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Treatment of hip osteoarthritis in dogs using pentosan polysulfate sodium: A clinical study

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Abstract

The present study was undertaken with the objectives to study the influence of Pentosan Polysulfate Sodium on osteoarthritis in dogs thus the present study was conducted to study the influence of Pentosan Polysulfate Sodium on physiological, clinical, haematological, biochemical, synovial fluid and radiographic parameters in dogs with osteoarthritis. Study was carried out among the six dogs presented to Department of Veterinary Surgery and Radiology, Veterinary College Hospital, Hebbal, Bengaluru irrespective of breed, age and sex diagnosed with osteoarthritis of hip joint for a period of one year. 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. There were no significant variations observed in physiological, haematological and biochemical parameters. There was significant improvement in weight bearing in all the six dogs after the treatment. The drug Pentosan Polysulfate Sodium administered was found to be effective and best suited for the treatment of osteoarthritis in dogs.

Keywords: pentosan polysulfate sodium, osteoarthritis, hip joint

Introduction

The dog was the first domesticated animal and are susceptible to degenerative, and dynamic disease which can cause notable signs of pain, lameness, and disability known as osteoarthritis (Johnston, 1997) ^[10]. 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 (Anderson *et al.*, 2020) ^[11]. 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 (Cook and Payne, 1997) ^[4]. Sodium pentosan polysulfate, a polysulfated polysaccharide heparin analogue derived from beechwood hemicellulose, is used extensively in for the treatment of osteoarthritis (OA) (Dart *et al.*, 2001) ^[5]. Pentosan polysulfate is a GAG used as a treatment for a variety of inflammatory conditions. 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 (Ghosh, 1999) ^[6]. These results have led to PPS being licensed as a disease-modifying drug against osteoarthritis in dogs (Wijekoon *et al.*, 2018) ^[13].

Materials and Methods

Place and span of study

Study was carried out among the dogs presented to Department of Veterinary Surgery and Radiology, Veterinary College Hospital, Hebbal, Bengaluru was recorded for a period of 12 months (September, 2019 to August, 2020), among the clinical cases of either sex, having osteoarthritis of hip joint were selected based on the history, clinical examination and radiography. The clinical study on the influence of Pentosan polysulfate sodium on osteoarthritis of hip joint was conducted on six dogs confirmed with osteoarthritis of hip joint.

Clinical studies

Dogs were evaluated to assess the osteoarthritis, before the treatment and on 7th, 14th, 28th and 45th day after the treatment with drug pentosan polysulfate sodium.

Radiographic evaluation

Patient preparation and anaesthesia

All the dogs were fasted for 12 hours by withholding food and water. After the clinical examination the dogs were 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.

Radiographic view and intervals

The coxofemoral joints were radiographed in ventrodorsal

extended view and were used to evaluate the hip joint [fig 2 and 4] and to assess the severity of degenerative joint disease. The radiographic scores [Table 1] were studied before the treatment and on 7th, 14th, 28th and 45th day after the treatment.

Table 1: Radiographic scores of hip joints affected with osteoarthritis (Impellizeri *et al.*, 2000)

| Grade | Classification | Description |
|-------|----------------|---|
| 1 | Slight | Periarticular osteophytes only. |
| 2 | Mild | Periarticular osteophytes and femoral head remodeling. |
| 3 | Moderate | Periarticular osteophytes, femoral head and neck remodeling, and acetabular remodeling. |
| 4 | Severe | Periarticular osteophytes, femoral head and neck remodeling, acetabular remodeling, and sclerosis of the subchondral bone of the femoral head and acetabulum. |

Technical programme

Six clinical cases of either sex, having osteoarthritis of hip joint were selected based on the history, clinical examination and radiography. They were administered with Pentosan Polysulfate Sodium [Fig 1] subcutaneously with the dosage of 3 mg per kg body weight at weekly intervals for 4 weeks.



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

Synovial fluid collection by hip joint arthrocentesis

Procedure for hip arthrocentesis

For arthrocentesis of the hip joint was done under general anesthesia. An 18 to 22-gauge spinal needle (2.5- to 3-inch) was used. The hip was flexed slightly, and the femur was positioned parallel to the table to maximize the width of the joint space. The hip was palpated, and the needle was inserted at the midpoint of the proximal edge of the greater trochanter. 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 (Anirudh and Ranganath, 2015)^[2].

Parameters studied

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

Statistical analysis

The results of clinical, haematological and biochemical values were presented as Mean \pm SE. The data was analyzed by paired t-test, using GraphPad Prism version 5.01 for Windows, GraphPad Software, San Diego California USA. Results were interpreted as per the procedures described by Snedecor and Cochran (1996)^[12] to arrive at a conclusion ($P \leq$

0.05).

Results and Discussion

Among the 8,548 cases of dogs presented to the Department of Veterinary Surgery and Radiology, Veterinary College Hebbal, Bengaluru during the study period of 12 months. Out of these, 172 (2.01%) dogs were diagnosed with joint related problems and in these 51(29.65 %) dogs were affected with osteoarthritis. Similarly, various authors recorded different occurrence of osteoarthritis in dogs *viz.*, Johnston (1997)^[10] 20 per cent and Lamani (2012)^[11] 32 per cent. The mean radiographic score of animals before the treatment was 3.50 ± 0.22 and after the treatment ranged from 2.33 ± 0.21 to 3.00 ± 0.00 , the variations were statistically significant. After the treatment there was significant reduction in the radiographic scores [Table 2]. This was in agreement with the observations earlier made by Lamani (2012)^[11] and Anirudh and Ranganath (2015)^[2].

Table 2: Mean \pm SE values of radiographic scores in dogs

| Days | Radiographic score | P value |
|------|--------------------|----------|
| 0 | 3.50 ± 0.22 | |
| 7 | 3.00 ± 0.25 | 0.075 |
| 14 | 2.83 ± 0.34 | 0.012 * |
| 28 | 2.33 ± 0.21 | 0.001 ** |
| 45 | 2.33 ± 0.21 | 0.001 ** |

*significant, ** highly significant

In the present study, it was managed to collect the synovial fluid only in four dogs and even the mean synovial fluid volume before the treatment and on 45th day in dogs were ranged from 0.26 ± 0.03 ml to 0.36 ± 0.04 ml respectively. Similar results (0.24ml to 0.35ml) were reported by Lamani (2012)^[11].

The synovial fluid samples collected before the treatment had the viscosity ranked as ++ (2 cases), +++ (1 case) and ++++ (1 case) before the treatment. The synovial fluid samples collected after (45th day) the treatment had the viscosity ++++ (2 cases) and +++ (2 cases) 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 (Clements, 2006)^[3].

The mean synovial fluid protein concentration before the treatment was 2.5 ± 0.40 g/dl and after the treatment was 1.81 ± 0.26 g/dl in four dogs suggesting that there was decrease in the protein concentration after the treatment. Houlton (1994)^[8] reported that protein concentration of synovial fluid would be normally low and it raised and became closer to serum value in inflammatory conditions.



Fig 2: Ventrodorsal extended view of hip radiograph- before the treatment on day 0

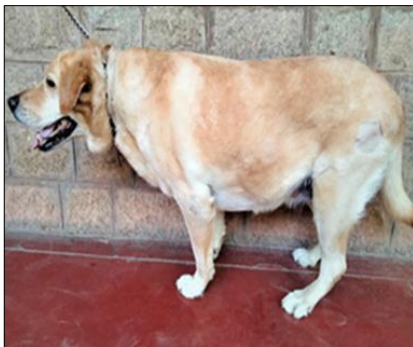


Fig 3: Dog partially bearing the weight while standing and walking before the treatment on day 0



Fig 4: Ventrodorsal extended view of hip radiograph- after the treatment on day 45



Fig 5: Dog fully bearing the weight while standing and walking after the treatment on day 45

Conclusion

The physiological, haematological and serum biochemical parameters in the dogs 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. Most of the dogs were bearing partial weight [Fig 2 and 3] on the hind limbs before the treatment, but significant improvement in weight bearing [Figure 4 and 5] in all the six dogs was observed between the 14th to 45th 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 osteoarthritis in dogs. Further the drug had no adverse effects, provided improvement in overall clinical signs and quality of life in dogs affected with osteoarthritis of hip joints. The drug was also economically feasible and easy to administer when compared to the daily oral medications.

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