order to evaluate the extent of the lesion and the involvement of the elbow joint, the patient was referred to the imaging department for radiography, ultrasound, and strain and shear wave elastography.

For the radiographic examination, the patient was positioned in the left lateral decubitus and in the sternal decubitus position so that the mediolateral (Figure 1A), mediolateral oblique (Figure 1B), and craniocaudal (Figure 1C) projections could be made. The radiographic examination showed lytic areas, sclerotic areas, and subchondral cysts in the distal epiphysis of the humerus and proximal epiphyses of the radius and ulna. Additionally, there was irregularity in the articular surface of the distal epiphysis of the humerus, obvious bone trabeculation, and periosteal reaction in the medial epicondyle of the humerus and in the head of the radius. The radiographic findings revealed osteophytes and increased volume and radiopacity of adjacent soft tissues in the medial epicondyle of the humerus and medial margin of the olecranon. The lesion was described as a lytic and proliferative bone lesion, which could be of inflammatory, neoplastic, or degenerative joint disease origin.

Following the radiographic examination, the animal was subjected to a cytologic examination to determine the nature of the lesion. The results of the examination revealed an active chronic inflammatory process.

An ultrasound was performed due to the patient's lack of clinical improvement under anti-inflammatory therapy and the possibility of a neoplastic lesion. The joint ultrasound examination and shear wave elastography of the elbow region were carried out with the patient in the right lateral decubitus position, with the MyLab™X8 Platform[1] device, using a linear transducer (4-15Hz). Ultrasound showed areas of heterogeneous echotexture interspersed with anechogenic areas in the periarticular and articular regions (Figure 2A). The qualitative elastographic examination (Figure 2B) showed that the areas identified on ultrasound had high rigidity and were colored red on the color elastogram. Quantitative elastography revealed a mean ROI shear wave velocity of approximately 2.80 m/s (Figure 3). The elastographic examination demonstrated high tissue stiffness, which is indicative of malignancy.

Based on these results, the patient was referred for bone biopsy and samples were collected for histopathologic and immunohistochemical examination. The examinations characterized the increase in

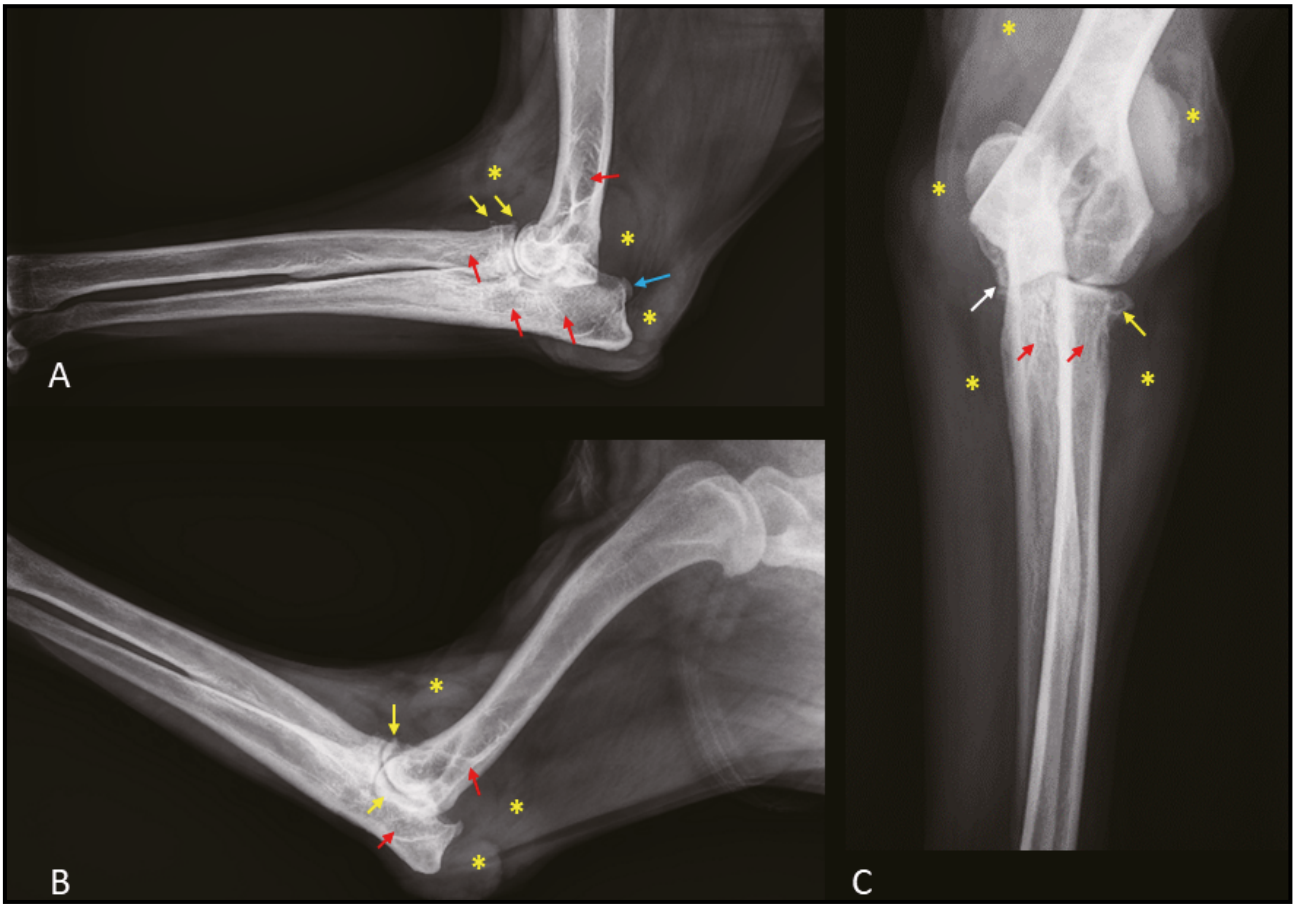

Figure 1. Radiographic images of the humeroradioulnar joint of the left thoracic limb. A- Mediolateral projection. B- Mediolateral oblique projection. C- Craniocaudal projection. The images shows lytic areas and periosteal reaction in the distal epiphysis of the humerus and proximal epiphyses of the radius and ulna (yellow arrows), bone trabeculation in the distal portion of the humerus and proximal portion of the radius and ulna (red arrows), an osteophyte on the medial margin of the olecranon (blue arrow), irregularity on the articular surface of the distal epiphysis of the humerus (white arrow), and increased volume and radiopacity of adjacent soft tissues (asterisks).

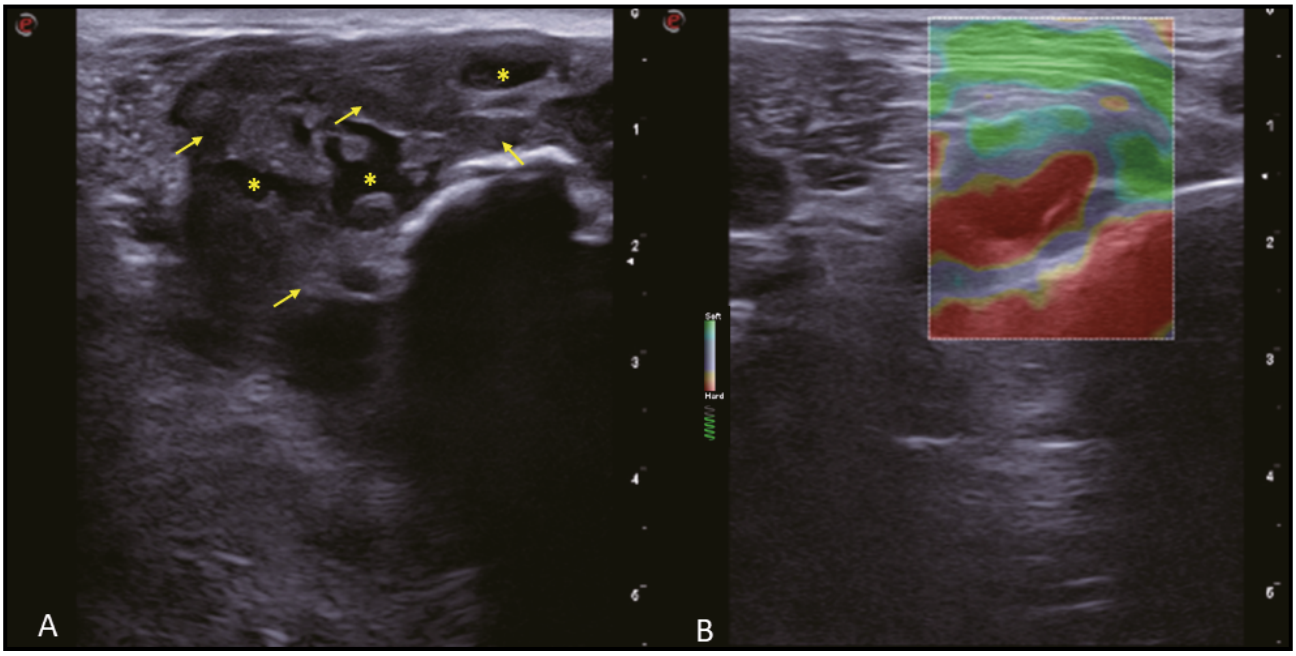

Figure 2. Periarticular increase volume ultrasound and qualitative elastographic image of the humeroradioulnar joint of the left thoracic limb. A- Heterogeneous echotexture areas (yellow arrows) interspersed with anechogenic areas (asterisks) in the periarticular region. B- Reddish areas indicating high stiffness (hard) colored in red by the color elastogram, blue areas indicating intermediate stiffness and green areas indicating low stiffness.

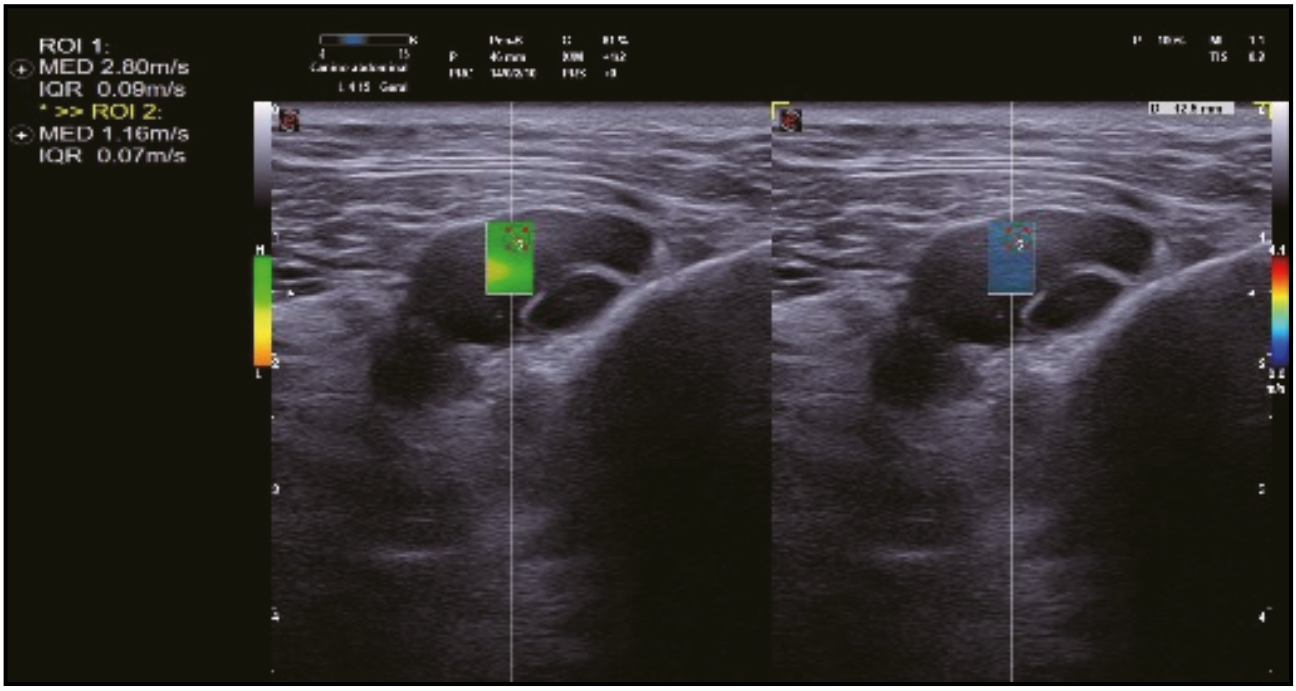

Figure 3. Quantitative elastographic image of the increase volume region that showed a reddish color on the color elastogram (hard). ROI1 with a shear-wave velocity of 2.80 m/s and ROI2 with 1.16 m/s.

volume as a synovial histiocytic sarcoma. Throughout the investigative process, the patient was treated with anti-inflammatory medications to relieve the pain and reduce the local inflammation. After diagnosing synovial histiocytic sarcoma, the animal was referred for oncological treatment.

DISCUSSION

The aim of this report is to highlight the fundamental role of shear wave elastography in the evaluation of tumors and periarticular volume increases as a predictor of malignancy. The report describes the main imaging findings of an articular histiocytic sarcoma on radiography, B-mode ultrasound, and shear wave elastography.

This sarcoma type is the most common malignant tumor in dogs with the above-mentioned characteristics, and radiography is one of the ways of assessing its extent, infiltration and consequences in bones, soft tissues, and adjacent muscles [2]. The radiographic findings of the patient were consistent with lytic and proliferative bone lesions, but it was not possible to assess whether they were inflammatory or neoplastic in origin.

The cytology results supported the possibility that the volume increase was due to an inflammatory lesion. Shear wave elastography was performed as a way of predicting the malignancy of the lesion and confirm the cytological finding of an inflammatory lesion. It played a fundamental role in assessing the stiffness of the mass. In this case, the qualitative (red color elastogram) and quantitative (average speed of 2.80 m/s) characteristics indicated that it was a malignant process. Because the rigidity of the mass was associated with malignancy, the patient was referred for biopsy for histopathology and immunohistochemistry. These tests confirmed the malignancy shown on elastography by assessing the cell type present in the lesion [7]. Immunohistochemistry is a recommended technique for diagnosing histiocytic tumors, as they can have different cell origins and biological behaviors and should be differentiated from other types of sarcoma [4,16,17].

The report shows a significant difference between the cytologic diagnosis and other diagnostic modalities such as strain and shear wave elastography, histopathology, and immunohistochemistry in presenting the lesion as an active chronic inflammatory process. However, recent studies suggest a possible relationship between the appearance of articular histiocytic sarcoma and a marked inflammatory response, which could lead to misclassification of the tumor by cytology [6,13]. Strain and shear wave elastography can therefore be established as a diagnostic tool to help

reduce the misclassification of histiocytic sarcoma and other tumors. Veterinarians can refer samples with high wave velocity values and a reddish color elastogram to the most recommended tests for diagnosing malignant tumors, which will allow for the most appropriate therapy to be instituted.

Immunohistochemistry should be performed routinely on tumor masses [16] to avoid confusion with other histiocytic diseases [12], especially in the case of histiocytic sarcoma. Elastographic characteristics can endorse a diagnostic suspicion by predicting the existence of malignancy in a lesion in a non-invasive way. However, invasive procedures, such as biopsies, are necessary to collect material for immunohistochemistry, which is the definitive diagnostic test.

Previous research has evaluated the effectiveness of elastography in distinguishing between benign and malignant lesions in various organs [3,5,9,10]. The results consistently demonstrate the ease of performing elastography in dogs and cats, as well as its high sensitivity, accuracy, and non-invasiveness. Thus, elastography could be a valuable tool in the field of oncology, aiding in the referral of patients to the most suitable complementary examination. This optimization of diagnostic investigation time would contribute to the prompt establishment of the most appropriate therapy. For this to become a reality, more studies are needed linking strain elastography and shear wave with immunohistochemical findings in different histiocytic tumors.

It is believed that the high rigidity of histiocytic sarcoma is intimately related to its composition of large, polygonal dendritic and neoplastic cells with indistinct borders and a moderate amount of cytoplasm [14,15]. These cells may also be associated with multinucleated giant cells, neutrophils, macrophages, and lymphocytes scattered throughout the mass [15]. The sarcoma's neoplastic cells may be arranged in streaks and intertwined fibers, sustained by a moderate amount of fibrovascular stroma [4], a feature that may correlate with high tissue stiffness. Thus, B-mode ultrasound, strain elastography, and shear wave elastography were tools that helped characterize the findings of articular histiocytic sarcoma in this report.

This report was able to combine radiographic, ultrasound and elastographic findings to characterize an articular histiocystic sarcoma as completely as possible. Furthermore, elastography was a reliable diagnostic tool that could provide information on tissue stiffness and malignancy prediction of various lesions even before the results of other complementary tests such as histopathology and immunohistochemistry are available.

It is suggested that further studies to evaluate joint and periarticular stiffness should be conducted to consolidate the applicability and technique of elastography in the detection of joint neoplasms.

MANUFACTURER

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