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Diagnosis and therapeutic management of osteosarcoma in dogs

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Abstract

The aim of this retrospective study was to clearly identify, diagnose, treat and manage the cases of osteosarcoma which is felt to be very essential in day to day canine clinical practice. Dogs presented to the various clinics and hospitals in Telangana with clinical signs suggestive of OSA i.e., swelling of a part of the limb, unable to bear weight, dependent edema, unhealing inflammatory swellings were referred for further evaluation. The swellings were evaluated by various confirmatory diagnostic methods like fnac, histopathology, radiographical evaluation of the swelling, ultrasonography of the effected part, radiographic evaluation showing typical moth eaten appearance or sunburn appearance of the swollen area was diagnostic. A very rare incidence of the metastatic lesions in the lungs was also observed. These diagnosed dogs were further confirmed by Histopathology of the effected part by extracting the samples. These dogs were subjected for chemotherapy (adjuvant) alone, chemotherapy after surgical excision (neo adjuvant) of the part by following the norms of oncological surgical guidelines. Twelve dogs (Group I) were subjected for chemotherapy with Inj Cisplatin @ 50 mg /m2 slow i/v once every week along with supportive therapy. Twelve dogs (Group II) were subjected to surgical excision of the effected part and after the amputation wound healing these were subjected to chemotherapy with Inj Cisplatin 50 mg @/m2 slow i/v once every week along with supportive therapy. The dogs were alleviated of the symptoms of osteosarcoma and all the hemato-biochemical parameters returned to normal after three doses of chemotherapy and the dogs lead a good quality of life without metastasis and recurrence of clinical signs of OSA.

Keywords: Osteosarcoma, cancer, chemotherapy, supportive treatment

Introduction

Osteosarcoma is the most common primary bone tumor in dogs accounting 5% of all neoplasia [24]. Osteosarcoma is locally invasive and highly metastatic. Osteosarcoma (OSA) is highly malignant tumor of mesenchymal origin which is characterized by the formation of osteoid or immature bone by the tumor cells [1- 3, 23]. Mean age at diagnosis is 7 years, and males are reported to be over represented. The incidence of canine OSA is low but quite high in certain breed groups. Breeds reported at increased risk of developing OSA include the Doberman Pinscher, German Shepherd, Golden Retriever, Great Dane, Irish Setter, Rottweiler and Saint Bernard. Appendicular OSA occurs in large breed dogs in classic locations [4 – 6]. Appendicular sites are most common, with the front limbs twice as likely to be affected as the hind limbs. The distal radius and proximal humerus are the most commonly affected sites [3, 7-9]. Extraskelatal OSA can include cutaneous and non-cutaneous locations, and is associated with a poor prognosis.

Standard treatment recommendations for canine OSA include surgery (amputation or limb-sparing procedures) alone, chemotherapy alone or surgery followed by chemotherapy [12-17]. Despite treatment, most dogs still die of metastatic disease within 1 – 2 years of diagnosis [12, 13, 15, 17-21]. Current chemotherapy protocols include the chemotherapeutic agents like Cisplatin, Carboplatin, and/or Doxorubicin. The optimal treatment protocol has yet to be determined. Hence this study has been taken up with the intension of deriving at an appropriate protocol of therapy and management of osteosarcoma to achieve the maximum life span, increasing the disease free interval, minimizing the metastatic spread and good quality of life.

Materials and Methods

A retrospective study of all canine OSA cases diagnosed over a period of three (03) years (2021– 2024) was performed at Department of Veterinary Medicine; College of Veterinary Science, Mamnoon.

Physical examination for clinical signs

Clinical signs suggestive of OSA like swelling of a part of the limb, unable to bear weight, dependent edema, un-healing inflammatory swellings formed the clinical material of evaluation.

Information regarding breed, sex, castration status, body weight in kilograms at diagnosis, age at diagnosis, location of primary tumour and presence and location of metastases was collected. All dogs underwent standard diagnostic staging. This included physical examination i.e., clinical signs were identified and subjected for further evaluation.

Hemato-biochemical parameters: Complete blood cell count, serum biochemical profile was performed before during and after treatment of the case and the parameters are evaluated.

FNAC: The Fine needle aspiration cytology sample was obtained by a 10 ml disposable syringe which was poked directly into the lesion and the aspirate is extracted from the needle and syringe on to the glass slide and evaluated for the presence of typical osteocytes of the bone. In order to perform the microscopic evaluation, the aspirate smear was stained using the DiffQuik staining procedure. The Diff-Quick stain consists of a fixative agent (methanol), solution I (eosinophilic) and solution II (basophilic). The smear was dipped sequentially into each solution 5 times, followed by a water rinse and drying.

Histopathology: The small histo-pathological sample of the swollen bone tissue was extracted with an open or closed approach using either a Jamshidi needle or Michelle trephine instrument and was harvested, fixed and examined for presence of cancerous cells.

Radiography of the affected limb and thorax: Radiographical evaluation of the affected part was done by taking x rays of the part from three directions to evaluate the presence of the cancerous bone tissue. Thoracic radiographs were taken in both lateral and ventro-dorsal views and the presence of metastatic lesions were evaluated.

Ultrasound scan: Ultrasound scan of the affected part and the internal organs was performed to evaluate the typical appearance of the cancerous bone tissue; the internal vital organs were evaluated for metastatic tumours.

Treatment: Treatment comparison, the type of chemotherapy drugs used was recorded. The dogs diagnosed to be suffering with Osteosarcoma were subjected for chemotherapy (adjuvant) alone, chemotherapy after surgical excision (neo adjuvant) of the part by following the norms of oncological surgical guidelines

Twelve dogs (Group I) were subjected for chemotherapy (adjuvant) with Inj Cisplatin @ 50 mg/m² slow i/v once every week along with supportive therapy. Twelve dogs (group II) were subjected to surgical excision of the effected part and after the amputation wound healing these were subjected to (Neo Adjuvant) chemotherapy with Inj

Cisplatin 50 mg @ /m² slow i/v once every week along with supportive therapy.

The supportive therapy suggested with the following.

- Inj. Dolonex containing piroxicam
- Inj. Dexona containing dexamethasone sodium phosphate
- Inj. Graniset containing granisetron
- Inj. Normal saline containing 0.9 % sodium chloride
- Inj Toxol @ 2 ml i/m once daily
- Suspension Alka pet oral
- Inj. Neurokind containing methylcobalamine.
- Tab. Nephrotec DS
- Tab. Silybon containing Silymarin .
- Radiography with x ray machine
- FNAC done with 10 ml syringe
- Histopathological sample derived with jamshidi needle
- Ultrasonography done with ----machine

Results and Discussions

Location of the most primary bone tumors are in the metaphyseal region whereas metastatic lesions are often diaphyseal. The primary OSAs are seen in the following locations: distal radius, proximal humerus, proximal tibia, and distal femur. Other sites including distal tibia, distal humerus, ulna and proximal femur.

The incidence of overtly metastatic disease was low in OSA (approximately 6%) at diagnosis, but prognosis and treatment dramatically altered. Long-standing cases showed systemic clinical signs such as weight loss and anorexia

The complete blood count (CBC) was normal but there were changes in the biochemical parameters as shown in table 1. Although most blood tests were within normal limits, increasing alkaline phosphatase was a cause for concern. The routine blood work like haematology, biochemistry and urinalysis are normal. An elevation of alkaline phosphatase may appear, which is a negative prognostic factor ^[21].

Table 1: Biochemical parameters of the dog presented in this paper

Parameter	Value	Reference range
TP	7.9	5.2-8.2 g/dL
ALB	3.5	2.2-3.9 g/dL
GLOB	4.2	2.5-4.5 g/dL
CRE	0.8	0.5-1.8 mg/dL
UREA	11	7-27 mg/dL
ALKP	295	23-212 UI/L
ALT	78	10-125 UI/L
GLU	88.5	70-143 mg/dL

TP: Total protein, ALB: Albumin, GLOB: Globulin, CRE: Creatinine, ALKP: Alkaline Phosphatase, ALT: Alanine aminotransferase, GLU: Glucose

Radiographs of the affected limb were often diagnostic which shows the “sunburst” appearance because of proliferation and destruction of bone. Radiographs of the affected limb revealed an osteolytic and proliferative lesion of the femur. Radiographic features displayed that both the diaphysis and the epiphysis of the femur were affected. Cortical lysis and perpendicular radiating new bone formation from the cortical bone into the surrounding soft tissue (sunburst pattern) were observed. Usually, the radiographic appearance in Osteosarcomas is variable, it presents either loss of bone structure (lysis), or proliferative lesions, or a mixture of both patterns ^[22]. Three-view chest radiographs were evaluated. Which revealed no pulmonary pattern consistent with lung metastasis.

Abdominal ultrasound, helped to identify early subtle metastatic lesions.

The fine-needle aspiration from the mass and the cytological examination were performed, being less invasive than a bone biopsy. The cytological evaluation revealed a group of osteoblasts, anisocytosis, anisokaryosis, binucleated cells and osteoid extracellular protein matrix among the cells.

Bone biopsy facilitates histologic confirmation, but diagnosis can often be made via fine needle aspiration under mild sedation.

A multimodal therapy was recommended, including both the treatment of the local disease (primary tumour) and systemic disease (micrometastasis). The therapy was primarily focused on local tumour control, so amputation of the affected limb was recommended. In order to control the micrometastasis adjuvant chemotherapy was recommended. During the administration of chemotherapy the patient was constantly monitored and also blood tests were performed.

Adverse reactions following therapy were in the gastrointestinal system, clinically represented by vomiting and diarrhea. To reduce side effects, when needed, the patient was treated with anti emetics, anti diarrheal drugs. Considering the aggressiveness of the tumour and the patient's condition, palliative treatment was recommended to maintain the patient comfort. It was administered Meloxicam in a dose of 0.1 mg/kg daily with a gastrointestinal protector (Omeprazole). The goal of palliative treatment is to alleviate pain and improve quality of life.

Canine osteosarcoma represents a challenge for veterinarians being a highly malignant and metastatic tumour. The prognosis is often negative, with frequent euthanasia in patients due to the extension of the neoplastic lesion and the appearance of metastases. Being able to make an early diagnosis and starting a multimodal treatment as soon as possible, contributes to providing a longer median survival time. Radiographs and cytologic examination were essential to diagnose and the blood tests contributed to the assessment of the patient's health. In the present cases, we consider that if the owners accept the amputation of the affected limb, the patient's survival time can be extended. If a dog diagnosed with osteosarcoma is treated only with analgesics and non-steroidal anti-inflammatory drugs the survival time rarely is not beyond 3 months. When treated only surgically, MST is increased, but when surgery is associated with adjuvant chemotherapy MST has considerably increased with a 12 month survival rate^[21]. In the present study, cases which the treatment consisted only of chemotherapy, the survival time after diagnosis was 5 months, being obtained a longer interval than if no treatment had been received at all, but less than if the amputation had been performed before chemotherapy.

Conclusion

Canine osteosarcoma (OSA) presents a significant challenge due to its aggressive and metastatic nature. Early diagnosis, typically through radiographs and cytologic evaluation, along with multimodal therapy, is crucial in improving survival outcomes. Local tumor control, often achieved via amputation, combined with adjuvant chemotherapy, can significantly extend median survival time. However, without surgical intervention, survival remains limited, even with palliative care. Proper management, including monitoring for side effects of chemotherapy, is essential to improve the

quality of life and extend survival. Early intervention and owner compliance are key to better prognoses.

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