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Successful Management of Stifle Joint Osteoarthritis in A Police Dog With Pentosan Polysulfate Sodium: A Case Report

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Abstract
Osteoarthritis is a degenerative disease affecting movable joints. It is characterized by degeneration of articular cartilage with new bone formation at the articular surface and changes to the synovium and adjacent soft tissues. An average weight, Dobermann breed dog, with moderate unilateral left stifle joint osteoarthritis was presented with progressive hind lameness. Previous treatments with dietary weight loss, non-steroidal anti-inflammatory drugs and oral joint supplements had failed. The present study was undertaken with the objectives to study the influence of Pentosan Polysulfate Sodium on stifle joint osteoarthritis in a dog. The drug Pentosan Polysulfate Sodium administered at the dose rate of 3 mg per kg body weight by subcutaneous route at weekly intervals for four weeks was found to be effective and best suited for the treatment of osteoarthritis in dogs. There were no significant variations observed in physiological parameters like rectal temperature, respiratory rate, and heart rate, haematological parameters and biochemical parameters. There was significant improvement in weight bearing in the dog after the treatment. The drug was also economically feasible and easy to administer when compared to the daily oral medications.
Keywords: *Pentosan polysulfate sodium, Stifle joint, Osteoarthritis, Cartilage, NSAID*

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I. INTRODUCTION

The dog was the first domesticated animal and widely kept as working, hunting, and pet companion. However, dogs are susceptible to slowly progressive, degenerative, and dynamic disease, which can cause notable signs of pain, lameness, and disability known as osteoarthritis [14]. OA is a degenerative disease affecting movable joints. It is characterized by degeneration of articular cartilage with new bone formation at the articular surface and changes to the synovium and adjacent soft tissues [3]. Prevalence of osteoarthritis among pets is high and is increasing because of an aging pet population and because overweight and obese pets have a greater risk of the disease [1]. The deterioration of the articular cartilage is characterized by local splitting and fragmentation of articular cartilage. Synovitis and joint effusion are often associated with the disease [15]. There are no known cures for the disease and it is often managed by combinations of therapies *viz*., non-steroidal anti-inflammatory drugs (NSAIDs) and analgesics, nutraceuticals, functional foods, physical therapy and alternative therapies. These are used to slow the progression of the disease and surgeries are carried out to replace the whole joint [6]. Sodium pentosan polysulfate, a polysulfated polysaccharide heparin analogue derived from beechwood hemicellulose, is used extensively in for the treatment of osteoarthritis (OA) [8]. In addition, it has undergone promising clinical trials for the treatment of non-infectious arthritis and has shown promise in effectively maintaining levels of cartilage proteoglycans in a number of experimental animal models of arthritis [11]. These results have led to PPS being licensed as a disease-modifying drug against osteoarthritis in dogs [17].

II. CASE REPORT

A 6-year-old, 24kg, intact male Dobermann dog was presented to the Department of Veterinary Surgery and Radiology, Veterinary College Hospital, Hebbal, Bengaluru with the history of hindlimb lameness. The dog presented with the history of lameness on hind limbs was subjected to the clinical examination and the osteoarthritis of the stifle joint was confirmed by radiography. The dog was administered with Pentosan polysulfate sodium (figure 1) subcutaneously at weekly intervals for 4 weeks and evaluated for a period of 45 days. Routine clinical, physical and radiographic examinations were conducted to evaluate the effect of the drug pentosan polysulfate sodium.

2.1 Clinical studies

Dog was evaluated to assess the osteoarthritis, before the treatment and on 7th, 14th, 28th and 45th day after the treatment.

2.1.1 RADIOGRAPHIC EVALUATION

2.1.1.1 Patient preparation and anaesthesia

The dog was fasted for 12 hours by withholding food and water. After the clinical examination the dog was premedicated with Xylazine hydrochloride given at the dose rate of 1 mg per kg body weight but Atropine sulphate administered at 0.04 mg per kg intramuscularly. Subsequently they were anaesthetized by administering Thiopentone sodium at the rate of 12.5 mg per kg intravenously given to effect.

2.1.1.2 Radiographic view and intervals

The stifle joint was radiographed mediolateral and dorsoventral view and were used to evaluate and to assess the severity of degenerative joint disease. Radiographs (Figure 3) were taken before the treatment and on 7th, 14th, 28th and 45th day after the treatment.

Figure 1 -Pentosan Polysulfate Sodium (Inj. Pentorse 100® 10 ml vial (100mg/ml), Swati Spentose Pvt Ltd., Hyderabad-62)

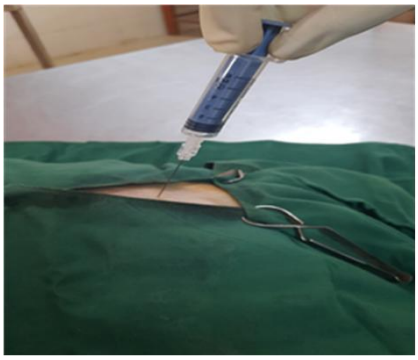

Figure 2 - Synovial fluid collection by arthrocentesis

2.1.2 Synovial fluid collection by stifle joint arthrocentesis

The dog was fasted for 12 hours and water was withheld for 6 hours prior to the procedure. The skin was prepared aseptically covering the stifle region around the joint. The dog premedicated with Atropine sulphate followed by Xylazine hydrochloride and the general anaesthesia was induced and maintained using Thiopentone sodium. For arthrocentesis of stifle joint, the patient was positioned in dorsal recumbency with the pelvis placed at the end of the operating table to facilitate unobstructed access to both sides of the stifle. A cranio-medial approach was chosen. An 18 G hypodermic needle was inserted into the supra patellar pouch and synovial fluid was withdrawn. (Figure 2). To ensure that the needle was placed within the joint, a syringe was attached to the needle and synovial fluid was aspirated using a 3-milliliter syringe [2].

2.1.2.1 Parameters studied

Synovial fluid was collected from hip joint and analyzed for physical features-colour, viscosity and transparency, protein concentration, total nucleated cell count and differential cell count, before and after (45th day) the treatment (Table 1). Synovial fluid samples were collected in cases with Hip osteoarthritis by techniques of arthrocentesis after following aseptic conditions.

In the present study, the synovial fluid volume before the treatment was 0.2 ml and on 45th day after the treatment was 0.3 ml. The colour of the synovial fluid sample collected before the treatment was red tinged. The colour of the synovial fluid sample collected after the treatment (45th day) was colourless. The red tinge colour of synovial fluid of normal dogs recorded in the present study might possibly subscribed to haemorrhage during collection. The synovial fluid sample collected before the treatment had the viscosity ranked as ++. The synovial fluid samples collected after (45th day) the treatment had the viscosity ++++ suggesting that there was increase in the viscosity after the treatment. The synovial fluid from inflammatory joints showed decreased viscosity and was an indicative of joint disease [5]. The synovial fluid protein concentration before the treatment was 2.6 g/dl and after the treatment was 1.8 g/dl suggesting that there was decrease in the protein concentration after the treatment. In the present study, the differential cell count in dog before the treatment was 90.45 % and after the treatment was 93.22%. Jacques *et al.* (2002) reported significant decrease in mononuclear cell count of

synovial fluid of polyarthritis dogs and these observations suggested that in inflammatory arthropathies mononuclear cell count might decrease.

Table 1: Values of synovial fluid volume (ml), Protein Concentration (g/dl), Total nucleated cell count, Differential cell count (Mononuclear cells %) and Differential cell count (Polymorphs %) in dog

Days	Volume (ml)	Protein concentration (g/dl)	Differential cell count (Monomorph cells %)	Differential cell count (Polymorph cells %)
Before Treatment	0.2	2.60	90.45	9.55
45th Day	0.3	1.80	93.22	6.78

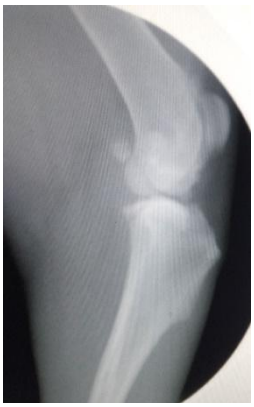

Figure 3 -Mediolateral view of stifle radiograph- before the treatment on day 0

Figure 4 -Dog partially bearing the weight while standing and walking before the treatment on day 0

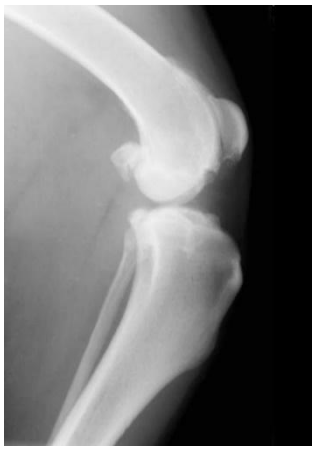

Figure 5: Mediolateral view of stifle radiograph- after the treatment on day 45

Figure 6: Dog fully bearing the weight while standing and walking after the treatment on day 45

III.DISCUSSION

Osteoarthritis is a disease that frequently affects domestic dogs. In the case specifically suffering from stifle joint OA, OA was related to two pathologies: RCCL (88.64%) and patellar luxation (11.36%). Some authors have described these pathologies as the most frequent in pelvic limbs of dogs [7]. When the cranial cruciate ligament undergoes chronic degenerative inflammation, it loses strength and suffers spontaneous

rupture, and the resulting instability favors OA development. Patellar luxation is a development disease with high prevalence in smaller breeds due to an instability that increases gradually. During development, the patella loses contact with the trochlear groove and gives rise to stifle joint inflammation [10]. Female dogs show a three times greater predisposition to develop the disease than males, a finding which cannot be readily explained may be hormonal, but this has yet to be proven [12]. For the effective management of osteaoarthritis a variety of conventional pharmaceuticals, experimental treatments, nutraceuticals and supplements, and life change, such as stem cell therapy, physical therapy with acupuncture, and weight loss and exercise programs should be practiced in combination [4].

PPS was used in veterinary medicine mainly for prophylaxis and treatment of OA despite of limited scientific evidence proving its efficacy. PPS had been found to inhibit articular cartilage degradation and increase synthesis of hyaluronan and proteoglycans [12]. The pentosan polysulfate sodium resulted in significant improvement in clinical signs and articular cartilage healing, and no adverse effects were detected confirming that pentosan polysulfate sodium had disease-modifying properties [9]. The effects of pentosan polysulfate subcutaneous administration weekly once was greater than daily oral treatment in the Mucopolysaccharidosis VI rat model, particularly in avascular tissues such as the cartilage and bone [16]. Sodium pentosan polysulfate (NaPPS) was testified as a chondroprotective drug with a detailed rationale of the disease-modifying activity and also suggested that NaPPS was beneficial for treatment of inflammatory joint diseases and other bone diseases associated with excessive bone resorption [17].

IV.CONCLUSION

The physiological, haematological and serum biochemical parameters in the dog were found to be within the normal range and did not show any significant variations during the period of study. No adverse effects were reported during the study period. The dog was bearing partial weight [Figure 4] on the left hind limb before the treatment, but significant improvement in weight bearing [Figure 6] was observed between the 14^{th} to 45^{th} day. It could be concluded that the drug Pentosan Polysulfate Sodium administered at the dose rate of 3 mg per kg body weight by subcutaneous route at weekly intervals for four weeks, was found to be effective, and best suited for the treatment of stifle osteoarthritis in dog. Further the drug had no adverse effects, provided improvement in overall clinical signs and quality of life in dog affected with osteoarthritis. The drug was also economical and easy to administer when compared to the other medications.

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