# Canine Synovial Sarcoma of the Stifle Joint with Pulmonary and Liver Metastases

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## SUMMARY

A seven-year-old female mongrel dog was presented at the Sokoine University of Agriculture Teaching Animal Hospital for second opinion regarding a progressive swelling of the right hind limb of two months duration. Clinical examination revealed a loss of body condition, tachypnea and tachycardia, a painful immobile solid mass of 20 cm x 14 cm x 10 cm located on the right stifle joint, leucocytosis, and anaemia. Radiographic examination of the joint revealed marked soft tissue swelling with amorphous areas of mineralization and complete destruction of the proximal tibia. Smooth and solid periosteal reaction was seen around the tibia and fibula with a Codman's triangle. Multiple nodules and a mass with soft tissue opacity were seen in the lung fields. Post-mortem examination revealed separation of tibia and fibula, softening of the proximal parts of the tibia, and complete integration of the proximal region of the two bones and articular tissues into the surrounding muscular tissues. Multifocal nodular lesions of variable sizes were mostly found in the lungs and partly in the liver. Histologically, predominantly oval and round cells with variable nuclear sizes and moderate mitoses were observed in tissue samples from the joint, lungs and the liver although some parts of the lung metastases showed both round and spindle shaped tumor cells. Clinical profile is suggestive of aggressive biphasic (spindle and epithelial) type of synovial cell sarcoma with lung and liver metastasis. Early radiographic and biopsy examination of persistent musculoskeletal nodules is recommended for early diagnosis and interventions.

**Keywords:** *Dog, Liver, Lung, Stifle, Synovial cell sarcoma*

## INTRODUCTION

The canine stifle is a condylar synovial joint formed by the lateral and medial condyles of the distal femur and proximal tibia, the proximal fibula, and sesamoid bones of the quadriceps femoris (patella), gastrocnemius (lateral and medial fabellae) and popliteal (popliteal sesamoid) muscles (Anderson, 1994; Budras *et al.*, 2007; Carpenter and Cooper, 2000). It consists of three articulations, which are femorotibial, femoropatellar and proximal tibiofibular (Carpenter and Cooper, 2000). The stifle permits motion in three planes, with extension and flexion being the primary motion of the joint (Carpenter and Cooper, 2000; Budras *et al.*, 2007). It is also capable of slight adduction and abduction as well as rotation of the tibia on its long axis (Carpenter and Cooper, 2000; Budras *et al.*, 2007).

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Extensive studies have been performed to describe the normal gross anatomy of the canine stifle joint (Payne and Constantinescu, 1993; Carpenter and Cooper, 2000; Budras *et al.*, 2007; Soler *et al.*, 2007). Further, the normal radiographic, ultrasonographic, computed tomography and magnetic resonance imaging anatomy of the canine stifle joint has been described by several authors (Reed *et al.*, 1995; Coulson and Lewis, 2002; Samii and Dyce, 2004; Soler *et al.*, 2007; Marino and Loughin, 2010). Knowledge of the normal gross and diagnostic imaging anatomy of the canine stifle joint is important for accurate diagnosis and treatment of various diseases affecting the stifle joint.

In small animals, the stifle is the most commonly diseased single joint (Anderson, 1994; Marino and Loughin, 2010). Acquired and developmental conditions such as osteochondrosis, osteoarthritis, patellar instability, fractures, luxation, and inflammatory disease have been reported to affect the stifle joint (Anderson, 1994; Marino and Loughin, 2010; Comerford, 2016). Further, the stifle has been documented to be the predilection site for synovial cell sarcoma (Marino and Loughin, 2010; Comerford, 2016). Other tumours, which have been reported in the stifle joint, are histiocytic sarcoma, fibrosarcoma, undifferentiated sarcoma, chondrosarcoma and osteosarcoma (Craig *et al.*, 2002; Marino and Loughin, 2010; Comerford, 2016; Monti *et al.*, 2018). The latter, can occur in the distal femur, proximal tibia or patella (Comerford, 2016). This report describes a case of canine synovial cell sarcoma of the stifle joint with pulmonary and liver metastases.

## CASE PRESENTATION

A seven-year-old female mongrel dog was presented at the Sokoine University of Agriculture Teaching Animal Hospital for second opinion regarding a progressive swelling of the right hind limb of two months duration. The dog was treated with oxytetracycline and dexamethasone but failed to improve. On presentation, clinical examination revealed tachypnea (46 breaths/min; reference: 18-34 breaths/min), tachycardia (136 beats/min; reference: 70-120 beats/min), thin body condition (weight; 13 kg) with marked lameness. A painful immobile solid mass 20 cm x 14 cm x 10 cm was seen on the right hind limb from the distal two-thirds of the femur extending distally to proximal two-thirds of the tibia (Figure 1). Vascular engorgements were visible on the medial side of the mass (Figure 1A) and a very little brown-red sticky fluid was aspirated. Abnormalities detected on haematology were leukocytosis ($38.02 \times 10^9$/L; reference: 6.0-17.0 x $10^9$/L), and anaemia (Red blood cell: 3.79 x $10^{12}$g/L, reference 5.5-8.5 x $10^{12}$g/L; Haemoglobin: 7.1 x 10 g/L, reference 10.0-18.0 x 10 g/L). The dog was sedated with xylazine hydrochloride (Alfasan®, Holland) at a dosage of 2 mg/kg intravenously for radiographic examination. Radiography of the right stifle and thorax were performed using Roller 30 (Smam X-ray Equipments®, Italy) X-ray machine. A table top technique was used at a source to image distance (SID) of 100 cm. Mediolateral (ML) and caudocranial (CdCr) views of the right stifle joint were taken, whereas for the thorax, right lateral (RL), left lateral (LL) and ventrodoral (VD) views were taken at the end of inspiration. Images were obtained using Colenta HighCap Xr (Fujifilm Corporation, Tokyo 106-8620, Japan) computed radiography system.

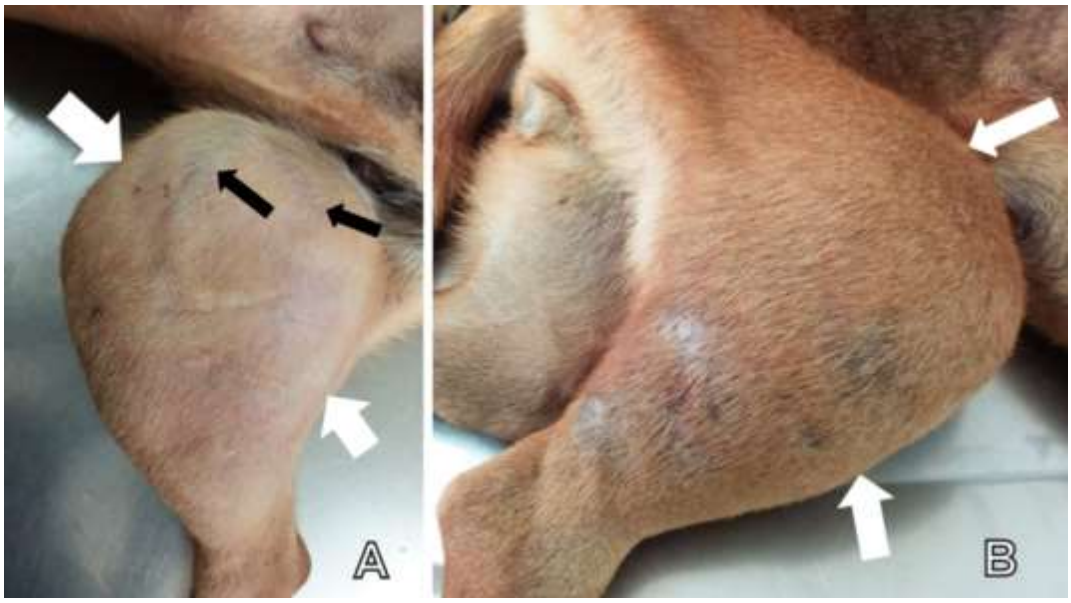


**Figure 1.** Medial (A) and Lateral (B) photographic views of the right hind limb of a seven-year-old female mongrel dog. A mass is seen from the distal two-thirds of the femur extending distally to proximal two-thirds of the tibia (white arrows). Note also the presence of vascular engorgements on the medial side of the mass (black arrows).

Radiographic examination of the right stifle joint revealed marked soft tissue swelling from the proximal two-thirds of the tibia and fibula extending proximally to distal two-third of the femur (Figure 2). Amorphous areas of mineralization were also seen within soft tissues (Figure 2). Medial angulation of the distal femur with loss of articulation between femoral condyles and the tibia and fibula was observed with marked interosseous space (Figure 2B). There was also a complete destruction of the proximal metaphysis and epiphysis of the tibia with a poorly defined zone of transition in the proximal third of the bone (Figure 2B). Up to 5 mm smooth and solid periosteal reaction was seen around the tibia and fibula (Figure 2) with a Codman's triangle (Figure 2A). Cortico thinning of the distal part of the femur with subtle areas of osteolysis was also observed (Figure 2). Multiple rounded nodules of soft tissue opacity were seen randomly throughout lung fields with a large nodule measuring 21 mm in diameter (Figure 3A) and a triangular mass of soft tissue opacity measuring 46 mm X 37 mm was seen in the left caudal lung lobe (Figure 3B).

The dog was humanely euthanized due to deteriorated body condition by intravenous injection of pentobarbitone (Euthapent®, Kyron laboratories [Pty] Ltd, South Africa). Post-mortem examination revealed separation of tibia and fibula, softening of the proximal parts of the tibia, and complete integration of the proximal region of the two bones and articular tissues into the surrounding muscular tissues. A mass was seen in the left caudal lung lobe and multifocal nodular lesions of variable sizes were mostly found in the lungs (Figure 4A) and partly in the liver (Figure 4B). On histopathology, predominantly oval and round cells with variable nuclear sizes and moderate mitoses were observed in the lungs and the liver and which were histologically similar to those found in the affected stifle joint. Some regions of the lung showed both spindle and oval to round shaped tumor cells suggesting a biphasic (spindle and epithelial) type of synovial cell sarcoma (Figure 4C and D). A diagnosis of synovial cell sarcoma of the stifle joint with pulmonary and liver metastases was made based on the history, clinical signs, radiographic and post-mortem findings.

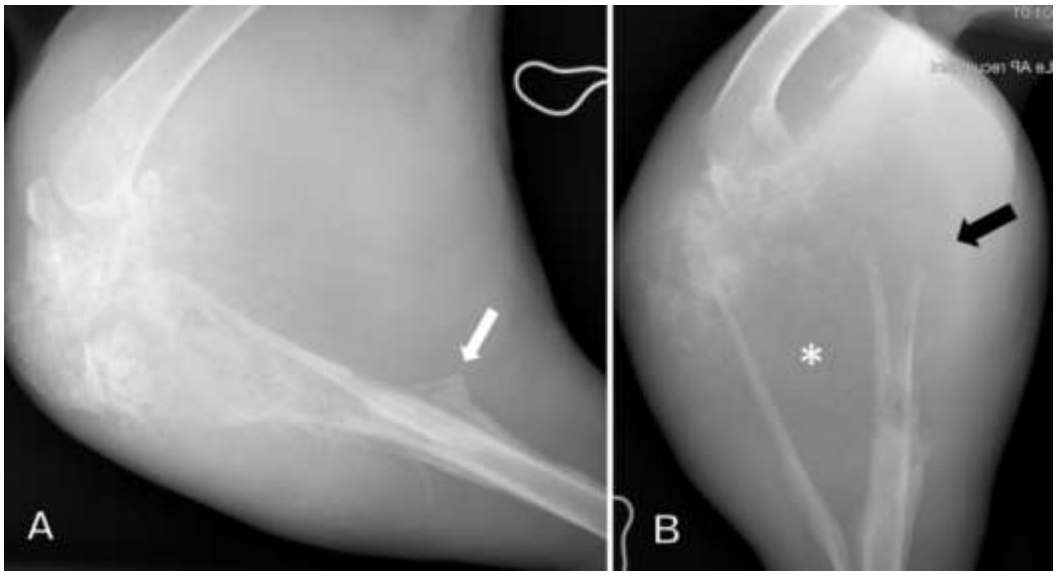


**Figure 2.** Mediolateral (A) and caudocranial (B) radiographic views of the right stifle joint of a seven-year-old female mongrel dog. There is a marked soft tissue swelling with amorphous areas of mineralization. Smooth and solid periosteal reaction is seen around the tibia and fibula with a Codman's triangle (white arrow). Note also the presence of a marked interosseous space (asterisk) with complete destruction of the proximal epiphysis and metaphysis of the tibia (black arrow). Medial angulation of the distal femur is also seen.

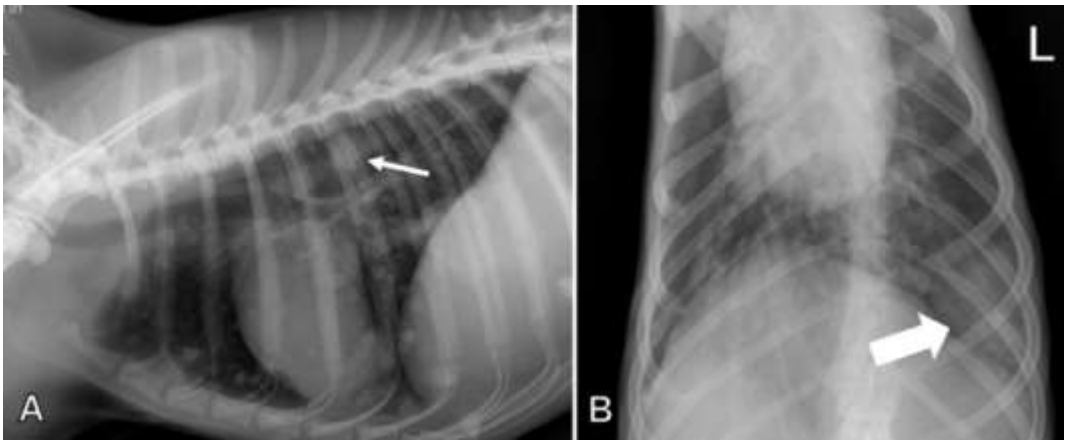


**Figure 3.** Right lateral (A) and close-up of ventrodorsal (B) radiographic views of the thorax of a seven-year-old female mongrel dog. (A) Note the presence of multiple rounded nodules with soft tissue opacity throughout lung fields with a large nodule superimposed on the 6$^{th}$ pair of ribs (thin white arrow). (B) A triangular mass with soft tissue opacity is seen in the left caudal lung lobe (thick white arrow).

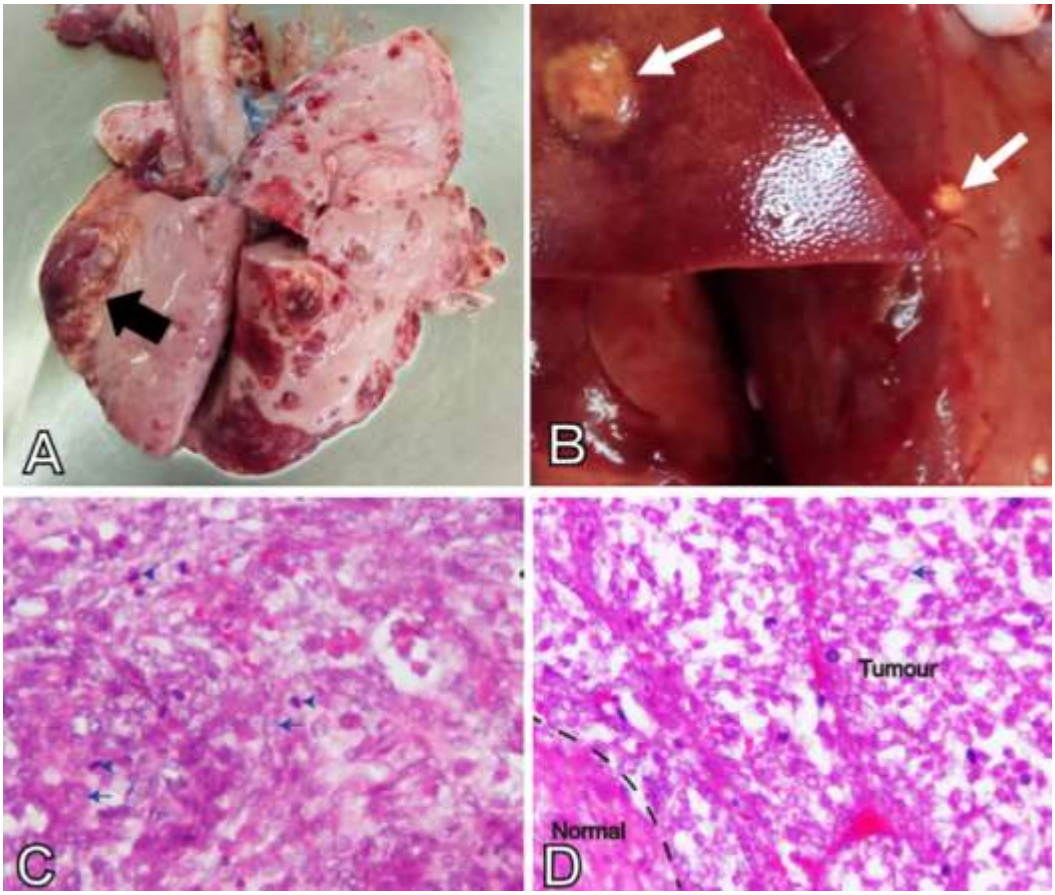


**Figure 4.** (A) Dorsal photographic view of lungs of a seven-year-old female mongrel dog. Note the presence of a mass in the left caudal lung lobe (black arrow) and multifocal nodular lesions of variable sizes. (B) Close-up photographic view of the liver of a seven-year-old female mongrel dog. Multifocal nodular lesions of variable sizes are seen on the surface of the liver (white arrows). (C) Tumour cells in the lung nodules with variable nuclear size and shape (blue arrows) and mitoses (blue arrow heads). (D) Normal hepatocytes and tumour cells (arrow) separated by a dotted line.

## DISCUSSION

Joint tumours are rare in small animals and majority are malignant (Whitelock *et al.*, 1997; Harasen 2002). Synovial cell sarcoma is the most commonly primary joint neoplasm in dogs (Craig *et al.*, 2002; Davies *et al.*, 2016). It arises from synoviocytes of the joint capsule, tendon sheath or bursa (Liptak *et al.*, 2004). Synovial cell sarcoma is classified as either biphasic i.e. with both epithelioid and spindle cell components or monophasic i.e. with spindle cell based on histologic appearance (Whitelock *et al.*, 1997; Craig *et al.*, 2002; Monti *et al.*, 2018). The latter, is the commonest (Craig *et al.*, 2002; Monti *et al.*, 2018). In this report, a clinical case with histomorphological features consistence with synovial cell sarcoma is presented although positive immunohistochemical staining with cytokeratin could be helpful in differentiating of synovial cell sarcoma from other spindle cell sarcomas (Craig *et al.*, 2002). Synovial cell sarcoma occurs in large joints of the extremities and the stifle is the most commonly affected (Whitelock *et al.*, 1997; Craig *et al.*, 2002; Harasen 2002; Davies *et al.*, 2016) as it was observed in this case. Other joints, which have been reported to be affected with synovial cell sarcoma, are the elbow, shoulder, antebrachiocarpal, talocrural and hip (Whitelock *et al.*, 1997).

The clinical signs, which have been reported in this case including pain, marked lameness, progressive swelling are in

consistence with previous reports (Dyce 1994; Whitelock *et al.,* 1997; Harasen 2002; Yamate *et al.,* 2006; Monti *et al.,* 2018) on synovial cell sarcoma. Moreover, the mean age of dogs affected with synovial cell sarcoma has been reported to be between 7.7 years and 8.4 years (Whitelock *et al.,* 1997) and the reported time of diagnosis ranged from 7 to 12 years (Craig *et al.,* 2002), which is almost similar to the reported age in this case. Large breed dogs have been documented to be predisposed to synovial cell sarcoma (Whitelock *et al.,* 1997). However, there is a previous report on the synovial cell sarcoma in the mongrel dog (Yamate *et al.,* 2006) as it has been encountered in this case.

Radiographic signs, which were observed in this case such as marked soft tissue swelling, mineralisation of soft tissues, osteolysis of metaphyses and epiphyses of bones adjacent to the stifle joint and periosteal reaction have been reported in previous cases of synovial cell sarcoma (Dyce 1994; Whitelock *et al.,* 1997; Craig *et al.,* 2002). Moreover, periarticular soft tissue swelling with bone lysis on both sides of a joint in older dogs as it was seen in this case is said to be strongly suggestive of synovial cell sarcoma (Craig *et al.,* 2002; Whitelock *et al.,* 1997). Further, the radiographic visualisation of a periosteal reaction with a Codman's triangle and the presence of a poorly defined zone of transitional in this case strongly suggest an aggressive lesion (Dennis *et al.,* 2010; Kirberger 2016).

In addition, metastases observed in this case is in agreement with previous report on the ability of synovial cell sarcoma to spread to other organs (Craig *et al.,* 2002) in which 25% of dogs had lung metastases. In this case, the lungs were found to be mostly affected compared to other visceral organs, therefore, thoracic radiographs are recommended in dogs suspected of having synovial cell sarcoma to rule out lung metastases before planning appropriate intervention. In cases where synovial cell sarcoma is confirmed, follow-up thoracic radiographs are recommended in animals detected free from lung metastases on initially diagnosis. Moreover, abdominal ultrasonography is also recommended to rule out the presence of metastases to other visceral organs including the liver.

Amputation of the affected limb is the recommended therapy in dogs with malignant joint tumours such as synovial cell sarcoma (Dyce 1994; Whitelock *et al.,* 1997; Craig *et al.,* 2002; Harasen 2002), in order to relieve pain and in trying to arrest tumour spread (Harasen 2002). Moreover, chemotherapy such as cyclophosphamide and doxorubicin hydrochloride and radiotherapy have also been used in dogs as an adjunct to limb amputation or as a sole method for treatment of synovial cell sarcoma (Dyce 1994; Whitelock *et al.,* 1997; Craig *et al.,* 2002; Harasen 2002). Generally, the prognosis of malignant joint tumours has been reported to be guarded to poor (Dyce 1994; Harasen 2002). The average survival time from diagnosis to euthanasia or death has been reported to be 31.8 months (Craig *et al.,* 2002). Whitelock *et al.,* 1997, reported survival time of one month and six months after chemotherapy and limb amputation, respectively. Therefore, the choice of intervention method and post intervention survival will be guided by the prevailing clinical status.

Early radiographic and biopsy examination of persistent musculoskeletal nodules is recommended for early diagnosis and a better post-intervention outcome.

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